THE UNIVERSITY of LIVERPOOL

THE INFLUENCE OF PSYCHOLOGICAL PREPARATION ON SHORT- AND LONG-TERM RECOVERY FROM SURGERY

Thesis submitted in accordance with the requirements of the University of Liverpool for the degree of Doctor in Philosophy by

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ABSTRACT

On the basis of recent theory and research which suggests that active coping is more beneficial than denial strategies, and that coping is related to the neuroendocrine response, and that a raised physiological response may be detrimental to recovery, three main hypotheses were tested. Firstly, that active coping preparation for surgery would facilitate recovery from surgery in comparison to other interventions. Secondly, that an elevated stress response would be associated with passive coping, and that a reduced response would be associated with active coping. Lastly, it was hypothesised that elevated stress response would be associated with delayed recovery. A subsidiary investigation involved a qualitative study of patients' reactions to attempts to increase passive or active coping with surgery. To assess the effects of coping on recovery from surgery, this prospective randomised controlled trial assessed the effects of interventions which preoperatively encouraged patients to cope in a passive or active way. Patients included 160 orthopaedic patients recruited sequentially from two teaching hospitals in the city of Liverpool: 107 total hip arthroplasty (THA) and 53 total knee arthroplasty (TKA). A range of psychological, physiological and functional indices of recovery were monitored to assess immediate, short and long-term outcome in both treatment groups and an attention-control group which received routine care. Psychological measures included subjective indices of mood, bodily state, and quality of life. Physiological markers of the hormonal (glucose, adrenaline and noradrenaline) and inflammatory response (C-reactive protein and Interleukin-6) were used to provide a more objective account of surgical processes; these were monitored during the perioperative period. An instrument was developed to measure immediate functional progress postoperatively, while existing measures were used to measure functional outcome. Contrary to expectations, active coping was not associated with facilitated recovery from surgery. Also, coping was largely independent of the surgical stress response, suggesting that recovery could not be influenced by the effect of psychological interventions on the hormonal and inflammatory response to surgery. In general, psychological variables were better predictors of long-term compared to short-term recovery. In contrast the physiological response was a better predictor of immediate recovery. Clear associations between the physiological response to surgery and functional recovery were seen. In support of the third hypothesis, both an increased stress and inflammatory response were associated with delayed immediate functional progress. The qualitative study on patients' reactions to active and passive coping failed to reinforce the taken for granted judgement that perceived increased control is preferable to external sources of control, and was useful for providing possible explanations for the lack of relationships between the treatment and intervention groups.

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PREFACE

This thesis is based upon the assumption that physical and psychological factors interact. It therefore adheres to a holistic model of health care. As such, for the purposes of this investigation it is accepted that psychological treatment can be used to improve adjustment to the stress of surgery.

Two highly influential but very different ways of coping with stress during medical treatment have been advocated in popular literature by Fulder who states that:

'One of the main ways in which this can be done is to make sure you feel you are in control and involved in your treatment.'

'one of the most well tried methods of reducing stress, tension and anxiety, is deep relaxation, which has now been taught to millions of people'

(Fulder, 1994)

The two methods advocated above are fundamentally different in that one encourages patients to be more involved with their treatment and hospital care, and the other encourages patients to take a less involved, and more passive role. Although it has been shown by controlled research that using relaxation or more active and problem-focused methods of coping are both associated with positive recovery, recently it has been found that specific types of coping may influence the physiological response, in particular the stress response, to surgery. At present there has been no research that has compared how the different types of coping might affect the physiological response, and its implications for recovery. Consequently, this study is concerned with the effects of psychological preparation on the physiological and psychological response and recovery from surgery. It specifically assesses the affect that 'active' as opposed to 'passive' coping strategies have on physiological, psychological and functional recovery from surgery over a six-month period.

Outline of this thesis

This 4 part thesis is made up of a total of 8 chapters. The first part consists of literature reviews, the second methodology, the third outlines thesis findings, and the fourth is a discussion of those findings.

Part 1: literature reviews

Chapter 1, a literature review, provides a comprehensive account of the physiological and psychological response to surgery. For the physiological response an account of the hormonal and inflammatory response is given. The psychological response includes an account of psychological factors which have been found to affect recovery from surgery e.g. personality, social support, preoperative state, and coping strategies. Lastly, possible mediators in the recovery process, particularly the effect of control enhancing and other psychological interventions on long-term recovery are discussed.

Chapter 2 provides a review of total hip arthroplasty (THA) and total knee arthroplasty (TKA); the surgical model used to investigate the hypothesis of this thesis. The review discusses the psychosocial and physical effects of arthritis, major joint arthroplasty as a surgical treatment, and the outcome associated with total arthroplasty. Both subjective and objective measures of outcome are discussed, with specific attention on the concept of quality of life and how it is measured.

Part 2 :Methodology

Chapter 3 documents the methodology of this investigation. It provides an account of psychological, physiological and functional measures used for data collection, and procedures followed for all research conducted for this thesis. A more in-depth account of the methodology for two subsidiary studies, which were necessary to help in the testing of the main hypothesis of this investigation (see below), is provided in chapters 4 and 5.

Part 3 Findings

Chapters 4 -7 are the findings of this thesis. Chapter 4 documents immediate functional recovery from THA or TKA, which was monitored via a tool which was specifically developed, as part of this thesis, for monitoring of incremental functional progress in orthopaedic patients. Chapter 5 is an account of patients' responses to passive or active behaviour encouraged in the hospital setting; it is one of the first attempts to assess patients' responses to psychological interventions. A qualitative analysis of verbal responses to interventions conducted for this investigation is conducted, and findings are discussed with reference to research which has attempted to enhance or reduce control in general or in a surgical setting. Chapter 6 provides an account of the influence of psychological preparation on the physiological and psychological response in orthopaedic surgery. Chapter 7, examines relationships between psychological, functional and physiological recovery.

Part 4 Discussion

Chapter 8 is a discussion of the overall effect of psychological preparation on physiological, psychological and functional recovery from surgery, as found in this investigation. Findings from the main and the subsidiary studies of this thesis are discussed with reference to 3 main hypotheses which are outlined at the end of the introductory chapter.

PART 1

Chapter 1

The Physiological And Psychological Response To Surgery

Chapter 1

The Physiological And Psychological Stress Response To Surgery

1.1 Introduction

Stress has been defined as a stimulus, a response, or an interaction between an organism and its environment (Goetsch & Fuller, 1995). The lack of a single accepted definition of stress is associated with a lack of uniform measurement of stress, quantitative or qualitative (Brantely & Thomason, 1994). Indeed, there is an opinion that the search for one specific sole measure of stress, 'the' stress of the stress process is fruitless (Lazarus, 1990). This investigation follows the paradigm that stress is multi-faceted, comprising many psychological and physiological aspects, which make it difficult to define. Given this, *Stress* in this investigation designates an area of research instead of a precise concept (Lazarus & Folkman, 1984).

1.2 Recovery from surgery

Recovery from surgery is a diverse process involving physiological, psychological and functional components. Recovery is variable among patients; influences on this variability include physical and psychosocial factors.

Various outcome measures have been used to measure recovery from surgery. Both subjective psychological and physical recovery have been gauged by objective indices of recovery such as length of hospital stay, amount of analgesic consumption, postoperative complications, amount of assistance needed and amount of perceived problems. However, these indices are not necessarily accurate indicators of subjective recovery because of their susceptibility to external influences. For example, it has been argued that medication consumed by patients may be related more to patient compliance or routine hospital practice rather than a patient's actual need for medication (Wilson-Barnett, 1982; Salmon, 1994; Manyande & Salmon, 1998). Reporting of complications or limitations may also reflect a patients need to be viewed as socially desirable (Mosher, 1965) or may represent the amount of attention given to physical symptoms (Salmon et al., 1998).

Recently, hormonal and other biochemical markers have been used as direct and objective indices of the psychological and physiological stress response. Although these indices are reliable and easily quantified, used alone they are limited from a clinical perspective (Salmon, 1992). Hence, it is suggested that their use will be more effective in conjunction with other stress measures as a means of furthering knowledge about stress (Baum & Grunberg, 1995). However to date, research which has assessed endocrine and metabolic indices, in conjunction with more subjective indices (Salmon et al., 1988; Salmon et al., 1994; Manyande et al., 1992; 1995; Salmon & Manyande, 1996; Wilson, 1981), has demonstrated limited if any relationship between objective physiological indices of recovery and subjective measures of recovery.

The lack of relationship between different dimensions of recovery confirms that recovery is multidimensional. As well as lack of relationships between hormonal and subjective recovery others have found pain, physical and emotional recovery to be independent from one another (Wolfer & Davis, 1970). The diversity of recovery has made it extremely difficult to identify one successful measure of recovery for patients. It was suggested by Johnston (1984), in a study of patients who had major gynaecological surgery, that recovery may be associated more with certain factors than others. This interpretation resulted from the finding that although wellbeing, anxiety about hospital care, and distress amongst patients were major factors in recovery, they were not related to one another during the first postoperative week after surgery. The wellbeing factor, in contrast to other factors, had a strong positive association with recovery variables such as sleep, appetite, interest in things around them, and was more indicative of recovery.

Consequently, although there has been a large amount of research on the physiological and psychological adjustments that occur with surgery there is an absence of definitive indices of recovery, that is techniques which provide a realistic measure of outcome for patients, and are agreed upon by practitioners in various health fields. The relatively recent use of generic health measures which gauge recovery by assessing the patient's subjective state in several domains of recovery, and can be used by various health practitioners, can be regarded as more definitive than other measures. These generic health measures can be said to provide an estimate of patients' concept of their quality of life after treatment interventions. The concept of quality of life and a discussion of outcome measures used for its assessment are discussed in chapter 2.

1.3 The physiological response to surgery

Tissue damage is an integral part of any surgery, and this trauma is a stimulus for a physiological response. A complex series of hormonal, autonomic and immune system responses occur which influence surgical outcome. This response to surgery can be seen as a manifestation of Selye's general adaptation syndrome (G.A.S, Selye, 1956), a theoretical 'response' model of stress (Wilmore et al., 1976). Selye believed the G.A.S response to be adaptive. Three stages, the alarm, reaction and exhaustion stage, constitute the syndrome, and are likely to occur when stress is extreme and chronic (Munck & Guyre, 1986). The alarm stage occurs immediately after exposure to a stressful stimulus or situation; the resistance stage involves coping and attempts to reverse the effects of the alarm stage, and finally the stage of exhaustion depicts an inability to show further resistance after repeated exposure to stress. Selye's model can be applied to the response to surgical trauma.

The alarm stage otherwise known as the "fight-or- flight" response (Cannon, 1929) is theoretically instigated by surgical incision, and consists of a series of immediate physiological changes that facilitate survival. Fight-or-flight responses are not only triggered as a reaction to direct physical and psychological stress, but are also triggered in anticipation of stress (Cannon, 1929; Cox, 1978). Consequently, the stress response is considered a psychological response. During the stress response the body shows a progressive rise in various hormones and other biological markers which peak and then decline, showing its ability to recover from the alarm stage. However, these changes can only be maintained for a certain period of time before they become non-adaptive. In the resistance stage, resources are used to cope with immediate 'stressful' changes. Progress to this stage signifies adaptation to a stressor; during this stage resistance is heightened to a level which exceeds pre-alarm measures. Lastly, postoperative fatigue and other complications are believed to result in a collapsed physical state with ensuing irreparable damage or fatal consequences; on a theoretical level this represents the stage of exhaustion. Surgery is not a chronic but an acute stressor, and is therefore, more likely to involve the alarm and resistance stages. However, despite this, lengthy periods of postoperative fatigue are known to occur in surgical patients (see postoperative fatigue 1.3.3).

The consequences which result from surgical trauma are collectively known as the acute phase response (Berczi, 1998), which also occurs in response to infection, toxic agents and malignancy. This biochemical response to injury can be divided into two phases, which can be differentiated by periods of anabolism and catabolism (Barton, 1987). The catabolic phase results in breakdown of tissue protein resources. The anabolic phase is characterised by conservation of metabolic resources, resulting in protein synthesis. In reality both these phases occur very close in time to each other.

In the anabolic phase, cytokine and neuroendocrine mediators are produced as a result of injury, which begins with surgical incision (Barton, 1987). These reactions mark the beginning of a complex chain of interactions (Carola, Harley & Norback, 1990). The catabolic phase is characterised by changes in the levels of inflammatory response markers. Interleukin-6 (IL-6), and plasma concentrations of catecholamines increase, whereas cortisol and glucagon levels decrease. In the recovery phase, acute phase proteins show initial increases.

The physiological response to surgery can be divided into the inflammatory response and the stress response. The inflammatory response is thought to be associated with the actual physical trauma caused as a result of injury to human tissue. Two classes of hormones are involved in the stress response. These are corticosteroids and catecholamines. The specific biochemical variables that are associated with the two different responses are documented below.

Originally, Cannon (1929) and Seyle (1956) recognised that psychological challenges could stimulate the physiological stress response. In conjunction with this, recent research has found coping styles to be associated with hormonal responses to surgery, as well as psychological outcome measures, suggesting that they may be important in influencing recovery from surgery. This has also led to further speculation that the physiological response to surgery might have a psychological basis. In this thesis, the hormonal and inflammatory responses are discussed not only because they are suggested to be psychological responses to surgery (Salmon, 1994) but because they may influence recovery from surgery. This may have important clinical implications. Indeed, recent research has found a reduced inflammatory response (in particular cytokine response) to be associated with faster recovery and shorter hospital stay (Joris et al., 1982; Bardram et al., 1995). However, research which has assessed the mechanism for the effects of various coping styles on outcome, is limited. This study attempts to assess the potential mediating influence of the physiological response to surgery on outcome, in conjunction with attempts to encourage specific coping in elective surgery patients.

1.3.1 The stress (hormonal) response

<u>Catecholamines (adrenaline and noradrenaline)</u>. Catecholamine levels are variably affected by surgical trauma (Ellis & Humphrey, 1982), with some surgery showing increased adrenaline, but not noradrenaline (Misrtop Marsden et al., 1978; Hall, 1985; Udelsman et al., 1987). Within seconds after surgical incision, increased

levels of the catecholamines, adrenaline and/or noradrenaline are released into the bloodstream from the adrenal medulla. This response is neurally mediated. The neural pathway is from the sympathetic preganglionic neurons in the spinal cord, which reach the adrenal gland through the splanchnic nerves, and release acetylcholamine (a neurotransmitter), which provokes release of catecholamines from the adrenal medulla. Adrenaline and noradrenaline are important mediators of the stress response (Kehlet et al., 1979). They increase the release of glucose from the liver by initiating the breakdown of glycogen; this process is known as glycogenolysis. Noradrenaline acts as a neurotransmitter at synapses in the autonomic nervous system, and increased levels of catecholamines mimics arousal of the sympathetic nervous system. As a consequence, the release of noradrenaline from the adrenal glands will prolong, indirectly, the action of noradrenaline released at synapses. In such a system, even though a stress stimulus may be short lived it will continue to have physiological effects for some time after the stimulus has ended.

The effects of catecholamines on the immune system appear to be contradictory. Consistently high levels may compromise the immune response, via their effect on lymphocyte availability or leukocyte production, whereas short exposure may result in activation or suppression of the immune system depending on initial metabolic cell states (Kavelaars et al., 1990). Catecholamine levels have not been consistently related to the severity of surgery (Udelsman, 1987). However, in major elective surgery, adrenaline and noradrenaline have been elevated postoperatively from baseline levels (Salmon et al., 1992). Catecholamines indirectly inhibit the insulin response, thereby increasing glucose levels (Allison, 1971).

Glucagon. Glucagon increases blood glucose through glycogenolysis (breakdown of glycogen in the liver) and gluconeogenesis (increased production of glucose in the liver). Although it is not certain, glucagon increase probably follows the catecholamine response to surgery. Its ability to increase blood glucose is limited, the increase being maximal for the initial two hours of surgery being proportional to the extent of the injury (Hall & Desborough, 1992). A period of 'insulin resistance' develops (Hall, 1989) characterised by a lack of insulin response to increased circulating glucose levels (hyperglycaemia); insulin levels remain low during and immediately after surgery. Glucagon however has not been shown to increase after all types of surgery (Hall, 1989). Laparoscopic surgery, because it causes less injury, has been considered less traumatic than conventional surgery. Amongst cholecystectomy (gall bladder removal) patients glucose levels are higher in open compared to laparoscopic surgery at 4, 12 and 24 hours after surgery (Ortega et al., 1996). So surgical technique has an influence on the stress hormonal response.

Cortisol. With reference to the stress response, cortisol is the most important of the corticosteroid hormones. Cortisol production is increased with the onset of surgery when the adrenal gland in the adrenal cortex is activated to release cortisol. Adrenocorticotrophic hormone (ACTH) in the blood (released from the pituitary via instructions from the hypothalamus) stimulates the adrenal cortex to release cortisol, which controls the amount of glucose in the blood. Cortisol is a slower reacting hormone compared to catecholamines. Cortisol concentrations rise rapidly after injury, remaining above basal levels for a variable period of time, and levels are linked to the severity of surgery (Plumpton et al., 1969; Hall, 1989). Cortisol concentration usually reaches a maximum during the early hours immediately after surgery, and can remain elevated for up to five days after major surgery (Plumpton, Besser & Cole, 1969; Salmon et al., 1988). As an immediate response to injury, cortisol blocks the inflammatory response and raises blood sugar level by activating glycogenolysis (glycogen breakdown) in the liver. Here immune system activity is suppressed. Cortisol is limited as a mediator of metabolic change, it is mainly responsible for increased glucose (Lacoumenta et al., 1978). Contradictory effects of cortisol on the immune system show that low doses of cortisol tend to increase immune responses and high doses tend to suppress them (Ursin & Olf, 1993). 'Diseases of adaptation' such as hypertension, heart disease, coronary heart disease, asthma and stomach ulcers may arise under such physiological pressure (Selye, 1956).

Increased cortisol results from the release of the hormone adrenocorticotrophic factor (ACTH), which occurs in response to surgical injury, from the pituitary to instigate the increase of these hormones. A negative feedback system eventually should inhibit further release of ACTH from the pituitary, thereby reducing cortisol levels.

The cortisol response has been shown to differ in laparoscopic versus open surgery techniques. In a study comparing cortisol levels at 8 hours postoperatively, increased levels were found in open cholesystectomy patients compared to laparoscopicaly operated patients (Aktan et al., 1994). Another study detected diminished cortisol levels in laparascopic patients on the first postoperative day when compared to open cholecystectomy patients (Glerup et al., 1995).

1.3.2 The inflammatory response

Cytokines. Cytokines are released from macrophages (white blood cells) at the site of injury and affect a wide range of metabolic and immunological responses. In general, the interactive effects of cytokines are poorly understood. Cytokines may act separately or interact to produce systemic effects, such as the acute phase response (APRP), fever, leukocytosis (increased white cell count per volume of blood) and immune activation (Udelsman & Holdbrook, 1994). Cytokines (IL-1, IL-6, TNF) are critical triggers of the acute phase response, in which there is a breakdown of acute phase proteins such as C reactive protein (CRP-see below) and alpha-mg protein (Bauman & Gauldie, 1994). In sepsis (infection), the cytokines tumour necrosis factor (TNF), IL-1, IL-6 all increase. Cytokines initiate hypermetabolism and potentiate the release of hormones, catecholamines, glucagon and cortisol. IL-1 which is released from macrophages, surrounds and destroys microbes and in turn stimulates the release of IL-6 from macrophages and fibroblasts. This is followed by further release of IL-1 (Maier, Watkins & Fleshner, 1994). When IL-6 and IL-1 reach the hypothalamus they stimulate production of ACTH releasing factor, which is responsible for later increases in cortisol; here cytokines are mediators of the increased glucocorticoid synthesis in the adrenal cortex (Baumann & Gauldie, 1994).

As IL-6 is the only cytokine which has consistently been found to increase after surgical incision (Cruickshank et al., 1992; Shenkin et al., 1989; Baigrie et al., 1992), particular attention is given to it in this thesis. Increased tissue trauma, associated with increased length of operation has been found proportional to the IL-6 response (Shenkin et al., 1989). Different levels of cytokines have been found for different types of surgery, for instance, hernia repair surgery has shown lower IL-6 levels compared with those seen in major aortic surgery (Biffl et al., 1996). In hip replacement surgery the IL-6 response was greater than the response for abdominal and thoracic surgery (O'Nuallain et al., 1995). An increase in cytokines can be seen within one to three hours after incision, remaining for 48 to 72 hours in non-complicated surgical cases. In general, research has shown serum IL-6 to increase within one and a half to 2 hours after surgical incision for total hip arthroplasty (van-Deuren et al., 1998; O'Nuallain et al., 1995; Kristiansson et al., 1995) and reach its maximum in the in the early postoperative period. Research specifically with 15 total hip replacement patients showed IL-6 concentration to increase from 2 to 3 hours after incision, reaching its maximum level at eight hours postoperatively (van-Deuren et al., 1998).

Studies have shown cytokine responses to vary in open versus laparoscopic surgery. Although cytokines always increase in surgery, increased IL-6 has been associated with adverse clinical outcome (Biffl et al., 1996; Baigrie et al., 1992). This has prompted efforts to reduce surgical stress by various anaesthetic and surgical techniques. A number of studies have shown reduced cytokine response to laparoscopic compared to open surgery. In contrast to open techniques, laparoscopic surgery has been associated with a reduced cytokine response (Joris et al., 1992; Ueo et al., 1994; Jakeways et al., 1994; Glaser et al., 1995; Harmon et al., 1994). However, other research has found no advantages in laparoscopic over open hernia repair concerning the inflammatory or immunological response (Takahara et al., 1995). Similarly, Milheiro et al. (1994) demonstrated that cortisol, and neutrophil levels together with lymphocyte counts, show no major difference in their metabolic response in laparoscopic compared to open surgical techniques.

Cerial reactive protein. An increase in C- reactive protein (CRP), an acute phase protein, arises with the reduction in level of catecholamines, cortisol and glucagon, and occurs approximately eight to twelve hours after incision (Maier, 1994; Shenkin et al., 1989). This phase can be prolonged if the patient suffers from postoperative haemorrhage. Other systemic effects which occur in this phase are the breakdown of muscle protein into amino acids, and the conversion of these to glucose (Maier, Watkins & Fleshner, 1994) - these functions are respectively promoted and facilitated by glucocortoids, whose effects on nitrogen balance are minimal (Bessey et al., 1984). The magnitude of muscle (nitrogen) loss is related to the severity of surgery (Hall, 1989). It has been difficult to attribute increased protein loss to the counter-regulatory hormones, due to the nature of feedback systems which operate during the acute phase response. Glucocorticoids and cytokines initially combine to activate the acute phase response, and then via homeostatic feedback mechanisms, glucocorticoids suppress cytokine levels. Glucocorticoids are said to contribute initially "permissively" and later "attenuatively" (Udelsman & Holbrook, 1994). It is for this reason that the possible role of cytokine release from cells at the site of the wound, which have local and systemic effects, has been attributed to protein breakdown. So although the acute-phase proteins are probably regulated by IL-6 (Saunders, 1995), the rate of protein breakdown relates to the extent of injury (Cruickshank et al., 1990). In total hip and knee replacement, CRP levels have been shown to show a gradual increase after incision up to day 2 and 3, and thereafter decline (Niskanen, Korkala, & Pammo, 1996), and to normalise within two weeks after surgery (Kolstad & Levander, 1995).

Other metabolic effects as a result of surgical trauma.

As part of the acute phase response, leukocytes (white blood cells) produced in bone marrow, enter the circulation before reaching the site of injury. They have various functions which include removal of cell debris; promoting bacterial destruction; and reducing plasma iron and zinc necessary for pathogen growth. Initial responses to injury show a reduction in white blood cells (leucopenia) and lymphocytes (lymphopenia). However, for hip and knee replacement, adjustment to normal levels occurs quickly as research has found concentrations to be within normal ranges in the postoperative period (Kolstad & Levander, 1995).

Other metabolic effects from the surgical stress response include increased temperature, often rising to 38°C (Carli & Aber, 1987), increased heart rate and blood flow to muscles, increased blood pressure, respiration, and pupil dilation and reduced platelet count (Bennett & Towler, 1985). In hip and knee replacement, patients' temperature can be expected to rise for the first and second postoperative day (Kolstad & Levander, 1995). Haemorrhage (Carli & Itiaba, 1986) and sepsis (Carli & Aber, 1987) can exaggerate the hormonal and metabolic response to surgery.

1.4 Psychological responses to surgery

1.4.1 Anxiety and other emotional responses

Anxiety has been shown to increase upon admission to hospital in several groups of surgical patients (Clewes & Endler, 1994; Sarantandis et al., 1997; Vingerhoets, 1998). Anxiety, a common and pervasive emotion in hospital, can be manifested on a physical, emotional and cognitive level (Carpenito, 1993), and is variable in patients undergoing the same surgery (Wallace, 1985). Sometimes patients find it difficult to say exactly what their anticipatory anxiety refers to (Vingoe, 1994). Anxiety is not related to the severity of surgery but to the hospital environment and personality traits of patients (Lucente & Fleck, 1972). It can exist for many weeks postoperatively (Johnston, 1980). Although anxiety is usually reduced following discharge from hospital, research with heart surgery patients has shown it to remain high for up to several weeks after surgery (Magni et al. 1987; Pimm, Foole & Fiest, 1986; Cay & O'Rourke, 1992).

Although a large number of fears are surgical or anaesthesia related (Ramsay, 1972), other worries are known to exist amongst surgical patients. These include: separation from the family, worries about the family coping, financial worries (Franklin, 1974; Carnevali, 1966), and separation from normal routine (use of a bed-pan, night time in a hospital environment, seeing ill patients), and having to leave work (Lucente & Fleck, 1972). Also, comparative lack of privacy, potential for embarrassment and fitting into the hospital routine (Freche, 1975) will cause anxiety for patients. Loss of control has been reported as a primary psychological stressor (Soehren, 1995), together with lack of support and indignity (Volicer et al., 1977).

Admission to hospital brings depersonalisation and acceptance of that depersonalisation, submerged identity and a yielding of control to individuals who may appear disrespectful (Volicer, 1973). Stress in the medical setting has been classified as procedural and outcome based (Weinman & Johnson, 1988). Procedural stress is the immediate unpleasantness of the procedure itself and outcome stress is the long-term fears and concerns relating to treatment outcome. It is suggested that procedural anxiety should be regarded as evidence of a faliure of clinical care Salmon, 2000).

1.4.1.1 Worry as manifestation of anxiety

Worry will be discussed briefly here as it is presumed to be a cognitive manifestation of anxiety. Although a large amount of clinical work has addressed pathological worry (defined by DSM-IV-R, as a central feature of Generalised Anxiety Disorder), there has been little clinical work on the nature and/or function of worry about fearful anticipated events. Borkovec (1994) defines worry as a sequence of negatively affect-laden thoughts and images, usually about the future, which evolve when someone attempts problem-focused coping. Here it is assumed that dwelling on worrisome thoughts will help an individual to cope with outcome. Whether it does this by weakening the effects of outcome or by other mechanisms is not fully understood. According to Borkovec (1994) there are five possible benefits of worry. Firstly, there may be a superstitious benefit to worry in that it will reduce the likelihood of an event or events occurring. Secondly, worrying may help to avoid or prevent a catastrophe thus portraying worry as a problem solving technique. Thirdly, worry is seen as a distracting activity. This type of worry is inappropriate, and can be interpreted as an attempt to control events on an internal level, thereby shutting out the external environment. Fourthly, worry can be a means of preparing for a predicted event. Fifthly, worry might act as a motivating device which assists in the achievement of short term plans (Borkovec, 1994).

The relationship between worry content and anxiety level is complex. Gynaecological surgery patients with low anxiety generally have worries that are common amongst patients, whereas those with high anxiety declare unique worries (Johnston, 1982). Variation of worry content has also been associated with anxiety and frequency of thoughts (Johnston, 1987). In a study, 35 women due to have gynaecological surgery were interviewed the day before, or on the day of surgery. Individuals with elevated anxiety levels had a higher frequency of thought and worries about things not associated with common worry, i.e. worry about surgery conditions and procedure. Instead, they were concerned with factors such as illness, family and medication, suggesting that the majority of patients are not primarily concerned with understanding the treatment. Due to the fact that some worries are associated with low anxiety and others with high anxiety, the amount that individuals worry about does not always predict the level of anxiety that they experience. This suggests that worry content, as opposed to quantity influences level of anxiety experienced (Johnston, 1987). Patients may cope with surgery by controlling their anxiety; they may attend to critical events or they may avoid them. An effective tactic may be to focus on relevant and more manageable day to day worries in the preoperative period, which may result in failure to do the 'work of worry' (Johnston, 1987).

Fatigue, denial, anger and depression are other emotions that are experienced before and after surgery. In the case of heart surgery patients, it has been shown that those patients who are most depressed preoperatively are more likely to show the most postoperative depression at short and long term follow-up (Timberlake, 1997). Emphasis is placed on postoperative fatigue in this discussion as this is known to be a major concern for patients.

1.4.2 Postoperative fatigue

The concept of postoperative fatigue is characterised by increased subjective feelings of malaise and exhaustion in the postoperative period. Although there is no agreed upon definition of fatigue (Chalder, Pawlinkowska & Wessely, 1992), it is suggested that the concept has physical, mental and psychological components (Wessley & Powell, 1989).

Until recently fatigue was considered completely physical in nature, and an important variable in predicting recovery, with those that are more fatigued generally having a poorer recovery (Jenkins, Stanton & Jono, 1994). Fatigue has been shown to be present for up to one month postoperatively (Christensen & Kehlet, 1984). In some patients the duration of postoperative fatigue can be as lengthy as several weeks after surgery (Christensen & Kehlet, 1993). Such extended tiredness is the difference between 'normal' postoperative malaise and postoperative fatigue.

The physiological basis of postoperative fatigue has been substantiated by studies that found a relationship between postoperative fatigue and concurrent cardiovascular measures (Christensen, Bendix & Kehlet, 1982; Vogele & Steptoe, 1986), along with claims that postoperative fatigue is dependent on the severity of surgery (Christensen & Kehlet, 1993). Consequently, fatigue has often been assumed to be a physiological response to surgery. Preoperative fatigue and body composition in the individual are used as evidence in support of the physiological model of fatigue.

It is difficult to attribute any single physical cause of postoperative fatigue. Nutritional support has not influenced the prevention of fatigue (Schroeder & Hill, 1991; Jensen & Hessov, 1997). Secondly, there is no relationship between postoperative fatigue and muscle function, which generally normalises after 2 weeks (Schroeder & Hill, 1994), or endocrine function which is seen to normalise a few days after surgery (Hall, 1994).

In a psychobiosocial theory of fatigue put forward by Salmon & Hall (1997) it is argued that psychological mechanisms operate in postoperative fatigue. They argue that postoperative fatigue is not a universal experience. Support for this is shown by findings that abdominal surgery patients (Schroeder & Hill, 1991) and total joint replacement patients (Aarrons et al., 1997) have shown no increase in fatigue after surgery. It has also been found that patients who do not experience tiredness or fatigue prior to surgery, experience little, if any fatigue postoperatively (Douglas & Shroeder, 1992).

Clinical support for a more psychological basis to fatigue has been found. In a six week postoperative follow-up of 63 patients who had major joint replacement, both mental and physical fatigue before and after surgery were measured. It was found that patients with increased preoperative mental fatigue and more negative mood were more mentally fatigued immediately after surgery and at follow-up. Also, those with increased preoperative mental fatigue had worse subjective emotional and physical state (Aarons et al., 1996b). It is possible that in the hospital setting, where the priority is towards getting the patient mobile and ready for discharge, patients that have a negative mood state or reduced motivation for rehabilitation might be falsely diagnosed as fatigued. A study of 478 heart disease patients was performed to monitor patient fatigue between 3 and 6 weeks postoperatively (Denolett, 1993). Patients involved were those who had either a myocardial infarction, bypass surgery, or coronary angioplasty. A sub-set of 140 patients from the three different groups showed no association between fatigue and physical markers such as cardiorespiratory fitness, however, those patients with increased fatigue showed more negative affect. This finding suggests the independence of fatigue from objective indicators of physical recovery, and its stronger relationship with more 'subjective' psychological indices of emotional distress.

Other support for a psychological basis to postoperative fatigue can be seen from findings amongst 1204 hysterectomy patients. Those who were more fatigued after surgery had more contact with a physician and felt more satisfied with their treatment (Kjerluff & Langerberg, 1995). This ironically suggests that although patients may be satisfied with their treatment they may feel that they are expected to be tired after surgery and to express this to important people in the hospital.

A recent piece of research by Pick et al. (1994) highlighted a physiological and psychological basis to postoperative fatigue. Their assessment of 74 patients who had coronary artery bypass surgery revealed that those patients with the highest concentrations of catecholamines immediately after surgery had the most fatigue one month after surgery. This provides support for a physiological basis to fatigue. However, despite the finding that training of coping skills and emotional support were not found to influence postoperative fatigue, some support for a psychological basis to fatigue comes from the finding that individuals with increased anxiety and depression one month postoperatively showed greater fatigue. It is suggested that an increased noradrenaline response occurs in individuals who may be fatigued for reasons other than surgery for example, physical fitness levels. Further support for a psychological basis to fatigue is inconsistency between pre and postoperative fatigue levels. For instance, Pick et al. (1994) found fatigue levels at day one or day 4 postoperatively showed minimal correlations with fatigue levels at one-month follow-up.

The experience of fatigue may have negative clinical implications. Physically a patient may be recovered but if they feel exhausted this will affect their functional recovery. For example, they may fail to do the recommended amounts of exercise each day. Patients may place more emphasis on their physical recovery and attribute tiredness to physical rather than psychological factors - this denotes a form of somatisation (Salmon & Hall, 1997).

1.5 Influences On Recovery

This section documents how the psychological challenge of being in hospital, for surgery, and the ensuing psychological and physiological response resulting from this can be 'cushioned', technically known as buffered, by psychological and social processes. The principle behind this section is to illustrate that although the challenge of a situation cannot be changed, the way that it is dealt with can be.

1.5.1 Anxiety

Anxiety is an uncomfortable state which can influence psychological and physical recovery. Worry, discussed earlier, is a psychological process which is associated with anxiety. In keeping with one of Borkovec suggestions about the benefits of worry (Borkovec, 1994), this investigation attempts to use interventions which encourage 'constructive-worry'. Such worry emphasises problem-focused activity as preparation for surgery, which has been theorised to be beneficial for recovery. In this sense the 'work of worry' is synonymous with coping rather than emotional state.

On a theoretical basis it has been claimed that increased preoperative anxiety is associated with a process termed the 'work of worry' (Janis, 1958) and can improve postoperative recovery when performed to a moderate degree. Hence, moderate 'work of worry' can have a more positive outcome than excessive, unrealistic worry, or indeed no worry at all, which could lead to a lack of mental preparation. Janis (1958) perceived that the 'work of worry' theory describes realistic mental preparation for anticipated surgical events. He claimed this preparation would reduce surgical stress and improve recovery, and hence advocated moderate 'work of worry' as a mechanism for faster recovery. His emotional drive theory (Janis, 1958) proposed a curvilinear relationship between preoperative anxiety and recovery. In particular, he argued that, if patient levels of anxiety preoperatively are too low, there is a failure to elicit mental preparation, and if patient levels of fear are high, there is a generation of unrealistic fears, which reduce the efficiency of any preparation that occurs. Importantly, the 'work of worry' was viewed as an active as opposed to a passive process by Janis. The provision of information to patients was regarded by Janis as a strategy for instigating the 'work of worry' process. Unfortunately, Janis' model of the 'work of worry' failed to acknowledge individual differences in coping with information which is shown to affect the efficacy of information interventions.

Although it is beyond the scope of this thesis to provide an account of interactions between different personalities and information, in general, it is clear that certain personality types benefit more from increased information (Miller & Mangan, 1983; Watkins et al., 1986, Law et al. 1994; Furst, 1978; Davis et al., 1994; Pickett & Clum, 1982; Partridge & Johnston, 1989; Shaw et al., 1985). Consequently, the value of information and outcome is affected by the personality type (Gatchel, Baum & Krantz, 1989).

Janis' theory is important because clinically it has been believed that 'the work of worry' could be promoted by provision of information and involvement of patients. However, whether the relationship between anxiety and recovery is actually mediated by the 'work of worry' remains unclear. The 'work of worry' performed before surgery can be presumed to protect individuals against increased anxiety and other discomfort in the postoperative period. In theory, it may do this by reducing patients vigilance for threatening stimuli, reducing the likelihood of making threatening interpretations, and reducing the tendency for initiating memories associated with past negative surgical experiences (Salmon, 2000). Johnston (1973) is also supportive of the preoperative period as being a time for effective preparation; a time to accurately anticipate the intensity of pain and discomfort in order to reduce distress by diminishing the discrepancy between anticipation and experience. It is difficult to quantify the benefits of preparatory worry. Although it is argued that worry and problem-solving are similar, worry may not lead to satisfactory outcome if the danger or feared anticipated event is constantly rehearsed without any solution being found (Mathews, 1990).

Existing research literature suggests that the role of anxiety preoperatively is equivocal for recovery. Little support exists for a curvilinear relationship between preoperative anxiety and other postoperative psychological and objective variables. Many findings have been contrary to Janis' curvilinear hypothesis, showing no relationship between pre-operative and post operative anxiety and other recovery measures (Rothberg, 1965; Brugel, 1971; Wolfer & Davis,1972; Wallace, 1986; Johnston et al., 1971). In general, the effects of preoperative anxiety on postsurgical recovery are inconsistent. This suggests that preoperative anxiety is not the most valid indicator of recovery (Salmon, 1994). With reference to Janis' curvilinear hypothesis, the lack of effects of preoperative anxiety on postoperative recovery has resulted in the hypothesis of a curvilinear relationship being extended to include additional indices of recovery apart from anxiety. In effect, anxiety seems to have very little significance for postoperative recovery, and has not always been found to be clinically beneficial.

Increased preoperative anxiety has not always been associated with a better recovery from surgery. In a study of 43 periodontal patients (Croog, Baume & Nalbandian, 1995), postoperative pain was related to increased preoperative pain, dental anxiety and fatigue. Individuals with higher preoperative anxiety and fatigue also had less positive wellbeing after surgery, and those with heightened preoperative positive wellbeing showed reduced pain at this time. In comparison to the effects of psychological variables, those which assessed surgical trauma were found to be insignificant in predicting recovery. It was hypothesised that the impact of psychological factors may be weaker with repeated surgery. However, pre dental surgical anxiety, fatigue and pain interfered with recovery to a similar degree after a second surgery, emphasising the influence of the preoperative period on outcome, rather than the surgical experience (Croog, Baume & Nalbandian, 1997).

The negative impact of anxiety has also been highlighted in a large study by Jenkins, Stanton & Jono (1994). In a group of 463 patients with coronary artery bypass surgery, those with heightened preoperative anxiety, lack of sleep, and little social support showed poorer ventricular function, a clinical variable considered to be the most important predictor of degree of recovery from heart surgery. Those with heightened state-anxiety, depression, hostility and fatigue showed worse outcome at 6 months follow-up. In contrast, positive outcome was predicted by high self-esteem, vigour and perceived social support. Another study showed that lumbar disc surgery patients with reduced preoperative anxiety had fewer postoperative anxiety and psychosomatic distress symptoms and a more satisfactory outcome at 12 months after surgery than those with heightened preoperative anxiety (Graver et al., 1995).

Other research has found that patient expectations, as well as anxiety can act as a negative self-fulfilling prophecy for recovery. For instance, George et al. (1980) showed increased preoperative surgical anxiety and negative recovery expectations were associated with more pain, disability and slower healing in 38 patients who had third molar tooth extractions. However, no relationship of recovery expectations and trait-anxiety with physical trauma which was indexed by length and difficulty of surgery, degree of compaction of teeth, postoperative pain and interference with normal functioning, was found (George et al., 1980). It was suggested that preoperative anxiety and negative expectations could be modified by positive information or suggestions about recovery and by teaching anxiety-inhibiting responses such as relaxation (George et al., 1980).

As well as the negative impact of anxiety, recent research findings have implied that psychological state may be a better predictor of long-term rather than short term recovery from surgery. This is ironic as most research studies have been designed to assess the impact of psychological state on recovery in hospital. A recent investigation by de Groot and colleagues (1997) who worked with lumbar surgery patients, found that three days after surgery those with heightened anxiety preoperatively reported more postoperative tension, leg and back pain and were generally seen to have poorer observable recovery than those with less preoperative anxiety. However, three months after surgery those with increased preoperative anxiety and fatigue showed even greater anxiety, fatigue, and back pain (de Groot et al., 1997), suggesting that anxiety is not used in a constructive way by patients. The finding that psychological factors had more impact on long term recovery than biographical and medical indicators led the authors to conclude that psychological factors may be more appropriate indicators in terms of predicting long-term recovery.

Despite research findings that increased anxiety is not beneficial to recovery, the interpretation of increased anxiety as negative, and the use of reassurance or any method attempting to reduce it, might be counterproductive to the natural stress response. This has been interpreted as an unhealthy 'medicalisation' of the stress response (Salmon, 1993). It is naive and mechanistic to assume that, if an individual is reassured, they will always be better able to cope with current conflicts (Fareed, 1994).

Despite the inconsistent and ambiguous relationship between anxiety and recovery from surgery, as shown in the above research, the relationship between these factors has not been completely dismissed. Janis' theory (Janis, 1958) may seem unsupported for several reasons. The majority of research has assessed preoperative variables and recovery in the first week after surgery, providing a limited assessment period of recovery. Studies looking at the preoperative effects of anxiety have used a diverse variety of surgical groups (gynaecological, dental, orthopaedic, etc.), some of which are known to hold a greater surgical risk and less positive clinical outcome (Salmon, 1994). Also, measures of distress used to index 'work of worry' are often passive, and may not accurately measure the 'work of worry' (Selye, 1976; Salmon, 1992; Ray & Fitzgibbon, 1981).

Indeed, Ray & Fitzgibbon (1981) suggested that if the 'work of worry' is construed as a coping variable, as opposed to an emotional variable, that postoperative recovery may work according to that suggested by Janis' model (Janis, 1958). They equated coping with state of arousal and, more specifically held the belief that a high arousal state in a threatening context, represents active coping while low arousal represents more passive coping. To test this idea, Ray and Fitzgibbon examined the relationship of stress versus arousal (*emotion versus coping*) with recovery amongst 36 cholecystectomy patients. Using an adjective checklist, a distinction between stress and arousal was made. The subjective stress of hospitalisation was associated with words such as 'tension', 'distress' and 'uneasiness', whereas arousal, which was understood to indicate coping was associated with words such as 'energetic', 'lively' and 'active'. They showed that high arousal was associated with reduced pain and analgesic consumption, along with a shorter hospital stay. In contrast, increased stress was associated with increased pain, heightened pain and longer stay in hospital. Overall, a heightened emotional response to stress which is propagated by increased stress, led to reduced postoperative adjustment. The findings from the above study demonstrate that high arousal equates to Janis' optimal preoperative state and may be a more plausible indicator of the 'work of worry' compared to anxiety as a measure of recovery (Ray & Fitzgibbon, 1981).

1.5.2 Personality

Personality has been shown to affect health in general and recovery from surgery. However, because of the fact that it is unlikely to be changed by clinical interventions it is not given much attention to in this review. Different personalities have been associated with different types of behaviour and surgical outcome. Examples of such personalities are: 'time-conflicted' individuals (Graham, 1992), who have have been categorised as Type A in their behaviour (Friedman & Rosenman, 1959), internal versus external locus of control personalities (Rotter, 1966), anxious versus non-anxious personalities (Spielberger et al. 1973), monitoring versus blunting personalities (Miller, 1979) and optimistic versus pessimistic personalities (Scheier & Carver, 1985;1987). Brief attention is drawn to internal versus external locus of control personalities (also associated with desire for control), anxious personalities, and monitoring versus blunting personalities as these measured in this thesis.

Desire for control is similar to locus of control (LOC), a concept originally defined by Rotter (1966). If someone has an internal locus of control, they feel that control of events in their life comes from them. Alternately, for the individual with an external locus of control, the control for life events is independent of them. Generally, research over the past three decades addressing the effect of external locus of control on recovery has shown inconsistent findings (Wallston, 1989; Levesque & Cahrlebois, 1977; Mathews & Ridgeway, 1981). In a review of studies, Wallston (1989) highlighted that patients' perception of their control in the face of various health interventions such as chemotherapy, barium enema, and postoperative recovery, was dependent on desire for control. More specifically, those with moderate desire compared to individuals with a high desire for control showed less distress and greater compliance. Individuals with a low desire for control were adversely affected by increased choice. Hence it is important to identify the extent of an individual's desire for control, in order to administer effective care. It has been suggested that control is not important for those with a low desire for it, while it may not be enough to satisfy patients with a high desire for control (Wallston, 1989).

The anxious personality (i.e. the individual who has a stable high anxiety trait), has shown greater state-anxiety pre and postoperatively (Auerbach, 1973; Spielberger et al., 1973; Martinez-Urritia, 1975), more distress, pain, increased medication requests, and increased hospital stay in comparison to non-anxious types (Mathews & Ridgeway, 1981; Taenzer, Melzack & Jeans, 1986). Adults with high-anxiety that were awaiting dental surgery showed increased physiological responses, preoperatively, compared to those with lower anxiety levels and control patients (Solcova & Sykora, 1995). The finding that trait-anxiety has been associated with high preoperative as opposed to postoperative anxious state has led to the belief that trait-anxiety is a predisposition to become anxious specifically in a situation where there is psychological, as opposed to physical trauma and pain (Ho et al., 1988).

Monitoring and blunting signify two different personality types for dealing with information (Miller, 1979). Monitors seek out and monitor information in a stressful situation and have more perceived control about their situation. While blunters distract themselves from receiving or obtaining information. Similar definitions can be given respectively to sensitisers and repressors (Krohne, 1978). In general, blunters (or avoiders) have shown a more favourable recovery over those who are more vigilant (Cohen & Lazarus, 1973; George et al, 1980; Chaves & Brown, 1987; De long, 1970; George et al. 1980; Kiyak, Vitaliano & Crinean, 1988). One study found that vigilant patients have more anxiety and depression on admission to hospital, and increased anxiety about procedures (Miller, 1979). However, these results might be biased if it is a characteristic of vigilant patients to experience more anxiety, than avoidance patients (Mathews & Ridgeway, 1981). It is possible that information obtained by vigilant patients is not necessarily of any real value to them, or that it is not used in a constructive manner, and hence it becomes harmful. However viglilant behaviour has not always been associated with negative responses. A positive account of vigilant behaviour was found in recent research with children who had orthopaedic surgery. Children who were more able to focus on concrete objective aspects of their surgery, were more likely to use vigilant coping and were found to return to normal activities sooner than children who used non-vigliant, emotion-focused coping strategies (La Montagne et al., 1997). See section 1.5.3 for a discussion of coping strategies.

It is suggested that avoidance is the most suitable strategy for short- term adaptation whereas, in the long term, vigilance is better. Further, avoidance is claimed to be more adaptive when patients have to cope with the emotional value of the event whereas vigilance is more adaptive when coping with non-emotional elements of surgery (de Groot et al., 1997).

It is also clear from many studies that the effect of information interventions on outcome is influenced by patient levels of anxiety (Hathaway, 1986) and desire for information (Miller & Mangan, 1983; Klos et al., 1980; Daltroy et al., 1998). The patients desire for information interacts with the level of information to create positive and negative influences; increased desire is more suited to information provision whereas the opposite fares for those individuals with a low desire. Monitor and blunter personalities, as previously mentioned, will affect an individual's desire for information. Those who want information will seek more information out themselves and be more behaviourally involved with their treatment, that is more vigilant, than those with a low desire for it, who can be classed as avoidant in their approach. Research to date provides a mixed account of the effects of more vigilant compared to more avoidant patients. Although vigilant patients have often shown more favourable emotional, bodily state and other recovery responses compared to more avoidant types this has not been without exception (see Mathews & Ridgeway, 1981). Consequently, it is suggested that it is crucial for clinicians to act as scientific-practitioners, matching information with personality (Salmon, 2000).

1.5.3 Coping

Coping, in comparison to personality, represents a dynamic construct within individuals which can be variable across different situations. In contrast, personality can be seen as a more stable individual difference which is unlikely to change in different situations. Coping strategies may represent an important mediator in a stressful situation which individual differences fail to address (Holroyd & Lazarus, 1982).

Coping is a theoretical concept used to assist in the understanding of how individuals restore meaning and balance to stressful situations or events. Coping is defined as any form of behaviour which helps individuals to manage the stress that they experience (Folkman & Lazarus, 1984). Coping styles can act as mediators in the stress response, affecting the ways in which events are appraised (Gatchel, Baum & Krantz, 1989; Folkman & Lazarus, 1984; Vogel, 1985). The coping process is dynamic in that it represents a number of ongoing transactions with the environment, which are continuously being re-evaluated. The re-evaluation process can influence subsequent coping.

Many methods of coping have been distinguished. A major factor in coping is control. This can be sub-divided between perceived and actual control. With perceived control an individual believes that they can control something, even when they objectively may not be able to. Outcome expectations and self-efficacy represent different aspects of perceived control (Breemhaar & van de Borne, 1991). Outcome expectations are the expectations that an individual has about a situation, and self-efficacy is an individual's ability to implement efforts to achieve the desired outcome. Outcome expectations are likely to be affected by the amount of choice individuals feel they have in different situations. Hence, one aspect of control is choice, and it is presumed that the patient with perceived control is more involved through knowledge and choice.

In this section, studies which have assessed the effect of coping strategies and perceived control in general and specifically in surgery are discussed. The psychological and physiological effects of coping strategies and perceived control are outlined.

1.5.3.1 General psychological and physiological effects of perceived control

With reference to health, it is claimed that perceived control can be gained from modifying behaviour, seeking information, making more personal decisions and using services (Krantz, 1980), or it may exist due to a wider set of beliefs (Thompson, 1986). The presence of perceived control may also create a feeling of personal responsibility. Research on perceived control has highlighted the beneficial effects of it in many contexts.

Theoretically, perceived control over an outcome in stressful situations has usually been valued as a beneficial mediator of outcome. Alternately, the absence of perceived control is associated with uncontrollability and learned helplessness (Seligman, 1975). On a subjective level, uncontrollability is associated with a feeling that nothing can be done to change a situation. Hence, perceived control is an aspect of coping which most theory suggests is beneficial in a stressful situation (Janis, 1958; Lazarus, 1988; Vogele, 1985). More specifically, it is theorised that perceived control permits predictability of stress, which enables individuals to prepare for it (Baum et al.,1981).

In experimental studies which have subjected individuals to loud noises, shocks or demanding mental tasks, those who have been led to believe that they have some control over such stimuli have shown reduced subjective distress (Corah & Buffa, 1970), reduced physiological arousal (Gerin et al., 1995) and less impairment in performance (Geer, Davidson, & Gatchel, 1970). Also, investigations which have assessed the effects of perceived control with humans in various life situations have found a lack of perceived control to be a risk factor in several clinical and physical problems. For example it has been shown that individuals with increased perceived control are less likely to suffer from feelings of emotional exhaustion and depression at work (Teuchmann et al., 1999; Glass & McKnight, 1996), infertility (Abbey et al., 1992), poorer general health (O'Leary & Helgeson, 1997), and increased depression and psychological distress as a result of chronic illness (Chaney et al., 1996; Fowers, 1994). Also, perceived control in naturally occurring stressful situations has been shown to be helpful. For example, increased perceived control was found to reduce negative health related behaviours during examination stress in medical students (Ogden & Mitandabari, 1997). This research provides overwhelming evidence of the positive consequences that are associated with increased control.

Lack of control has frequently been associated with a raised stress response in laboratory experiments with animals. Indeed heightened hormonal levels have been found in situations which create uncertainty (Mason et al., 1986), uncontrollability or unavoidability (Maier et al., 1985, Frankenhauser & Rissler, 1970; Swenson &

Vogel, 1983). The long-term implications of an increased stress response has not been unestablished.

In humans, research has shown self-efficacy, which can be presumed to indicate the level of control someone has in a situation, to have an effect on the physiological stress response. Laboratory based experiments have shown increased levels of self-efficacy to be associated with reduced physiological effects (Bandura et al., 1982, 1985). In Bandura et als. studies women with severe spider phobia were asked to rate their ability to cope in situations which had increasingly threatening interactions with spiders. These women then attempted to perform activities which involved interaction with spiders. Adrenaline and noradrenaline levels were comparatively higher for women with medium self-efficacy when compared to those with high self-efficacy levels. This suggests that the less ability someone believes themselves to have to cope with a stressful situation, the greater their physiological stress response to the situation will be (Bandura et al., 1985). Interestingly in Bandura's study, weak self-efficacy was associated with a failure to carry out tasks, and a sudden reduction in catecholamine levels. This suggests that those who perceived themselves to have very low self-efficacy to perform the task prevented an increased stress response by their decision to not perform at all. It can also be interpreted that the cessation of tasks for those with low self-efficacy in this investigation was the least stressful option from a psychological and physiological perspective.

In summary, increased perceived control is generally associated with positive psychological and physiological states in both laboratory and real-life circumstances.

1.5.3.2 The effect of perceived control in surgery

A diversity of coping methods are used by surgical patients (Ray, Lindop & Gibson, 1982). These can be broadly divided into emotion-focused and problem-focused categories, and are represented by behavioural and cognitive activities. Some have been shown to be more advantageous for surgical recovery compared to others. Research has found different coping strategies to be associated with certain psychological and physiological effects.

1.5.3.2.1 Psychological effects associated with perceived control

Generally emotion-focused coping aims to control the emotional response to a stressful situation, and is often used when perceived control in a situation is low. An individual may use denial or distraction techniques with this type of coping. Techniques include relaxation and distraction activities, as well as using psychological defence mechanisms such as denial and repression. Alternatively, problem-focused coping aims to reduce the demands of a situation, or increase the resources to deal with it. This may be done through addressing the situation constructively, for example seeking social support or changing the meaning of the situation. A greater sense of control can be assumed with problem-focused coping compared to emotion-focused coping. Emotion-focused coping strategies have been associated with a worse outcome from surgery in comparison to problem-focused coping. A cardiac study by Khalid & Sial (1998) showed that ten days after heart surgery, the majority of 'good recoverers' used more problem-focused than avoidance coping strategies compared to 'poorer recoverers'. Recovery estimations in Khalid and Sials' study were based on surgeons' reports.

Amongst dental surgery inpatients, Ho and colleagues (1988) showed that patients who used emotion-focused coping with acceptance of the situation being their main strategy had a reduced tendency to worry but were more distressed and had greater preoperative and postoperative state-anxiety. This contradiction of reduced worry but heightened distress relates well to Janis' theory, which states that attending to the surgical event, and engaging in 'constructive worry' about it, is associated with better surgical adjustment. In contrast, active coping was associated with reduced anxiety (Ho et al. 1988; Wong & Kouloupek, 1986). This suggests that *active* as opposed to *passive* coping, is more beneficial for individuals having surgery, in at least that it reduces their perioperative anxiety.

Where defence mechanisms have been used to cope with the challenge of surgery, outcome has been negative. A study by Shaw et al. (1995), which assessed the impact of denial in surgical patients, highlighted possible reasons for a poorer recovery amongst those using such an emotion-focused method. In denial, the individual will avoid rather than address the problem. Cardiac surgery patients who have used denial strategies, thereby refusing to acknowledge unpleasant realities, have shown less anatomical and physiological knowledge at discharge (Shaw et al., 1985). The authors suggested that because of this strategy, denial patients might leave the hospital with less follow-up and risk information, which may lead to slight confusion and inhibition of social functioning. However, there were no long-term detrimental effects from this form of coping six months postoperatively in terms of illness severity, complications, or behavioural function. This outcome was similar for those who used repression strategies whereby the individual remains unaware of internal impulses and feelings. The lack of information obtained by patients who use denial may lead to increased feelings of anxiety (Shaw et al., 1985).

Several groups of researchers have assessed the relationship of outcome expectations and self-efficacy with recovery from various types of heart surgery. It has been found that these factors, which affect levels of perceived control, can influence psychological responses to surgery. Self-efficacy as an aspect of perceived control has been shown to influence recovery from surgery. For example, 48 heart surgery patients (coronary artery bypass graft -CABG) with greater perceived self-efficacy and social support showed more energetic mood, increased activity levels, and less worry after surgery, compared to those with lower self-efficacy (Schwarzer & Schröeder, 1997). Also, another study which assessed 48 coronary artery bypass patients found that patients with greater self-efficacy for toleration of pain and rest without use of medications, had heightened tolerance to pain, less need for sleeping tablets and were more likely to rest after their surgery (Bastone & Kerns, 1995).

Increased perceived control has been shown to mediate the relationship between pain severity and patient satisfaction. It was shown by Pellino & Ward (1998) that amongst 137 patients who had elective orthopaedic surgery, those individuals with increased perceived control over ensuing pain after surgery were observed to have reduced pain severity and greater satisfaction with pain relief.

One way in which individuals can increase their perception of control in the surgical situation is to become more involved through direct action or obtaining information about pending surgery, these represent behavioural and cognitive problem-focused activity. A better health outcome has been associated with these strategies. Mahler & Kulik (1997) assessed 75 individuals having non-emergency coronary-bypass surgery, and found that those with a high information preference showed less negative psychological postoperative reactions. They had reduced pain and better overall recovery, compared to individuals with low information preference. Furthermore, those who were more behaviourally involved with their treatment were discharged earlier from hospital, compared to those with low behavioural involvement (Mahler & Kulik, 1997).

It has been shown that increased psychological adjustment before and after surgery is associated with patients' heightened feelings of self-control about their recovery (greater internal locus of control). In an investigation by Kugler et al. (1994), heart surgery patients who believed that control resided with others were more anxious and depressed 20 days after surgery. The fact that perceived control was more predictive of postoperative emotional adjustment compared to pre-surgical emotional adjustment suggests that perceived control has beneficial effects in the postoperative period.

Heightened beliefs about self control before and during surgery have been shown to have long term consequences. The belief held by patients that they can have control over their treatment, has not only been found to make breast cancer patients feel more responsible for treatment decisions, but also to be related to a higher quality of life at six months and one year after surgery (Street & Voigt, 1997). A similar finding was reported by Moser & Dracup (1995) for patients who had a myocardial infarction, coronary artery bypass surgery, or both. Those with greater perceptions of control about their illness had better psychosocial adjustment six months after surgery compared to those with low perceived control. They showed less depression and hostility at this time. Another investigation by Holland & Rowland (1989) showed that stronger belief in control over recovery amongst patients who had surgery for laryngeal cancer, were associated with more problem-focused coping and a more favourable recovery.

In an investigation by Thomas (1995) a traditional education intervention and a collaborative intervention were compared in 96 CABG patients, in the first phase of cardiac rehabilitation, after coronary artery bypass graft (CABG). The traditional intervention encouraged a passive role for patients, in particular a minimal role in decision-making or control. The collaborative intervention reinforced individual learning needs, recognition of rehabilitation principles and personal effort in planning and rehearsing for better health, and encouraged identification of personal risk factors and possible effects of current lifestyle on health, problem-solving activity and expression of concerns. In general, the collaborative intervention encouraged patients to have more control and involvement in their rehabilitation. Patients in the collaborative intervention showed reduced state-anxiety at hospital discharge compared to those in the traditional intervention, suggesting that preoperative preparation influenced postoperative emotional state. The main problem with Thomas's study is that, it is difficult to know if any particular aspects of the collaborative intervention contributed, more or less, to anxiety reduction (Thomas, 1995). It is also not clear whether patients were able to learn their specific coping technique, or not. However, as suggested by Salmon (1994), a more plausible explanation, given the short amount of time patients had to adjust to the coping technique, is that patients *felt* they had learned a coping technique. Consequently, the coping intervention employed by Thomas (1995) may have increased patients' perceptions of control over their health-care, without actually changing the amount of control that they had.

It is argued that although cognitive interventions are designed to enhance active coping they may not be directly responsible for their effects. It is possible that interventions may affect other variables, which in turn effect outcome. Consequently, the variables that affect the outcome are known as mediators of that outcome (Baron & Kenny, 1986). There has been recent speculation that the effects of psychological interventions may be mediated by their effects on the stress response (Manyande et al., 1992, 1995). To date, clinical research in surgery which has looked at the effect of coping on physiological responses has been limited.

1.5.3.2.2 Physiological effects associated with perceived control

As it is believed that a heightened physiological response in surgery might be detrimental to the recovery of individuals (Hall, 1985), one of the criteria for successful coping is the reduction in physiological arousal i.e. reduced heart rate, pulse, endocrine responses etc. (Steptoe, 1989; Taylor, 1995; Levine, 1983). However, it is suggested that attributing corticosteroid levels to coping may be flawed, as reduced hormone levels may not indicate coping but habituation or depletion of stored neurotransmitters (Steptoe,1989). As there is no completely effective style of coping, with all styles having costs and benefits, it is suggested that it is more beneficial to assess which, if any, physiological responses have clinical significance in different situations (Steptoe, 1989).

Amongst surgical patients, Boore (1978) found that being involved in treatment through breathing and muscular exercises was associated with a reduced cortisol response. As a reduced stress response is intuitively favoured over a raised stress response, the association of a better recovery with increased involvement in health care is reinforced by this finding. However, as with other investigations, the long-term implications of such effects were not followed through.

In an attempt to understand mediating factors in active coping, Manyande & Salmon (1992) assessed the relationship of active coping with other recovery dimensions in 40 minor abdominal surgery patients during the first week after surgery. A range of tests were selected to measure coping. These were indirect measures of arousal and a direct coping checklist. Another set of measures were selected to monitor recovery; these included type A disposition, extent of dependency on health care, and anxiety levels. Findings showed that 'active' copers had less pain and anxiety, fewer symptoms and better bodily state than those using passive coping strategies. Also, the associations of coping with other measures of recovery remained past the first postoperative day compared to other indices measured. This suggests a more long-term influence of coping compared to other indices of psychological state.

Also, in Manyande & Salmon's investigation preoperative arousal as predicted by Ray and Fitzgibbon (1981) was more indicative of active coping than anxiety. In particular individuals with increased arousal but less stress were found to worry more, as did Type A individuals, and be more inclined to be behaviourally active. Alternately, individuals who coped by being less behaviourally active were shown to have a higher dependency on powerful others. Type As were also least likely to attribute their health to powerful others. Overall, this investigation confirms that active coping is associated with a more positive recovery from surgery compared to anxiety. It also shows the connection of active coping with type A and dependency in health-care, suggesting that such predisposing attitudes can affect coping. One possible shortcoming with this investigation is that the improved bodily state for Type As is associated with their tendency to under report symptoms (Carver, Coleman & Glass, 1976), rather than specifically with active coping.

In summary, although a lack of perceived control has generally been associated with increased psychological distress, discomfort, increased arousal and a heightened stress response, it is uncertain whether such an outcome is harmful for more long-term recovery. Ironically however, because it is believed that it can be difficult to be in control in the hospital environment, it is suggested that the perception of limited control might be a positive adaptation in surgical patients (Breemhaar & van den Borne, 1991). This is because patients are often restricted in the amount of control that they can physically have over surgical procedures. Hence in such a situation the perception of increased control is artificial (Skinner, 1995), if not deluded.

In summary, perceived control has been shown to influence the physiological and psychological response to surgery, as well as affect an individual's behaviour in various circumstances. Although coping has been shown to influence psychological and physiological state both pre and postoperatively, there is no clear evidence that control brought about through being directly involved with hospital care and treatment, has any influence on the hormonal and inflammatory response, nor any long-term benefits over more passive coping. Hence, it is the purpose of this thesis to investigate whether the effects of psychological interventions, designed to encourage active and passive coping, are mediated by their effects on the stress and inflammatory response.

For the purposes of this thesis, patients' perception of control is manipulated; some are encouraged to actively seek information about health issues and make decisions about their treatment while others are encouraged to do vice versa. It tests the inconsistent evidence that these procedures are beneficial to recovery and the possibility, in the case of those procedures that encourage relaxation, that they may even be harmful. This suspicion has arisen from the association of a raised stress response with relaxation procedures. For the purposes of this investigation, the procedures that are likely to reduce control and involvement are denoted by the term 'passive'. In contrast, procedures which attempt to increase perceived patient control are therefore denoted by the term 'active'. Subsequently, in this investigation there is an 'active' and a 'passive' intervention. The active intervention attempts to initiate constructive preparation for surgery, that is what Janis' termed the 'work of worry', whilst the passive intervention works against this process.

1.5.4 Social support and Reassurance

This section discusses the concepts of social support and reassurance, and afterwards provides a review of their effect on surgical outcome.

1.5.4.1 Social support

Social support, like that of stress and coping, is a theoretical concept. It has been defined as 'the assistance and comfort provided by network members in times of need' (Lewis, Rook, & Schwarzer, 1993) and has been shown to moderate the effects of stress (Taylor, 1995). Social support is believed to come from many different sources such as partner, friends, community etc. It has been categorised as being emotional, cognitive, tangible, informational, or appraisal-based. Appraisal-based support refers to the availability of someone to talk to, and may be obtained on an individual level, or from the feeling of belonging to a group, no matter what the size. This diversity of social support is frequently ignored in research and it is suggested that there is a need for a more 'finely grained analysis' of the concept to clarify which type of social support can be attributed to positive health effects (Schradle & Dougher ,1985).

Importantly, perceived social support has not always been found to correlate with objective or actual amounts of support. In general social support is believed to either act as a stress buffer or stress reducer. The stress buffering hypothesis states that stress is more tolerable in the presence of social support (Cohen & Willis, 1985). Whereas the direct effects hypothesis states that stress can be alleviated by the presence of social support networks; support here acts as a stress reducer. In addition to this, support is thought to be beneficial regardless of whether stress is present or not. Whatever the effect, in general social support has been found to affect perceived levels of stress and health. For example, greater levels of support have been associated with less psychological strain in the work environment (Cottington &

House, 1987), and better recovery from minor illness (Waxler-Morrison, 1991; Ell et al., 1992; Cohen et al., 1997).

1.5.4.2 Reassurance

The concept of reassurance and support are often used interchangeably despite the fact that they are different strategies that are often implemented on the surgical ward. Reassurance is used informally by staff and is not based on any form of systematic assessment. It is not considered a 'supportive' strategy because it generally tries to provide patients with a positive, albeit not always realistic view of events, and often entails communication that shows limited empathy with patients' worries (Salmon, 1994). Methods of reassurance include prediction, distraction and direct action. In prediction the aim is to make patients feel safer than they presently do. In distraction patients are drawn away from their concerns, and in direct action nurses take action to enable patients to feel reassured about a worry, for example they can give results of a blood test. Prediction and empathy were found the most reassuring tactics amongst patients (Teasdale, 1992). Explanation of fears when combined with therapeutic reassurance has been shown to increase postoperative discomfort (Wilson-Barnett & Fordham, 1983) suggesting that reassurance may not be the most appropriate intervention for psychological wellbeing if it is combined with psychological interventions which encourage more vigilance in patients. It has been claimed that provision of control to patients may be more effective than therapeutic reassurance in relieving anxiety (Teasdale, 1994).

1.5.4.3 Support and reassurance in the surgical environment

Although hospital staff provide tangible and psychological support both formally and informally, there has been virtually no research which has assessed the impact of such social support on patients during their hospital stay. Research has mainly concentrated on the influence of social support from the family, both inside the hospital and after discharge.

In one study which did look at the effect of staff support, as well as hospital visitors, it was found that increased support was associated with positive recovery behaviours, such as coughing and ambulation in patients who had coronary artery bypass (Bastone & Kerns, 1995). Research has mainly concentrated on the influence of social support from the family, both inside the hospital and after discharge.

In one of the first systematised investigations which assessed intervention using emotional support, Egbert et al., (1964) explored its effect on postoperative recovery. Their 'special care package' intervention included a combination of pain management, visit by an anaesthetist and relaxation training. This was compared to routine hospital care. Patients in the ‘special care package’ group were more comfortable and had better physical and emotional adjustment postoperatively than those in the routine care group. They requested less analgesia and had a shorter hospital stay (Egbert et al., 1964). Although such an intervention was seen as useful, it is difficult to know which, if any, of the components were most effective.

Funch and Mettlin (1982) also showed the effectiveness of professional support on long-term outcome for patients who had breast cancer surgery. Women were followed up at 3 and 12 months after surgery. Professional support was defined as accessible support through relationships with health-care professionals, and was measured through patient's satisfaction with care, hospital procedures and communications. Other measures of support included financial, which was based on income, and social support which related to individuals' perception of the number of people they could talk to. Patients who perceived greater support from health care professionals had greater improved functional recovery compared to those with reduced perceptions of professional support. Also, those with increased income showed improvement on an even wider range of physical recovery measures. Alternatively, individuals with increased perceived social support had more positive mood at both follow-up times. No relationship was seen between social and professional support on outcome from breast surgery, suggesting the independent effects of different types of support. Here different types of support were all effective for beneficial outcome after breast surgery.

Other investigations have shown that during hospital stay, individuals with less perceived social support, from family and friends, have shown less immunocompetence after surgery (Linn, Linn & Klimar, 1988; Levy et al., 1990). Also, research with coronary artery bypass patients showed that those with increased preoperative social support were less depressed in the immediate postoperative period, compared to those with little support (Coombs et al., 1989). Heart surgery patients with increased social support have shown reduced pain medication intake, quicker recovery (Kulik & Mahler, 1989), and amelioration of stress and distress in short-term recovery (Fontana et al., 1989). Frequent visits from spouses have been associated with faster recovery from hospital in heart surgery patients (Kulik &

Mahler, 1987), and breast cancer surgery patients with increased family support showed less anxiety and depression whilst in hospital (Neuling & Winefield, 1988). From these findings it can be speculated that restriction in visiting hours may be harmful to patients recovery. Other research, with various orthopaedic patients, found that patients who were more satisfied with support, made less patient controlled analgesia (PCA) demands, and had a lower requirement for opium (Gil et al., 1990). Interestingly, cardiac surgery patients were found to seek more social support prior to surgery, despite other coping tactics remaining static (Crumlish, 1994). This suggests that support may be most beneficial preoperatively.

The impact of social support can also be seen after discharge from hospital. Research which differentiated different types of social support has found some interesting relationships. King et al. (1993) assessed the impact of tangible, emotional closeness, group belonging, appraisal and self-esteem support with postoperative emotional and functional outcome in coronary artery bypass patients. Although all types of social support were associated with positive outcome, it was found that increased levels of esteem support, compared to other types, were consistently related to better mood and increased satisfaction with life at one and four months and one year after surgery. Similarly, esteem support was associated with less functional disruption in activities of daily living at one and four month follow-up. At one and four months after surgery, individuals with increased perceived group support, compared to other types of support, had a reduced incidence of angina. Overall, the results from research by King et als. (1993) study suggest that emotional support, particularly self-esteem is more important for health outcome compared to other forms of support.

Another group of patients studied after discharge from hospital are those who have had surgery for hip fracture. Amongst this group of patients, research has shown that increased social support is associated with improved postoperative recovery. In Mutran et al's. investigation, of 214 females who had hip fracture surgery, those with inadequate support (that is those who had little help with daily tasks), showed less improved walking ability two months after surgery. This result emphasises the importance of social support early on in the postoperative period.

A study by Stams, Koopmans and Mathieson (1991) with a groups of 51 laryngectomy patients showed that social support was associated with more positive physical, i.e. oesophageal speech, and psychological adjustment after surgery. Improved psychological adjustment was associated with increased satisfaction after surgery.

Although social support is generally positive it has been seen as dangerous in certain situations. In 1983, Krantz and Deckel wrote of the role of the spouse in'cardiac invalidism'. In particular, it was suggested that a spouse's beliefs about their partner's physical abilities may effect the amount of rehabilitation their partner engaged in, that is it might slow down the rehabilitation process. It has been found that although being married or supported in other ways was shown to increase survival or freedom from reoccurrence of heart attack amongst myocardial infarction and coronary artery disease patients, this has been associated with delayed short-term physical adaptation in this group (Reifman, 1995). In some situations there may be unacknowledged collusion towards continuing dependence if it suits the carer to continue caring. This collusion may discourage rehabilitation or exercise; indeed spouses have illustrated how helping behaviour is irritating and non-supportive to their work as carers (Melamed & Brenner, 1990).

In summary, supportive relationships may be useful in reducing the stressfulness of recovery but they may also promote the 'sick role'' described by Parsons in 1951. This allows the sick person to be relieved from normal duties and from responsibility for their own condition. Sick role behaviour can be active or passive and it has been found that individuals with more passive beliefs are viewed as 'good patients' by staff, and are less likely to argue with and complain about physical discomfort to staff in comparison to more active patients (Lorber, 1975). Refer to chapter 5 for a more detailed assessment of patient attitudes and behaviour whilst in hospital.

The mechanism by which social support promotes health has largely been unanswered partly due to the complexity of what social support constitutes in research. It may result in a stressful situation being perceived as less threatening (Lazarus, 1964), or it may enhance an individual's self-esteem making him or her feel more valued, loved and competent (Willis, 1999), or it may reduce feelings of stress (Cohen & Willis, 1985). It is suggested that support and reassurance can increase or maintain a patient's perceived control (Breemhaar & van de Borne, 1991), which may affect the physiological response. Findings that low levels of social support are associated with a more compromised immune system are congruent with this theory (Sarason, Sarason & Pierce, 1988). Supportive relationships may help individuals to have increased self-esteem and to comply with behavioural and medical recommendations (Di Matteo & Hays, 1991) thereby increasing positive coping behaviour, which is impaired if there is a perceived lack of support (Linder, 1982). However, it is difficult to say whether coping behaviour encouraged by others is always positive.

1.5.5 Coping interventions

1.5.5.1 Definition

Cognitive coping interventions are varied. They include intervention techniques which are used to assist in retraining, distracting patients from or reinterpreting the situation they are in. Coping interventions commonly use systematic information, relaxation, imagery and encouragement of behavioural involvement techniques as components of a wider intervention. Coping techniques have been used with a variety of clinical groups such as individuals with alcohol and smoking dependency (Chaney, O'leary, & Martlett, 1978; Lang & Martlett, 1982), chronic illness (Lorig, 1984) and stress in medical settings (Morris & Kratochwill, 1983).

Interventions which use information as the main tool for influencing patients can be presumed to work by a different mechanism from interventions which educate patients about skills which they are led to believe will help them cope with pending surgery. The use of information as a tool in interventions can be attributed mainly to the practical implementation of Janis' theory (Janis, 1958) by psychologists. The theory was concerned with the effects of information provision on postoperative surgical patients. Alternately, interventions which encourage patients to be more involved with their treatment stem from psychological literature which has found that increasing patient perceptions of control in health settings were associated with positive emotional and behavioural adjustments (Langer, 1983; Schulz & Alderman, 1973; Slivinske & Fitch, 1987). It is claimed that cognitive coping interventions have the potential to create a cognitive reappraisal, and may be important in medical settings where there is little opportunity for behavioural coping (Steptoe, 1989).

Although cognitive coping interventions used with medical patients may not be effective every time they are used, they are known to be associated with specific beneficial effects (Weinman & Johnson, 1988). This section provides a discussion on the effects of coping interventions which have used information, relaxation, guided imagery and encouragement of behavioural involvement as vehicles of that intervention.

1.5.5.2 Limitations of existing research

The existing research on information, relaxation and guided imagery as interventions is fraught with many methodological and design problems. A large amount of research which has attempted to evaluate the effects of interventions is quasi-experimental (Mauer et al., 1999). Indeed, many studies have failed to use randomised controlled trial methods and hence are likely to have biased recruitment methods and no control group with which to compare their findings. Recently a review of relaxation studies by Seers & Carroll (1998) highlighted that the majority of studies using relaxation to assist in pain relief consisted of non-randomised controlled trials with sample numbers fewer than 10. Also, in Blankfield's review of research which assessed the effect of suggestion and relaxation between the period 1961 and 1988, at least 50% of studies were limited by non-randomised designs, small sample sizes and a variety of outcome measures (Blankfield, 1991).

It has also been suggested that lack of effects of interventions on postoperative outcome may be because patients are not able to practise the intervention preoperatively due to other hospital events (Daltroy et al., 1998). Inevitably, the amount of time in which patients have been given to practise interventions has also varied considerably in research. Also the delivery of messages has varied; some studies have chosen one-to-one interaction where a therapist, researcher or member of hospital staff has suggested various recovery messages, whilst others have used audio-tapes, and other studies have used both methods in conjunction with one another. Also, in reviewing the literature on cognitive interventions there are inconsistencies in the messages that they have given to patients. In particular, relaxation interventions whilst employing typical relaxation response methods (see below) will also encourage patients to take control over their ability to control their pain (Enquist & Fischer, 1997), while others will encourage patients to be more passive in their recovery. In effect, patients receiving interventions are provided with different coping messages. Also, many studies have looked at the effects of psychological preparation for minor surgery hence these effects may not be generalisable to major surgery. Where research is discussed in depth, this subsequent discussion concentrates on randomised clinical studies that have used interventions to prepare individuals for major and minor surgery.

1.5.5.3 Vehicles for coping interventions

It is commonly assumed that relaxation, imagery and information are interventions in themselves. However, it is perhaps more appropriate to say that they are used to achieve different coping strategies. This makes them the 'vehicles' by which an intervention is formed. These vehicles, often used to prepare individuals for surgery, are sole components of an intervention or they are used in conjunction with one another.

It is also clear that what constitutes a relaxation, a guided imagery or an information intervention is not clear-cut. Research to date has used these vehicles inconsistently. For example, relaxation has been used as a technique to encourage calmness, tranquillity and reduced involvement in recovery, whilst others have used it for similar purposes whilst also informing the patient of the body's natural ability to take control in such situations. In the former example it could be argued that individuals are actually provided with an ambiguous message. Consequently, although these interventions are often effective, the inconsistent way in which they are used makes it difficult to ascertain the process by which they may work.

This review outlines the principles behind information, relaxation and imagery techniques. It also provides a brief account of the general effects of these techniques, and a more detailed review of their effects on surgical outcome.

1.5.5.3.1 Information in surgery

Information can be procedural or sensory. Sensory information provides patients with an expectation of likely sensations that are experienced before, during and after procedures. Procedural information provides a practical account of the procedure, outlining time, place and parts of the body which are directly affected. Information has been studied so much because of its relevance to Janis' theory (Janis, 1958) which hypothesised that information would help to reduce anxiety after surgery by instigating 'the work of worry'. Janis did not discriminate between different types of information which could be used to instigate the 'work of worry'. It can be argued that although procedural information may be informative for patients, it does not involve much effort on the part of patients and may possibly encourage passivity. In contrast, it can be suggested that sensory information because it aims to instigate a personal visualisation and interpretation of pending surgery, would be expected to encourage more active and involved coping. This coping encourages patients to attend to their recovery, rather than distract themselves from it. In terms of Janis' theory, sensory information may be the most effective form of preparation for surgery because of its potential ability to influence the 'work of worry' process. Others have since also suggested a relationship between accurate anticipation of postoperative pain and discomfort and reduced postoperative distress (Johnston & Leventhal, 1974).

An assessment by Suls & Wan (1989) from a total of 21 studies, (of surgical recovery, medical exam or procedure, or pain induced in a laboratory setting) showed combined procedural and sensory information produced the largest and most consistent benefits compared to sensory or procedural information on their own. This led to the dual-process preparation hypothesis (Suls & Wan, 1989). It is suggested that information enables patients to form accurate expectations about future experience and match these (as they go through them) with preparation they have engaged in, as opposed to defining their experience in a fearful and unrealistic way (Johnson & Lauver, 1989). Thus, information might help reduce the novelty and suddenness of a stressful event (Wright, 1987).

Despite evidence to support the superiority of combined procedural and sensory information, in hospitals the desire to reduce anxiety has led to the development of preparatory interventions which mainly use procedural information which is objective in nature. Such objective information provision has been associated with anxiety reduction in heart (Kendall et al. 1979; Anderson & Masur; Peterson, 1991) and gynaecological surgery patients (Wallace, 1986). Also, hysterectomy patients who received information in booklet form showed reduced postoperative pain and distress and earlier discharge in comparison to control groups (Young & Humphrey, 1985). Procedural information has been described by patients as being useful (Ridgeway & Mathews, 1982), and has been associated with satisfaction about communication in the hospital environment (Ley et al., 1976). Other research showed that visits by an anaesthetist, the evening prior to surgery, reduced anxiety significantly in a group that received an education booklet compared to a group that received just information or routine hospital treatment (Leigh, Walker, Janagathan, 1977). As the booklet was less effective than the visits, it was believed that a visit by an important member of the operating team may have been perceived as respectful, and that it may have been this mechanism that was responsible for the beneficial effects seen. Information has also been beneficial in other areas of recovery apart from alleviating anxiety. Research with hip replacement patients given procedural, sensory and coping information, in verbal and written form, showed them to have increased physical function postoperatively compared to those who received routine advice and support (Gammon & Mulholland, 1996).

Despite the benefits that have been obtained from information, the process by which it works has not been confirmed. With reference to Janis' theory (Janis, 1958), it can be argued that procedural information is not likely to be as effective as sensory information in instigating 'the work of worry'. So although information has been shown to be beneficial it cannot be assumed that it facilitated 'the work of worry' in patients (Janis, 1971).

Also, despite the beneficial effects of information for surgical patients it is clear that the amount of information *received* does not always match that *provided* (Andrew, 1970), or as found by Marteau et al. (1996) does not always work as expected. For instance, Marteau et al., (1996) showed that amongst colposcopy patients, brief procedural, behavioural and outcome information was effective at reducing anxiety when compared to more complex procedural and outcome information.

It is suggested that while information can reduce anxiety it may also promote other processes (Salmon, 1994), such as making patients feel in control or that they are supported (Anderson, 1987). Other research findings have been helpful in suggesting possible mechanisms through which information may work. Santavirita et al. (1994) found that information influenced the way in which patients' communicated with staff. Total hip replacement patients who received teaching and an information booklet preoperatively were more likely to inform their doctors of complications and were inclined to seek out more information about their hip replacement compared to individuals who received no information (Santavirta et al., 1994). Information in this context appeared to encourage more 'involved' behaviour, which is the type of behaviour considered beneficial for surgery. Consequently, it has been suggested that when patients feel that they are actually participating in their health care rather than being passive recipients of it, they are more likely to have a more positive response to information (Thompson, 1993).

In contrast to the beneficial effects of information found by others, Johnston (1987) arues that there is little value in pre and postoperative treatment information for major surgery patients. This may be because responses to surgery, for example postoperative fatigue, extend beyond treatment (see section 1.3.1). Hence, provision of information which is largely concerned with treatment, and is not designed to address patients' anxiety that may occur afterwards (Johnston, 1987), may explain the lack of success of such preparation in the long term.

Such interactions have made it difficult to interpret the effects of information interventions. Information as an intervention was considered important to discuss in this thesis as it is not only a strong component of other coping interventions which have been seen to have more consistent beneficial effects on surgical recovery, but it is also the foundation for the development of them (Cohen & Lazarus, 1973). Hence, information is given whenever other coping interventions are used. It would be informative to look at the impact of information on an individual's perception of control, as there is no research which looks at the relationship between these two variables.

In this thesis patients were notified about how information could be used effectively. This was because the main emphasis in this thesis was not with information per se, but with its role in coping. This was crucial as a means of testing Janis' theory about the beneficial effects of the 'work of worry'. Opportunities to directly seek information or be more behaviourally involved with their treatment were made explicit, as a means of increasing patients' perception of control over their recovery. Theoretically, the implementation of an 'active imagery' intervention was important because it would hopefully assist in the processing of information by individuals, and hence make patients realise the value of that information for their recovery (Berlyne, 1960). In turn, increased information may assist in the development of preparatory response (Perkins, 1968) or an increased sense of control (Lazarus, 1966).

1.5.5.3.2 Relaxation

1.5.5.3.2.1 Definition

Relaxation is considered an antidote to the stress response. Benson uses the term 'relaxation response' as a way of describing the effects of relaxation (Benson, 1935). Benson's stress reduction technique specifically involves focusing on improving the efficiency of breathing. The focus on breathing is used to focus the mind and divert it from internal thoughts and external stimuli. This relaxation is enhanced further by the introduction of imagery. The relaxation stress response is marked by reduction in breathing rate, blood pressure, heart pressure and muscle tension. Relaxation requires that the individual becomes aware of their present physical and mental state and to let go of any tensions that they experience. Consequently, biofeedback techniques which provide information to individuals about their physiological state are often used to help the process of relaxation.

1.5.5.3.2.2 General effects

Relaxation has reduced incidence of headache (Blanchard et al., 1987) and headache pain (Andrasik, 1987). It has also relieved back pain (Belar & Kilbrick, 1986), and fear associated with agoraphobia (Gatchel, 1980). Also, a recent randomised clinical trial by Walker et al. (1999) showed relaxation was effective at improving mood and quality of life in individuals who were having chemotherapy for breast cancer. In relaxation, as well as various other interventions, positive self-talk is often encouraged as a way of reinforcing a message which has been encouraged (Zeigler & Prior, 1994).

1.5.5.3.3 Relaxation and surgery

Psychological and physiological benefits of relaxation in surgery have included reduced subjective distress, blood pressure and heart rate (Flaherty & Fitzpatrick, 1978; Frenn, Fehring & Karats, 1986; Lesserman, 1989; Manyande et al., 1992; Miller, 1987). A recent meta-analysis of the effects of relaxation, by Johnston & Voegele (1993), showed that it is associated with reduced pain, negative affect, reduced medication, reduced length of stay, increased satisfaction and comfortable physical state. Behavioural outcome was the only measure which did not improve.

A study by Enquist and Fischer (1997) compared the effects of what they called a hypnotic relaxation technique as opposed to normal hospital routine in patients undergoing dental surgery; more specifically the removal of the third mandibular molar tooth. There were 33 patients in the control group and 36 in the experimental group. Relaxation suggestions on healing and recovery were provided on audiotape to patients one week before their surgery. Included in the message were suggestions on ways to achieve control over stress and pain, as well as suggestions about the body's natural ability to control bleeding, coagulation and other aspects of healing directly related to dental surgery. Anxiety levels remained stable before, during and after surgery and pain medication was reduced between day 1 and 5 after surgery in patients who received relaxation and suggestion, in comparison to those receiving normal routine hospital treatment for whom both variables increased. In attempting to explain the difference in amount of analgesics used between the two groups the authors put forward varying explanations. Firstly, it was felt that the calmness induced by the relaxation intervention may have focused patients' attention way from pain. Secondly, it was suggested that the suggestions on how to reduce pain or how to dissociate from it may have resulted in reduced medication. Thirdly, based on other research findings of paradoxically increased endocrine stress response in patients provided with relaxation as a method for surgical preparation, it is suggested that this response may have affected the inflammatory response, which in turn may have affected pain levels and subsequent medication.

A study by Mogan and colleagues (1995) compared the effects of a relaxation treatment provided the evening before surgery versus a control treatment which consisted of usual hospital routine for 72 cholecystectomy, hysterectomy, and gastrectomy patients. Those in the relaxation group were informed that pain was related to muscle spasm and provided with a relaxation sequence asking them to imagine a relaxing scene and to be aware of bodily tension. Postoperative outcome measures included vital signs (blood pressure and pulse), pain medication, amount of time out of bed whilst ambulating, together with pain sensation and pain distress. Findings showed no differences between the two groups on vital sign readings or a visual analogue measure of pain sensation over the first 4 postoperative days; this was despite the fact that those in the relaxation group spent more time out of bed during ambulation. Despite the lack of differences in pain sensation, patients in the relaxation group showed less pain distress by the fourth postoperative day. The results from this investigation suggest that relaxation has more effect on subjective rather than objective variables. Mogan et al. (1995) suggests that the effects of the relaxation may have been due to the relaxation per se, or to the explanation of sources of pain and how to control it. Other studies with cholecystectomy patients, which have assessed the effects of relaxation versus control on postoperative outcome have also found no change in objective indices despite change in subjective outcome measures (Wells, 1982; Voshall, 1980).

Other research has assessed the efficacy of the relaxation response for minimally invasive surgical procedures. Angiography is one of these techniques and is performed to image and diagnose diseases of the blood vessels in the body. In therapeutic angiography a small catheter tube is inserted into the groin area. This is guided into specific blood vessels to remove any blockages. In a study by Mandle and colleagues (1990) 45 patients who had femoral angiography were given either relaxation tapes which encouraged the relaxation response, classical music tapes, or a blank tape. The music tape acted as an attention control and the blank tape as a control group. Findings showed that although all individuals had similar levels of anxiety before their medical procedure and similar heart rate and blood pressure before, during and after the procedure, those that were encouraged to elicit the relaxation response had reduced anxiety during the procedure compared to individuals in the music and control group. Patients self-reports of pain immediately after the procedure showed patients in the relaxation group compared to control and attention groups. Also, patients in the relaxation groups were found to request less fentanyl for pain relief, and diazepam to help with anxiety, during and after the procedure. Patients in the relaxation group in addition were observed by nurses to have less anxiety than those in the control groups immediately after the procedure. No differences were seen in self-reports of intensity of pain, nurse ratings of anxiety and pain, and medication consumption for patients in either of the control groups suggesting that music, which is concerned with passive relaxation is not effective at eliciting the relaxation response.

Research documented so far relates specifically to recovery on the surgical ward. Recent research which has assessed the effects of relaxation compared to routine hospital information, found that relaxation patients had greater analgesic use in the recovery room compared to patients who received routine information. However, return to the surgical ward showed a reduction in analgesia for those in the relaxation group (Manyande & Salmon, 1998). It is suggested that differences in analgesia might arise because pain relief which is received immediately postoperatively might be less subject to nurse-patient relationships, or less inhibitions due to patients' impaired consciousness. Hence patients ask for medication during immediate recovery, while on the ward they engage in increased emotion-focused coping (Salmon & Manyande, 1998). With reference to Janis' theory, Salmon and Manyande (1988) suggested that an increase in pain immediately postoperatively may have been because relaxation made it difficult for patients to prepare mentally for surgery.

Another investigation by Good, Stanton-Hicks and Grass (1999) assessed the effectiveness of taped interventions versus a control group on pain sensation and pain distress during rest and ambulation in abdominal surgery patients. The interventions included either jaw relaxation, music or a combination the two. It was found overall that 89% of patients who received taped interventions reported them helpful for relieving the sensation and distress of pain, despite the finding that no differences in postoperative sensory and affective pain was found for patients in either one of the three taped interventions. It is possible that patients in each of the interventions perceived the ‘dynamic’ two-way interaction approach to encourage them to cope in a specific coping technique, as more supportive than those individuals who just received routine hospital treatment. Further multivariate analysis showed that after ambulation the effects of relaxation on the first and second postoperative day, and music on day 1, showed no benefits over the control group. As the authors suggest this may indicate the need for greater emphasis on interventions in the postoperative period. Alternatively, it is possible that the pain related to ambulation was not as susceptible to any of the psychological interventions used because it was more physical, hence trauma related, than psychological.

Research which has assessed both psychological and physiological effects of relaxation in surgery has been rare. In an investigation which assessed the effects of relaxation in patients due to have colorectal surgery (Manyande et al., 1992), physiological and psychological differences were seen in surgical recovery between the two groups. The intervention group listened to a relaxation tape and the control group listened to a tape which contained background information about the hospital. The relaxation intervention turned patient's attention to various muscle groups and focused on getting them as relaxed and 'heavy' as possible. Anxiety, measured by a self-report questionnaire, was reduced in the intervention group immediately after patients had listened to the relaxation tape, and remained significantly reduced compared to the control group until the second postoperative day. The relaxation group also had reduced systolic and diastolic blood pressure from the evening before to the morning after surgery, reaching a lower maximum during surgery. Interestingly, cortisol, a measure of the hormonal stress response, was significantly raised postoperatively in the relaxation group (Manyande et al., 1992). An interpretation of Manyande's findings based on Janis' theory is that lack of preoperative anxiety, generated in theory from the relaxation intervention, impaired preparation for surgery which, in turn, increased surgical stress (Salmon, 1992). Similarly, Wilson (1981) found surgical patients in a relaxation group had increased cortisol levels compared to those in a control group. Contrary to Salmon's interpretation of this response, Wilson argues that relaxation is a difficult and active coping task which when put into practice will result in a heightened stress response.

A criticism of the above study by Manyande et al. (1992) is that it failed to provide an adequate control group. As the messages given were informative about patient care it is possible that the control group who received messages about routine hospital care actually felt reassured by them. In effect, it may be that reassurance is associated with a reduced stress response compared to relaxation.

Despite differences in opinion about relaxation being an active (Wilson, 1981) and passive coping technique (Manyande et al., 1992), the effects of such an intervention have been associated with reduced anxiety, and a heightened adrenal and cortisol response. Although the evidence for such an association is, at present, extremely limited it suggests that relaxation in surgical procedures may have a neuroendocrine basis. However, research looking at mechanisms by which relaxation has a positive effect on outcome is, so far, extremely limited and therefore at the moment reasons for effects can only be speculated upon. Of those few existing studies which have attempted to understand surgical stress from a multidimensional perspective, all have failed to assess the long-term clinical value of any physiological effects.

1.5.5.3.4 Guided Imagery

1.5.5.3.4.1 Definition

Guided imagery uses methods which create mental images to assist in change, relaxation and stress management. Procedural and sensory information are often used in guided imagery interventions. Guided imagery, like relaxation has been recognised as part of a hypnotic technique. Guided imagery attempts to encourage patients to actively participate in their recovery (Davenport, 1989) through fantasy or expected reality, and uses procedural and sensory information as part of the imagery process. Hence, imagery techniques are diverse. Sensory information is assumed to help an individual build a mental image of a stressful event and hence promote cognitive control and selection of coping strategies and behaviour conducive to a faster recovery (Johnson, 1980).

Amongst the literature on the effects of guided imagery there exist several uncontrolled studies that have used anecdotal case studies have implied that guided imagery has been helpful for facilitating healing of individuals with cancer (Rosenberg, 1983) and other diseases. Although there has been research which has looked at the psychological and physiological effects of 'spontaneous imagery' (McKinney et al., 1997), this review is concerned with randomised controlled trial investigations that have tested the effects of imagery techniques which are directed according to predetermined content which use procedural and sensory imagery.

A recent randomised controlled trial by (Zachariae et al., 1996), with psoriasis patients found that imagery was helpful for influence physiological and psychological activity which is known to be associated with the problem; more specifically psoriasis was shown to decrease blood flow and reduce stress. Another controlled trial showed guided imagery to be associated with reduced anorexia and bulimia symptoms in the short-term (Esplen et al., 1999). It is suggested that imagery created a stable and comforting experience as a means of counteracting feelings of tension and anxiety experienced by those with such distress around food.

1.5.5.3.4.2 Guided imagery in surgery

A state of relaxation is encouraged as a pre-requisite for guided imagery (Appler, 1982; Flaherty & Fitzpatrick, 1978; Wells, 1982), in which an individual focuses on specific areas of his or her recovery from surgery. Various preoperative suggestions of relaxation and guided imagery have been reported as positively influencing recovery from surgery (Field, 1974; Hart, 1980) though it is not clear whether they are more beneficial than non-hypnotic instructions (Gibson & Heap, 1991).

Blankfield's review of suggestion in surgery highlighted that although it did not always produce the same effects, it made patients feel more relaxed, increased postoperative comfort and reduced postoperative subjective distress (Blankfield, 1991). The review alerts the reader to the varied effects of suggestion, which included less complaints of pain and anxiety, better bowel movement, earlier mobility, fewer medical and surgical complaints, and reduced hospital stay compared to control groups exposed to normal hospital routine.

Firstly, the effect of guided imagery interventions initiated prior to surgery to help patients cope with their surgery are discussed. There are very few studies that have used these interventions, and which have assessed their influence on a diverse range of recovery indices.

Amongst 36 patients with head and neck cancer surgery (either laryngectomy or non-laryngectomy related) it was shown that guided imagery, which encouraged patients to develop their own positive healing images, was effective at reducing patients length of stay in hospital (Rapkin, Straubing & Holroyd, 1991). The authors believe that because patients were encouraged to develop their own images, they were more likely to be actively involved in the recovery process compared to passively receiving images that perhaps were not relevant for some individuals.

In an investigation by Disbrow and colleagues (1993), amongst 40 patients having major abdominal surgery which would result in cessation of intestinal motility for at least 4-5 days after surgery (otherwise known as ileus), postoperative recovery was better in an experimental 'imagery' group compared to a control group who received information and reassurance. Patients in the experimental group were given instructions on how to control gastrointestinal motility, whereas those in the control group were informed about postoperative deep breathing. In the imagery group interventions were tailored to idiosyncratic characteristics of patients. For example, when food was discussed, a patients' favourite food was used to help create the imagery. Intestinal movement began earlier in patients who had received positive suggestions compared to the control group, even when adjusting for pain killer intake and bowel manipulation which are also known to affect this. Also, although outcome measures such as fluid intake, and length of hospital stay were not significantly affected by positive suggestion, they were affected in the desired direction. This finding highlights the effect of positive suggestion on influencing physiological mechanisms.

The benefits of role-playing and imagery induction have been seen in surgical recovery (Mahler, Kulik, & Hill, 1993). One hundred and twenty seven students viewed one of three videos, in which they imagined themselves as coronary artery bypass surgery patients. One video (a mastery tape) showed patients to be fearless and calm before, during and after surgery. Another (a coping tape) showed patients to have initial fear or anxiety followed by successful management of the situation, and in another (nurse tape) a nurse demonstrated recovery behaviour in a straight forward manner or provided recovery information via narration. A control group watched patients fill in anxiety and self-efficacy questionnaires. Although all tape intervention groups had less anxiety and increased self-efficacy for performing recommended recovery behaviours compared to a control group, those who watched the mastery tape had a greater anxiety reduction compared to those who watched the coping or nurse tape, which produced similar anxiety levels. The effect of video tapes on anxiety were only partly mediated by self-efficacy, as when this was put into a regression equation, the effect of interventions (mastery, coping and nurse tapes combined as one) remained significant, although the effect was reduced (Mahler, Kulik, & Hill, 1993).

Manyande et al. (1995) showed how an intervention which included the use of an active coping imagery influenced the psychological response and the physiological stress response to surgery. In this investigation 26 patients who had colorectal or anal surgery were given an intervention which the authors presumed would increase patients' feelings of control and being able to cope with surgical stress. These patients were given a tape which included a brief mental relaxation exercise, as well as sensory imagery which related to how patients would feel pre and postoperatively, and positive coping suggestions (imagery group). In contrast, a control group of 25 patients received a tape which gave patients background information about the hospital they were in. The physiological stress response together with psychological indices of pain and coping were used immediately before and after surgery to monitor recovery. Although both imagery and control groups had similar anxiety before and after surgery, the imagery group had less pain, and felt less distressed by it, and in general coped better than the control group. The imagery group also had less analgesia compared to controls. Despite similar baseline hormonal levels for both groups, analyses of the stress response showed both groups to have similar hormonal levels the day before surgery. However, on the day of surgery (before anaesthetic induction) the imagery group had reduced cortisol levels but heightened noradrenaline levels compared to the control group. Although these results are interesting, they are by no means definitive of the effects of an intervention which encourages patients to be more in control. It is impossible to separate any components from the imagery group, which included relaxation, sensory information and positive coping suggestions, to outcome effects. Also, as previously mentioned the ambiguous measures of recovery may have affected outcome. Findings of Manyande et als. investigation may be biased because of an absence of a no treatment control group, or because the relaxation/imagery tape may have appeared more desirable than the control tape, and therefore used more (Manyande et al., 1995). As the imagery group were construed to represent more active and involved coping on the part of individuals using it, the authors of this investigation outline that their findings are only partially supportive of Janis' 'work of worry' theory. Although preparation for surgery using imagery and positive coping strategies was associated with a reduced stress response (reduced cortisol), it was at the same time associated with an increased stress response (increased noradrenaline).

Others have failed to find any relationship between the hormonal response and state anxiety level (Salmon et al., 1986). Failure to find effects of interventions on biochemical measures might be due to a lack of follow-up measurements over long time periods (Davey, 1986), or to the use of subjects with different health status (Mc Kinney et al., 1997). Alternately, it might be that there are no effects from such interventions.

Other research has focused on the impact of guided imagery after patients have had their surgery and are engaging in rehabilitation. Research in this area has concentrated on cardiac rehabilitation which has different phases. Phase I takes place in the hospital where activity is gradually increased, while phase II usually begins approximately six weeks after hospital discharge and consists of individually designed exercise programs, information about cardiac disease, stress management and dietary advice. Replicating a study design used by Bohachik (1984), Collins and Rice (1997) showed that amongst 50 individuals in phase II cardiac rehabilitation, after either coronary bypass surgery or acute myocardial infarction, or both, those who received individual progressive muscle relaxation and guided imagery during 6 weeks of their rehabilitation felt their recovery was smoother than patients who received routine care. For example, although there was no difference in anxiety between the groups, those in the intervention group had a lower mean resting heart rate compared to those in the non-intervention group, and reduced heart rate compared to previous levels. They also had less heart medication compared to patients who received routine care, and were more inclined to have a reduction in medication dosage.

Studies which have used guided imagery preoperatively right through to the postoperative period are rare. A study by Tusek, Church and Fazio (1997) which did this, gave patients guided imagery three days before surgery. Based on findings which have found music to increase the effectiveness of guided imagery (Naparstek, 1994), patients in the imagery group also listened to music during anaesthetic induction, during the operation and in the recovery room, and were provided with a guided imagery tape which they used for six consecutive days after their surgery. The imagery involved getting them to attend to any fear, anxiety or negativity they had. Findings showed that of 130 colorectal surgery patients, those who received guided imagery tapes (N=65) had less pre and postoperative anxiety, less postoperative pain and used approximately half the amount patient controlled analgesia than individuals assigned to routine perioperative care. These beneficial effects of guided imagery were reflected by a majority of patients in self-reports. Guided imagery had improved the quality of sleep, helped them to reduce their anxiety and facilitated their general recovery. Unlike other research however, no differences were seen for nausea and complications between the two groups. This study shows the beneficial effects of guided imagery both pre and postoperatively in helping patients control their reactions to a stressful situation.

Some research has highlighted the reduction in physiological and psychological distress with the use of guided imagery interventions. Research with children scheduled for elective surgery has found that those who received suggestions for a favourable postoperative course reported less pain, had a shorter stay in hospital, and were less anxious compared to no treatment controls (Lambert, 1996). In adults, Holden-Lund (1988) assessed the effects of relaxation with guided imagery (RGI) on patients which had non-emergency cholecystectomy. Dependent variables assessed were state anxiety levels, wound recovery and urinary cortisol levels. Four tapes were listened to by each patient in the treatment group. The first tape, listened to the afternoon before surgery, outlined the concept of relaxation and the benefits of this in promoting positive post-surgical recovery. The three remaining tapes were listened to on the first three postoperative days; each had 5 minutes of relaxation and images of wound healing. Each tape addressed a specific stage of wound healing (inflammatory, proliferative and maturation). Results showed that those patients who received RGI, had less anxiety and wound inflammation following surgery than control patients. The results from this investigation suggest that relaxation and guided imagery was associated with surgical trauma. Unfortunately, the long term effects of this were not followed through.

Although information, imagery and relaxation techniques have been shown to have beneficial short-term effects, their significance for long-term recovery has not been studied. It is important to find out possible long-term effects in order to establish the full clinical validity of such interventions. Also, although there is speculation that coping may mediate the surgical stress response there has been no research which has looked at this specifically. It is also not known how general the association between subjective state and hormonal response is between different surgical groups.

1.5.5.3.5 Increased involvement in health care

In the surgical setting specific interventions have been used to manipulate patients' coping by affecting their perceptions about how involved with their treatment and recovery they can be. Hence, such research has encouraged a direct coping message to patients, which is different from that employed by studies which have used vehicles of relaxation or guided imagery as a means of instigating more passive or active styles of coping. In particular, attempts have been made to increase patient perceived control by encouraging them to be involved with their recovery. These investigations have provided distinct coping messages to patients.

Anderson (1987) compared the effects of a coping and an information intervention with cardiac surgery patients. The coping intervention encouraged patients to have increased belief in control of their postoperative exercises. Patients in the coping intervention were: 1) expected to know the rationale for exercises (explained to them personally by staff), and 2) were to practice specific exercises that they would perform after surgery (taught to them by staff) until they could be performed. Those in the information group received procedural and sensory information (Anderson, 1987). Both of these groups were compared to a control group. Both groups had reduced preoperative anxiety one day before surgery, less emotional distress postoperatively, and were evaluated by staff to have improved psychological and physical recovery. Also, both interventions, were associated with reduced complications, and increased patient's perceptions of control over recovery. Contrary to expectations, reduced anxiety was not related to increased perceptions of control in patients who received the coping intervention. However, a regression analysis showed that information did not reduce anxiety unless it increased perceptions of control. This provides support for the idea that anxiety about a threatening event is determined by perceived control over that event, as opposed to information (Janis, 1958; Lazarus, 1966). The author puts forward various reasons for the lack of differences between the two intervention groups. Firstly, they suggest that getting patients to prepare for the postoperative exercises was ineffective. Secondly, they argue that the coping intervention may have been more effective if it had been practised for more than two days prior to surgery.

In summary, this literature review has identified limitations of current research that assesses the effect of psychological interventions on recovery from surgery. The majority of research has concentrated on immediate recovery from surgery, although actual recovery is known to be often long and protracted (see Chapter 2). Existing research has also used a limited range of measures that are susceptible to influence from extraneous factors, thereby having reduced clinical and theoretical value (Johnston, 1994). At present, the significance of endocrine measures for recovery is largely theoretical, and studies that have monitored these have failed to show whether they have any significance for patients' welfare. Also, the clinical significance of the inflammatory response has barely been investigated. Although there has been speculation about the possible differing effects of passive and active coping strategies on the surgical stress and inflammatory response, there is no research at this present time which has compared the effects of those specific interventions on both the hormonal and inflammatory response to surgery.

1.6 Conclusion and aims

Psychological preparation has been reported to improve surgical recovery, but most of the evidence suffers from two weaknesses. First, it is not clear that some of the most commonly reported effects (reduction of pain and duration of hospital stay) do represent improvements in outcome, due to influences from external sources. Secondly, the mechanism which accounts for the effects has not been identified; in particular there is little evidence about the role of the endocrine system in surgical recovery.

Although coping has been shown to improve postoperative outcome, the mechanism by which it does this is uncertain. There are a several mechanisms which may be operating here. Firstly, preparation might often amount to no more than suggestion. For instance, it might simply make patients think they are getting better more quickly. Secondly, preparation might change the way that patients and staff interact, which might in turn change aspects of the treatment that patients receive. Thirdly, it could reinforce positive coping mechanisms. For instance, it has been suggested that it may enhance individual feelings of being able to cope or be in control (Salmon, 1994). Finally, preparation may influence physiological mechanisms involved in the stress response to surgery, such as the endocrine response, which might, in turn affect recovery.

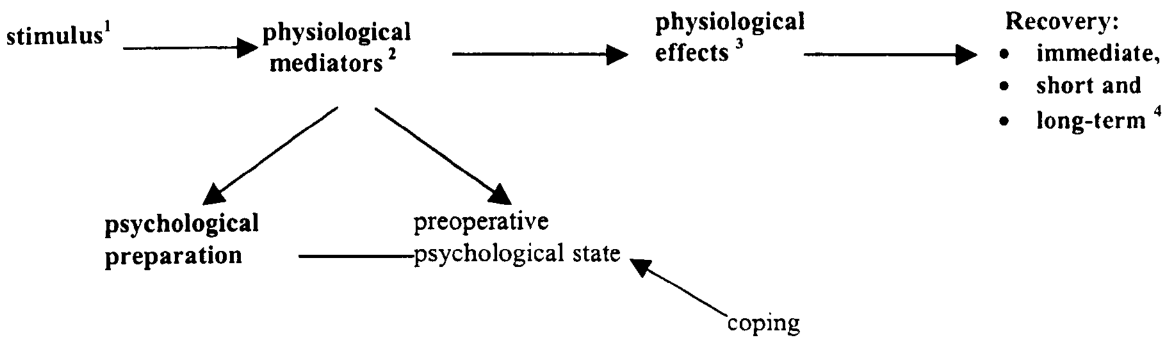
This investigation aims to assess the long-term effects of two distinct coping interventions, one which encouraged passive coping and the other which encouraged more active and involved coping. The relaxation intervention emphasises anxiety-reduction, reassurance and patient passivity, and the active intervention, based on coping imagery, is designed to increase patients' feelings of control. In this investigation it is assumed that a relaxation technique which focuses on getting patients to feel as relaxed as possible but does not encourage them to get involved in any other aspects of their treatment or recovery might lead to passive coping. In contrast, imagery which focuses on procedural and sensory elements of treatment and gets patients to cope in a more problem-focused manner, suggests a more active form of coping. Hence, this thesis compares, for the first time, the physiological and psychological response to surgery, and long-term quality of life, comparing an 'active' coping intervention designed to promote active coping and enhance control and involvement with an intervention designed to have the opposite effect, to promote passivity and uncontrollability. The major aim of this study is to find out whether active or passive coping facilitate recovery from surgery, in comparison to normal hospital routines. The first hypothesis in this thesis asserts that those encouraged to be more active will have a better recovery than those who are encouraged to take a passive approach. (Figure 1.2) This hypothesis is derived from existing theory and literature about the beneficial effects of increased perceived control and the mechanisms through which the 'work of worry' is likely to be initiated.

The second hypothesis is based on the potential effects to be gained from coping strategies that are thought to instigate the 'work of worry' and recent findings which show the glucocorticoid response to be a response to different styles of coping. This study used interventions which differed in the amount of perceived control that led patients to believe they had over their recovery from surgery. As such, the 'vehicle' for the 'work of worry' is perceived control. Based on recent research findings, it is predicted that patients who have been stimulated by the active coping intervention to engage in preoperative worry, should show a smaller adrenocorticol response. Patients who engage in a passive coping intervention will have a higher glucocorticoid response. Also, clinical research has suggested that a heightened inflammatory response is associated with a more negative recovery. However, the association of the inflammatory response with coping which encourages passive or active behaviour in hospital, has not been explored. The potential influence of interventions on neuroendocrine and inflammatory variables was seen as important because of their potential to affect clinical outcome from surgery. Unlike most research, the aim of the present study is to monitor the physiological response, sequentially, over the first postoperative week, and assess both the traditional 'flight and fight response' concerned with immediate survival, described by Selye (1956), and the inflammatory response which has recently been associated with tissue trauma and delayed recovery. This research is essential to show definitely whether the biochemical response might mediate the effects of psychological interventions, which has recently been suggested. The second major hypothesis of this investigation specifically predicts that active coping will be associated with a reduced endocrine response compared to passive coping. Refer to figures 1.1 and 1.2 (page 87) which depict the hypothesised medication of psychological interventions, and the hypothesised effects of active and passive coping on surgical processes.

It was considered important to monitor psychological, physiological and functional recovery in order to assess the relationships between these dimensions. This investigation assessed the relationship of the surgical stress and inflammatory response with other measures of recovery; many of these relationships, and the measures used as indicators of them, have not been assessed before. For instance, the relationship of the surgical stress response with immediate and long-term psychological recovery is unknown. Existing quality of life measures were used as definitive indices of long-term recovery when assessing the relationship between psychological and physiological indices of recovery. The development of a specific tool was designed to measure immediate functional recovery. This allowed for an assessment of the relationship of the neuroendocrine response with immediate functional progress after surgery, for which there is no extant instrument. It is hoped that the tool developed in this investigation to monitor functional progress will represent a more definitive index of immediate functional recovery than those already in existence, that is one that can be used by several groups of health professionals. In terms of the main aims of this investigation it was essential that two main categories of questionnaire were used. These included questionnaires measuring outcome and those measuring processes which are theoretically important for interventional effects. Psychological processes such as coping are evaluated as aspects which might be subject to manipulation from psychological techniques, and which may in turn influence outcome from surgery. Individual differences in locus of control and opinions about how responsible they felt for aspects of their health were monitored preoperatively as a means of assessing unevenness in trait characteristics for patients in different intervention, surgery, hospital and gender groups. Such trait characteristics would be unlikely to change due to psychological intervention, and if they did they would be meaningless. Outcome measures include physiological markers of stress and trauma, bodily state, functional and psychological performance, mood and quality of life scales. Specific details are provided in the methods section of this thesis. A specific surgical model (total hip and knee replacement), discussed in the next chapter, was chosen for this study. It allows for the assessment of the effect of psychological interventions on the immediate surgical stress response and the immediate, short and long-term psychological recovery from surgery.

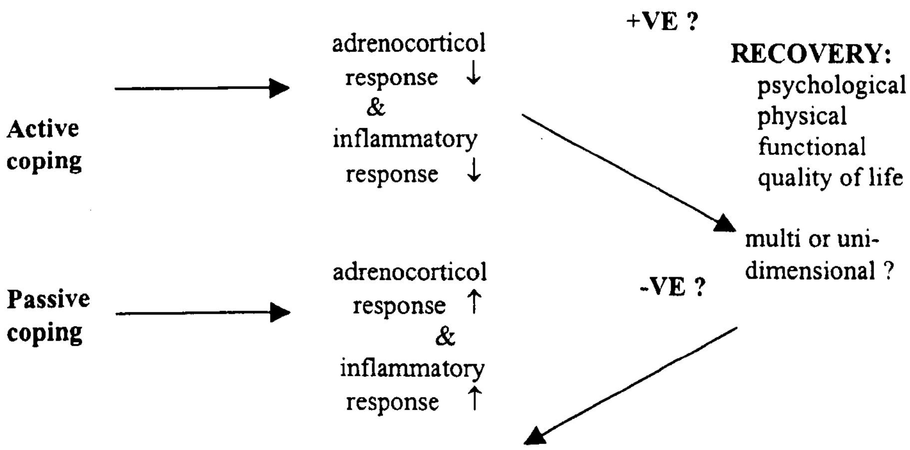
The main intention behind this investigation is to integrate the surgical stress response within its psychological and social context, thereby expanding research on stress. In effect, this thesis, instead of perceiving stress as a uni-dimensional construct measured in terms of psychological, physiological or functional recovery to surgery, perceives stress as multidimensional. Consequently, psychological, physiological and functional recovery, together with the interaction between them are assessed.

Figure 1.1 Hypothesised mediation of psychological interventions



[1] Injury
[2] hormones/cytokines
[3] glucose$\uparrow$, Temperature $\uparrow$, CRP$\uparrow$, White blood cell $\uparrow$, Lymph$\downarrow$
[4] psychological, physical, functional, quality of life. **multi- or unidimensional?**

Figure 2 Hypothesised effects of specific psychological interventions on surgical recovery



1.6.1.1 Summary of aims and predictions

The active intervention is construed to represent a process known as the 'work of worry' (Janis, 1958), as it requires that the individual prepares realistically for their surgery and recovery. From a theoretical perspective and existing research findings, mental preparation should be associated with a more positive outcome in comparison to a situation where a patient fails to prepare for surgery.

- **aim 1**: to assess the effect of coping on recovery from surgery

hypothesis 1: those patients who received the active coping intervention will have a facilitated recovery over those encouraged to cope passively.

- **aim 2**: to assess the relationship between the neuroendocrine response and coping in order to see if the biochemical response might mediate the effects of psychological interventions

hypothesis 2: that an elevated stress response will be seen for those who received passive coping and reduced response with active coping.

- **aim 3**: to assess the relationship of the neuroendocrine and inflammatory responses with other measures of recovery

  hypothesis 3: an elevated response will be associated with delayed recovery.

In addition, the relationship between psychological, physiological and functional indices of recovery will be assessed, in an attempt to elaborate further on the multidimensional nature of recovery.

Chapter 2

Total Hip and Knee Arthroplasty

Chapter 2

Total Hip and Knee Arthroplasty

<u>Mine!</u>

'It's settled in now and become part of me

It was hard to accept this thing I cannot see

At first it made me ill but now I feel just fine

Who made it I wonder and were they on overtime?

No one knows I've got it unless I tell them so

And although it's planted there it certainly won't grow

Maybe I walk carefully just in case I trip

But I'm forever grateful for my artificial hip.'

(Patient id 013-study patient, 1994)

2.1 Introduction

In order to assess the impact of surgery on long-term as well as short-term quality of life, it is important to have a surgical group whose progress in overall wellbeing and specific domains of wellbeing could be followed. This group would need to represent those who were scheduled to have elective surgery, who represented a fairly homogenous section of the population, and who were likely to have a protracted recovery.

This review gives priority to research which has assessed outcome from joint arthroplasty surgery based on patients' subjective experiences of their general health, psychosocial and functional state. It is believed that, logically, patients are the experts on treatment outcome (Sullivan, 1992); hence, for the purposes of this review patients were considered the only group able to comment authoritatively on outcome. Hence, this review is concerned with the social, functional and psychological benefits that have been reported from patients who have undergone total hip or knee arthroplasty.

In this chapter, treatment of arthritis, together with the effects of total hip arthroplasty (THA) and total knee arthroplasty (TKA) on quality of life are discussed. The surgical term for joint replacement is arthroplasty.

2.2 Arthritis and the treatment of arthritis

2.2.1 Clinical pathology

The most prevalent rheumatic diseases are osteoarthritis (OA) and rheumatoid arthritis (RA). Osteoarthritis is the greatest cause of disability and limitation of activity in the elderly. OA is a degenerative arthritis, and RA is an inflammatory disease (Edelmann, 1995). The hip joint is used here to explain the difference between the two.

The hip joint is held together by a joint capsule which is designed to allow smooth movement between adjacent bones. The hip joint is a ball and socket joint. Here cartilage surrounds the ends of bones which make up the ball and socket. The cartilage receives nutrients through the synovial membrane and bone. The joint space consists of synovial fluid between the cartilage and the bone. Joint function depends on the health of cartilage in a joint. Cartilage has an important shock absorber function.

With rheumatoid arthritis there is inflammation of the hip joint and an increase in synovial fluid in the joint which spreads primarily from the joint margins to the cartilage. RA, as is the case with OA, is characterised by typical radiographic features. Although the cause of rheumatoid arthritis is not certain, 90% of individuals with the condition are rheumatoid factor positive, that is to say a specific type of protein (R factor) is present in their bloodstream. R factor reacts to certain antibodies already present in the blood, treating them as if they are 'foreign' themselves. In effect R factor acts as an antibody to these antibodies. This scenario causes inflammation and swelling. It is for this reason that rheumatoid arthritis is claimed to be an autoimmune disease. Also, as the antibody to TNF-alpha has been found to be a good therapeutic agent in RA (Paulus et al., 1990) it is believed that the cytokine TNF-a is responsible for the breakdown of cartilage.

Osteoarthritis (OA) is characterised by loss of some of the joint cartilage and decay of bone. Abnormal bony spurs grow from the bone around the joint; these are called osteophytes. OA is generally associated with increasing age and reflects a decrease in ability to restore and maintain normal cartilage structure. However, recent research suggests that diet may be important in this disease (Kremer, 1985; Bellizini et al., 1996). It is the weight-bearing joints that are most affected by this process. The breakdown of cartilage matrix can lead to cracks and ulcers, as well as a reduction of shock absorption. In response to weakened cartilage underlying bone starts to thicken. Eventually an inflammatory reaction in the synovial membrane may be seen. Similarly to RA, recent research has found cytokines (TNF-a and IL-1) together with enzymes to be elevated in the synovial membrane of joint capsules, suggesting that these chemicals are responsible for cartilage destruction. (Feldman et al., 1996).

Arthritis affects 1 in 10 people, mostly the elderly, with the impact of the disease being variable. Clinical features associated with arthritis of the hip include: progressive pain, limited range of movement of the joint, possible shortening of the limb and associated pain in the ipsilateral groin, buttock and knee, lower back and opposite knee. The amount of pain, disablement, discomfort and treatment depends on the extent of the disease (Edelmann, 1995). Rheumatoid arthritis (RA) in severe cases is much more disabling than osteoarthritis: it is chronic and unpredictable (Shumacher, 1988), and individuals can have a variable response to treatment (Hazleman, 1992). Tissue damage can lead to varying degrees of incapacitation (Rasker & Cosh, 1987), acute and chronic pain, and swelling and stiffness, particularly in the morning. In the initial stages, inflammatory changes may not be localised to the joints, but include swelling of other areas such as the hands, feet and ankles. The extent of disability as a result of rheumatoid arthritis varies (Shipley, 1992). It has been claimed that of those who develop RA, 25% are capable of normal activities, 40% have moderate function, 25% are badly disabled, and 10% are confined to a wheelchair (Hazleman, 1992). Women are three times more likely to be diagnosed with RA (Anderson et al., 1985).

2.2.2 Psychosocial effects of arthritis

2.2.2.1 Effects of arthritis

Arthritis not only brings restriction in mobility, daily activities and increased pain but a loss of independence, change in family and social functions as well as financial problems (Anderson, 1988). Hence, arthritis is not just about pathology but is an illness in which biological and psychosocial factors are affected. Consequently, it is undisputed that a clinicians' role is to treat the illness rather than pathology (Salmon, 2000). Bendtsen & Hörnquist (1992) found patients, particularly rheumatoid, to complain less of psychosocial changes than of bodily complaints or behavioural activity.

Rheumatoid patients often rate pain, dependence and limitation as chronic stressors, and often perceive greater physical limitations than suggested by clinical assessment (Van Lankveld, 1993). Three aspects of social life affected by rheumatoid arthritis are: social participation, role activities and financial position (Krol, Sanderman, Suurmeijer, 1993). Reduced physical function can affect social interaction as it can affect the number of friends which an individual can access by normal means of transport. Under such circumstances the social support network may be threatened. More positively, when a person is admitted to hospital, fellow patients may enlarge their network of friends and therefore increase their social support network. Loss of work and leisure role activities also have significant effects. With arthritis the most affected role activity is loss of ability to work, which can lead to loss of identity, esteem, independence, and social support. The loss of leisure activities, often connected with work, mean that new activities need to be found. Lastly, financial state can directly and indirectly affect quality of life. (see 2.3 for a discussion of quality of life) For instance, with arthritis and immobility there is an increased need to keep warm thereby creating increased heating costs. Unfortunately, disability at work may result in changed financial position, which may lead to a decline in social and leisure activities. Furthermore, this may lead to social isolation (Krol, Sanderman & Suurmeijer, 1993). Social isolation is probably one of the main factors linked to the high rate of depression, found in those with rheumatoid arthritis (Smith, Peck & Ward, 1990; Fitzpatrick et al., 1988).

The effects of social isolation which may be incurred from changes in work or role activities and financial position can also have further consequences besides those documented above. Individuals with increased social support have shown better daily functioning in activities of daily living (Douglas et al., 1990). Furthermore, these individuals have shown reduced depression compared to those with little social support (Newman et al., 1989; Affleck et al. 1988; Patrick et al., 1986). Also, individuals who work and live with someone else have shown a better quality of life compared to those out of work and living alone (Bendtsten & Hörnquist, 1992). Increased quality of social support, i.e. that which includes supportive behaviours by others or perceived availability of different forms of support, has been found to be more influential in increasing physical functioning compared to social integrative support, i.e. that defined by an individuals social ties, relationships, and frequency of social contact (Goodenow, Reisine & Grady, 1990).

2.2.2.2 Psychological influences on the effects of arthritis

Due to the fact that the behavioural and psychological impact of RA is not directly related to different severity of arthritic disease, it is strongly believed that there is a mediating influence of psychosocial factors on the effects of RA (Bradley, 1989). There is an increasing database of research which has looked at the possible mediating effects of social support and coping behaviour in those patients with arthritis.

Firstly, referring to social support, a review of studies of individuals with rheumatoid arthritis, conducted between 1981 and 1986, led the authors (Krol, Sanderman & Suurmeijer, 1993) to conclude that social support increased psychological and physical health, and reduced stress. This is congruent with direct and buffering effects hypotheses of social support (Cohen & Willis, 1985). Consequently, it is believed that this health facilitating function (direct effect) and stress reducing (buffering effect) may be because social support strengthens coping behaviour, or maintains or increases the level of self-esteem to help the individual cope with the everyday problems that disability brings (Krol, Sanderman & Suurmeijer, 1993). With reference to marital relationships, Druley & Townsend (1998) found self-esteem gained via the relationship to be a mediator of depressive symptoms, with increased self-esteem being associated with less depressive symptomology in both healthy individuals and those with rheumatoid arthritis.

The way in which individuals adjust to arthritis may influence the effects of disease. Research has found that individuals who coped with rheumatoid arthritis by using negative and exaggerated interpretations of their illness, had increased depression and disability in comparison to those with less extreme interpretations (Young, 1992). Also, denial of emotional distress or depression (MacFarlane & Brooks, 1988), negative coping strategies (specifically catastrophising and escapist fantasy - Ravason & Felton, 1989) and feelings of lack of control over their illness (Murphy et al. 1999), low self-efficacy and learned helplessness (Nicassio et al., 1985; Lorig et al., 1989), and heightened negative affect have been associated with psychological and functional impairment in those with rheumatoid arthritis (Zautra et al., 1995). Similar findings have also been shown for those with osteoarthritis; women using escape-avoidance strategies had poorer physical and psychological health (Burke & Flaherty, 1993).

Hampson, Glasgow & Zeiss (1994) were able to elicit various models of osteoarthritis from interviews with individuals over 60 years of age who had arthritis. Shared beliefs of patients included the perception of OA as serious, painful, chronic and, although susceptible to control, incurable. Individuals with increased pain had reduced self-management which refers to coping and behaviours which help them control their pain, disability and other arthritis symptoms. Consequently, they were found to report more symtoms, use medical services more frequently, and experience poorer quality of life (Hampson, Glasgow & Zeiss, 1994).

Although it is not known if the documented psychological characteristics of RA are reactions to the disease process rather than causal factors (Leman, 1987), research has shown that stressful life experience can increase the onset and course of RA (Anderson et al., 1987). Psychological interventions that educate and provide self-management skills have helped individuals manage the consequence of disease, by increasing their self-efficacy, to help themselves (Taal et al., 1993). Interventions can change knowledge, behaviour, physical and social health (Lorig et al., 1989).

2.2.3 Treatment of arthritis

Non-operative or conservative treatments available for arthritis are drug therapy, rest and exercise programmes. Palliative treatment involves the use of analgesics such as paracetamol or aspirin for mild pain, progressing to a weak opioid for moderate pain and morphine for severe pain. Other palliative care methods such as TENS (used to stimulate naturally occurring opioid production by the body) are used by some patients. Non-steroidal anti-inflammatory drugs (NSAIDS), often used to treat inflammatory conditions, can reduce local pain by inhibiting prostaglandin synthesis. The shortcoming of these is that they can also cause gastrointestinal adverse effects such as ulceration and bleeding (Spanswick, 1992).

For patients with significant pain and functional disability despite conservative treatment, surgical procedures may provide immense benefits (Goldberg, 1994). The most common surgical procedures are osteotomy, arthrodesis, debridement and total arthroplasty. Arthrodesis is the fixation of a joint into an immobilised state; osteotomy refers to the removal of bone, and arthroplasty is the refashioning of a joint, usually resulting in total arthroplasty. Debridement refers to removal of excess, dead, infected or necrotic tissue. Operative treatment is considered for those with persistent pain and functional disability. Treatment is provided with the intention of increasing the quality of life of an individual. This thesis is concerned with the effectiveness of total knee arthroplasty (THA) and total knee arthroplasty (TKA) treatments on the quality of life (QoL) of individuals.

The total hip arthroplasty (THA) was first carried out by Sir John Charnley in 1962 and has been performed over a longer period of time compared to the more recent total knee arthroplasty (TKA). Approximately 50, 000 THA are performed in England each year in the UK (Clift & Rowley, 1992) and 400, 000 are performed world-wide (Gouldie, 1993). Approximately 200, 000 TKA are performed each year (Bulstrode, 1996), and research indicates that the demand for TKA is increasing. In a study by Tennant et al. (1995) the prevalence for knee arthroplasty from a postal survey amongst a population of 210, 000 in people aged 55 years in the North Yorkshire area of England conducted was clearly seen. The 86% response rate showed approximately 10% of the population to be eligible for some type of treatment. The degree of severity of pain and disability was established in a smaller sample of the eligible group (n=1227), which found that 20.4 out of every 1, 000 patients had significant pain disability to warrant arthroplasty surgery.

There has been an increase in the number of younger more active patients undergoing joint arthroplasty. However, it is within this population that the failure rate of the procedure is higher (Goldberg, 1994). Failures have been attributed to the type of arthroplasty given (Burly & Sculco, 1995; Lachiewicz, 1986; Arden, 1972). Surgeons have traditionally been selective about the age group they operate on, and have exercised most caution with younger patients, because of increased likelihood of the need for future revision of surgery, which can be problematic in this group. Bleasal et al. (1994) prospectively showed that of 21 young THA arthritics, 34% had a revision arthroplasty over a mean time of 8.6 years. Medical advances which have increased the durability of prostheses will hopefully mean a reduction of such figures in the future, although the impact of prostheses durability on QoL is relatively vague. A detailed account of the surgical procedure for total hip and knee arthroplasty can be found in the methods section, chapter 3, of this thesis.

2.2.3.1 The immediate postoperative experience

The mean duration of stay in hospital for a THA and TKA varies considerably. Although some have documented it as being respectively, 15 and 26 days (Johnsson & Larsson, 1991), duration of stay will vary according to hospital practice and patient complications. THA and TKA patients are at risk from early (specific and general) and late complications, which sometimes occur after discharge from hospital. Complications of THA include hypotension, swollen ankles and general swelling, which might lead to blood clots in the legs (deep vein thrombosis -DVT) and pulmonary embolism (when a blood clot travels from a distant venous site and becomes lodged in the blood vessels of the lung). Other complications include infection (prevented by antibiotics in the periopative period), dislocation of prosthesis, fracture of the femoral shaft, implant problems, leg length disparity, bleeding, extra bone formation, allergic reaction to metal parts, nausea, decubitus ulcers, and even cardiac arrest and death (O'Brien, 1994). Major medical advances have brought about a reduction in complications, with patient risk from DVT and pulmonary embolism being reduced by effective thrombotic prophylaxis (Johnson et al. 1977). Intra-operative surgical complication rate is less than 5%, with DVT being the most common complication, and infection and dislocation the least common (Edelmann, 1995). Failure of THA can result from infection or loosening of cement. A replacement component can be used for both conditions but this changes the nature of the operation (Dandy, 1993).

Although TKA patients experience many of the complications experienced by THA patients, their operation is more complicated, and the new prosthesis is subjected to more physical stress than a THA, which may increase the risk of loosening (Dandy, 1993). A TKA replacement is not as flexible as a THA replacement, as it does not provide as much rotation. Patellar problems comprise the largest percentage of problems following knee arthroplasties. These include: patellofemoral maltracking, patellar fractures and patellar implant loosening (Steiger & McLardy-Smith, 1993). In patello-femoral maltracking there is an alignment problem with the femoral and tibial components. Patellar fractures are caused by direct trauma or component fatigue, and loosening occurs when components become unfixed from the main joint. Another specific problem with TKA is peroneal nerve injury which is caused by pressure from tight dressings and splints around the knee area.

In summary, osteoarthritis and rheumatoid arthritis have serious medical and psychological implications and where the weight-bearing joints are affected in many cases warrant surgery. Technical advancements have made the option of surgery an extremely safe one. Research clearly shows that psychological mechanisms influence adjustment to these chronic diseases. In particular, social support has been linked to an individual's ability to cope with such illnesses, as have coping strategies used by patients. Educational interventions which encourage patients to be more independent have been found to be effective in helping patients to cope better with arthritis. However, the effects of such interventions on patients' surgical recovery during and after discharge from hospital has rarely been investigated.

2.3 Quality of life and recovery from surgery

2.3.1 Quality of life: Concept

Many definitions of quality of life (QoL) exist, but there is no agreement on what the term means. Day & Jankey (1996) recount how initial definitions of QoL were derived from research concerned with objective (e.g. housing) and external social (e.g. job) indicators. As a result of further research the definition has evolved to include psychological indicators. Indeed, the current emphasis in quality of life research has turned away from objective and social indicators to the patient's perception of their quality of life. This section addresses what the concept of quality of life refers to generally, before discussing a possible evaluation of the concept for surgical patients.

The concept of QoL is often used as synonymous with health and wellbeing (Post, Witte. Schrijvers, 1999). Health can be measured by either the presence of disease, functional capacity in broad domains of health, or subjective perceptions of health from the patient's perspective (Post, Witte, Schrijvers, 1999). When characterising health by disease or functional capacity, the focus is on the negative impact of illness or disability in comparison to subjective patients' perceptions which are likely to encompass both positive and negative aspects of health, and progress in many domains of health (Ryff & Singer, 1999).

In recent years researchers and writers have felt a need to separate general quality of life from health-related quality of life. Health-related quality of life (HRQL), is distinct from general quality of life, as it is conceptualised by those aspects of life quality or function which are affected by one's health. Others, more broadly, suggest

HRQL includes the impact that *health status*, illness and treatment have on overall QoL (Schipper, Clinch & Powell, 1990; Hopkins, 1992). Five domains of health status have been distinguished as follows: physical, mental health, social functioning, role functioning and general health perceptions (Williams, 1984), thus highlighting the multidimensional nature of this construct.

However, the inclusion of social wellbeing is not agreed upon by all as important for health-related quality of life. Torrance (1987) believes that functional and emotional functioning contribute directly to health-related quality of life, while social wellbeing, although an important aspect of overall quality of life, is not an appropriate contributor to health-related quality of life. Torrance (1987) also asserts economic, political, environmental, aesthetic and spiritual aspects of individuals to pay insignificant contribution to their health-related quality of life, mainly because he feels they are not part of an individual's health. In contrast Kaplan et al. (1989) believe that social role should be included in the health-related quality of life construct.

One important aspect of quality of life is subjective wellbeing or happiness, which consists of 2 independent dimensions (Argyle, 1987). There is an emotional dimension which relates to how good a person feels, and a cognitive or reflective dimension which relates to satisfaction with life. In effect Argyle (1987) asserts that subjective wellbeing consists of satisfaction, positive affect and the absence of distress. As the term wellbeing is synonymous with quality of life it can be assumed that the above criteria assist in the conceptualisation of quality of life.

The importance of health as a predictor of quality of life has been shown to vary across clinical groups. Compared to those with chronic conditions, such as arthritis (Pearlman & Uhlman, 1988), individuals with cancer placed a less salient role of health on their quality of life (Kreitler et al., 1993). It is suggested by McGee et al. (1991) that health is only related to quality of life in individuals who perceive health gains as realistic.

In terms of the relationship between wellbeing and health, judgements about wellbeing have been found to be independent of health. It is thought the health may act as a predictor of quality of life because it is through this that an individual will have the ability and capacity to satisfy needs (Post, Witte & Schrijvers, 1999). Indeed health has been found to be strongly associated with social contacts level between individuals, particularly those over 65 years of age, with increased health status being found to be associated increased social contact (Farquhar, 1995).

With reference to demographic features a metanalysis of studies has shown that women are generally happier than men (Fujita et al., 1991). However, both positive and negative affect reduce with age, as does the intensity of all the emotions (Argyle, 1987). It is reasonable to assume that age is likely to affect an individual's HRQL. An elderly person is not likely to have the same physical level of quality of life as a younger individual, and may view symptoms as part of 'normal' health; they may even accept them more (Hamburg, Elliot & Parron, 1982). This effect may be due to general increased satisfaction, which has been shown to increase with age (Witt et al., 1980). Argyle (1996) argues that increased satisfaction is because the gap between aspirations and attainments reduces as the individual ages.

In the field of surgery there has recently been a large amount of research which has assessed recovery from the patients' perspective; with quality of life measures used to monitor outcome. A specific index of surgical wellbeing (WISP) was also recently developed, specifically for abdominal surgery patients (McKenna, Doward & Whalley, 1998). Quality of life as an outcome measure for hip and knee arthroplasty is discussed below. More infrequently, quality of life has been used as a predictor of recovery. In a study by Rumsfield et al. (1998) health-related quality of life was a useful predictor of mortality after coronary artery bypass graft (CABG) surgery. In particular, individuals who had increased physical quality of life had reduced mortality 6 months after surgery. This study highlights the importance of quality of life variables for predicting subsequent recovery from surgery.

2.3.2 Quality of life: Measurement

The world health organisation has suggested that social, emotional and physical well being dimensions are all important in assessments of QoL (WHO, 1991). As there is no single successful measure of quality of life, various outcome measures are used to monitor the extent of this after surgery; these can be categorised into objective and subjective measures. Although many self-report quality of life measures exist, and have been used in in health research (Kazis, Anderson & Meenhan, 1989; Moran & Horton, 2000), QoL is often measured by surgical measures (Goldie, 1993, NIH Consensus, 1995), which provide an objective account of outcome. Although these measures are important because they allow surgeons to assess the technical success of surgery, they provide little indication of patients' satisfaction with surgery, and they have an absence of social and emotional factors (Cella & Tulsky, 1993). They can also be biased by demographic factors such as age, gender and medical conditions that are not relevant to their intended use (Brinker, Houston & Lund, 1997).

Objective measures are concerned with surgical criteria which include aspects such as degree of flexion, rotation, and other physical diameters depending on the physical condition, or conditions, being measured. In joint replacement surgery, the extent of radiographic loosening (measured by x-ray) of the replacement components have even been used as a measure of surgical success (Bohler et al., 1994). Other instruments have attempted to incorporate more subjective experiences surrounding recovery. Such instruments can be classified into those which provide an account of an individual's capacity in certain activities whilst others provide an account of whether they actually do carry these out. They are therefore more performance orientated. Despite the differences between the different measures of outcome, each have been used to provide some measure of the 'quality of life' an individual has.

This perceived clinical importance of subjective measurements has meant that patients are provided with the opportunity to inform medical staff not only about their physical condition which would have in the past concentrated on the alleviation of symptoms, but also their subjective condition after treatment. It is suggested that such measures are more appropriate for chronic conditions such as arthritis, where partial or temporary relief of subjective symptoms are achieved from surgical interventions compared to the sole use of clinical indicators (Ebbs et al.,1989).

Guyatt et al. (1989) categorised QoL measures into generic and specific types. Generic measures of health include health profiles and utility measures, and are used to provide an index of overall QoL that is obtained from several dimensions. Generic measures may be non-specific or specific based. An overall assessment of wellbeing, broad domains of QoL, or wellbeing with components of each domain of QoL is provided by generic assessments of quality of life (Spilker, 1992). When they are non-specific they can be applied to the general population., whereas if they are specific they have been designed to be used with specific clinical groups, for example those with arthritis or cancer.

Health profiles are single instruments that measure several domains of QoL. The Short-Form Health Survey (SF-36 - Ware & Sherbourne, 1992) is an example of a health profile. Shorter health status measures designed to assess subjective health status in a number of areas have been shown to be as responsive, if not more so, than longer measures (Kantz, 1992). Health profiles are particularly useful as they allow for comparisons between different disease groups (Fitzpatrick et al., 1992). A problem that has been associated with health profiles is that a total rating of quality of life is obtained without any feedback from the patient as to how important that outcome is to them and therefore, how it affects their quality of life (O'Boyle et al., 1992). In contrast to health profiles, utility measures either ask an individual to make a single rating of all aspects of their QoL (Andrews & Withey, 1976) or they determine what an individual did or did not do because of health (Balaban et al., 1986). Utility measures have been derived from economic and decision theories.

Research has found that although generic measures of physical functioning and role-limitation are useful for anticipating several dimensions of health-related quality of life, disease-specific measures are more effective for ascertaining limitations and clinical management in specific disease condition (Xinhua et al., 1998). It is therefore argued that disease-specific disease measures are more important for physicians than any other group (Deyo & Patrick, 1989)

As disease-specific measures are designed to be responsive to a particular group of patients they should include the most relevant items on their scales for measuring QoL in that group. The main problem with specific measures is that they do not allow for comparisons between different clinical populations or assess the impact of the condition on general wellbeing (Jenkins, 1992). Disease-specific measures pick up clinical information relevant to the disease or condition, rather than determining the impact of these on general functioning; hence, generic quality of life measures might be better at detecting dysfunction that is caused by something other than disease such as tiredness or depression (Kaplan et al., 1989).

In comparison to disease-specific measures, generic measures of quality of life often allow patients to take into account other comorbidities, that is other existing problems, which have a negative impact on physical role limitation response. This is supported by the existence of high correlations between generic and specific measures for those without comorbidities, compared to those with comorbidities on physical role limitation in TKA patients (Kantz et al., 1992). More specifically, Kantz et al. (1992) showed that the relationships between generic and specific measures of physical function were similar for patients with or without comorbidities. This suggests a weakness of specific measures in detecting physical function specific to knee related effects. Consequently, measures which assess specific health effects relating to joint arthroplasty have been found to reduce the influence of comorbid conditions, particularly in contralateral joints which have been shown to affect recovery from knee arthroplasty (Kay et al., 1983; Mattsson & Weidenhielm, 1995).

In general, with health-related measures, patients may fail to provide an accurate account of their quality of life which they attribute to health problems. On of the main reasons for this is because over time individuals, particularly those with chronic conditions, adapt to symptoms and may fail to discern them or may consider them as part of the ageing process and therefore not relevant (Fitzpartick, 1996). Another potential problem with patients' reports of their quality of life is their need to present as desirable. Hence, individuals feel they ought to give certain answers which appear more favourable. However, this is unlikely as research in general has shown a lack of correlation between subjective wellbeing and lie scales (Diener, 1984). Also, the existing quantitative expression of change in quality of life, from the preoperative to postoperative period, provides no information about the personal importance or significance of that change to an individual (O'Boyle et al., 1992).

2.3.3 Recovery and quality of life after THA and TKA

Until recently, outcome from total hip arthroplasty was monitored mainly by surgical measures, which was largely limited to the evaluation of pain, walking ability, range of motion and radiographic measures (Gouldie,1993). Most of this clinical evaluation failed to take a multi-dimensional view of health which includes patient's evaluation of recovery (Towheed & Hochberg, 1996).

The recent use of generic heath-related quality of life (QoL) measures in research has incorporated the patient's perspective in recovery from these operations, and shown how they differ from other individuals' views of their recovery. For instance, Lieberman et al. (1996) demonstrated that judgement for pain and overall satisfaction with THA varied considerably between patients and physicians. Physicians ratings of patients' pain was lower than patients' perceptions of pain. Physicians also believed patients to be more satisfied with treatment than they actually were. The differing perceptions between the groups were even more marked when patients reported more pain and less satisfaction. These findings suggest the need for caution to be attributed to physician accounts of recovery as they do not match those of patients. Here the clinical significance of physician accounts is questioned.

McGrory and colleagues (1996) also highlighted a difference between physician and patient reports of recovery. Total hip and knee arthroplasty patients' progress was evaluated by a physician at follow-up. Follow-up visits assessed short-term (up to 4 years) and long-term recovery (4.5 years plus). It was found that physicians reports of pain, transfer and range of motion, measured by objective scales, differed from patients' perceptions of these factors at both follow-up times. Invariably, the gap between physician and patient ratings were greater for patients who had a knee arthroplasty compared to those who had a hip arthroplasty.

2.3.3.1 Surgical outcome from THA and TKA

Although, as already mentioned, surgical indices of recovery have various shortcomings they have been valuable for assessing the validity of surgical techniques. In general, an excellent prognosis in long term improvement of symptoms and physical functioning after THA and TKA has been found (Charnley, 1995). The overriding surgical success of joint arthroplasty is supported by numerous studies which are briefly mentioned here.

Prosthetic devices work excellently and relieve the main indications for surgery, which are pain and disability. The majority of studies measuring long-term pain relief have found that at least 75% of patients obtained pain relief as a result of surgical intervention (Harris & Sledge, 1990; Wright et al., 1990; Laskin, 1981; Cracciolo et al., 1979; Sledge et al., 1978; Edwald et al., 1978). In terms of functional ability, research which monitored progress using surgical measures over various time periods, ranging from 2 to 7.5 years, also found favourable results. Collectively these studies show improvements in ambulation (Sheehan, 1979; Laskin, 1981; Wright, 1990; Harris & Sledge, 1990), walking ability (Cracchiolo et al., 1979) and overall functional ability (Insall & Kelly, 1986; Paget, 1986; Patel, 1991; Brander et al., 1997).

Studies which have monitored clinical recovery over more than 10 years have found outcome to be less promising than those studies which have asessed outcome at an earlier point in time after surgery (Reikeras, Bjerkreim & Gundersson, 1995; Franzen, Johnsson & Nilsson, 1997). This suggests that despite treatment, deterioration in various domains of recovery will eventually unfold over longer periods of time. Therefore, because of this deterioration it is difficult to establish when recovery, which relates specifically to treatment, actually ends. For example, in one study the health prognosis of 87 osteoarthritic THA patients followed over 5-13 years postoperatively, showed both negative and positive recovery on various dimensions (Reikeras, Bjerkreim & Gundersson,1995). Assessments of activities of daily living, such as walking, domestic tasks, and ability to dress showed that the most impaired preoperative function was the ability to walk, with most patients finding it impossible or difficult. Four patients found it impossible to walk outdoors, while 32 reported walking outdoors difficult, and 51 thought it easy. A large number of patients found domestic skills easy, providing they had an aid, compared to the few who had found this so preoperatively. Most patients found it very or extremely difficult to dress. It is suggested that findings from studies that monitor patients over 10 or 20 years are likely to be tempered by the fact that clinical decline may represent the natural morbidity which occurs with longevity (Brinker, Houston & Lund, 1997).

Interestingly, investigations using surgical outcome measures with the aim of comparing progress after THA and TKA, have found differences in the extent of progress for the two surgical groups. Some research has shown that despite greater preoperative disability in TKA compared to THA patients, the former group had greater improvement after surgery, so that both groups eventually had a similar level of disability one year after surgery (Norman-Taylor, 1996). Others have also shown TKA to exceed the effects of THA (Hawker et al., 1988).

The findings from studies which have used objective indices of recovery provide one perspective on recovery, which is very different to that provided by studies which have measured recovery more subjectively.

2.3.3.2 Subjective outcome from THA and TKA (comparative studies)

This section documents research that has assessed both short and long-term recovery from hip and knee arthroplasty, from the patient's perspective. Investigations are divided into those which have monitored outcome from either hip or knee surgery, and those which have integrated both surgical groups. The main reason for comparative investigations of THA and TKA surgery outcome has been because both surgical groups produce positive results, and are associated with infrequent complications together with correction of these if they do occur (Harris & Sledge, 1990).

For the purposes of this review, long-term recovery is that which has been measured at 1 month after surgery, and short term is that which is monitored before one month. Although this discussion is concerned with the subjective health status following surgical treatment, it is important to acknowledge that this is not the only factor to affect an individual's QoL. Research by O'Boyle and colleagues (1992) with 20 total hip arthroplasty patients showed those who reported greater QoL had better financial, environmental and educational resources as well as health status (O'Boyle et al., 1992). Also, although there has been no research on the relationship of health-related quality of life with personality and coping traits after joint arthroplasty, it can be assumed that such factors might influence recovery from surgery. This assumption is based on research which has assessed individuals with arthritis and has found that helplessness, self-efficacy, coping and perceived social support have been important psychological variables which can influence perceptions of their QoL (Parker & Wright, 1997).

The following discussion is structured in a way that documents pain, functional and wellbeing outcome from studies that have assessed outcome solely from THA and TKA, and comparative studies which have assessed outcome from both surgical groups.

2.3.3.2.1 Total hip arthroplasty outcome

An assessment of pain in the immediate postoperative period of THA has been rarely undertaken. In a study by Duggleby and Lander (1994) with 60 THA patients, one third of patients reported their pain as 'moderate' to 'severe' on day 4 after surgery despite the finding that pain intensity had showed an overall reduction in patients 48 hours after surgery. This implies that the intensity of pain experienced by patients is not to be underestimated, and is one aspect of recovery that deserves considerable attention.

Research by Vogele and Steptoe (1986) assessed duration of pain, tension, anxiety and fatigue after surgery in 8 patients. Pain was rated on a scale of 1 to 5, with 1 denoting that they had pain 'very little of the time' and 5 'most of the time. Patients were found to have the longest duration of pain (mean of 4.5) on the first postoperative day. After this time between days 3 to 11 postopertively, pain duration showed a stable reduction beyond preoperative levels. Both tension and anxiety and fatigue showed an increase during the first two days, but these declined by discharge.

A study by Liang et al. (1990) which assessed progress in pain relief and function after THA amongst 38 patients three months after surgery and betweeen twelve to fifteen months after surgery, showed that both dimensions had improved substantially by three months. A number of quality of life measures confirmed these improvements. Pain and function continued to improve between 3 months and one year at a lesser magnitude than earlier responses and there was no relationship between three months and one year progress. This suggests that most progress, in terms of pain relief and function, is likely to take place in the first three months after surgery (Liang et al., 1990). Incidentally, in the Liang et al. study, there was equal sensitivity on various pain scales despite a variation in change in patient mobility. Also, patients' response for social and global scales of quality of life were smaller than those concerned with pain or mobility. Another study by Wilcock (1978) showed that, amongst 49 THA patients, although the majority were pain free and could walk long distances six months after surgery, only a few patients showed complete independence in activities in daily living. This discordant response between pain relief and physical independence suggests that physical independence is not solely related to functional ability but may also be associated with psychosocial variables such as perceived social support, attitude or motivation.

Patients have shown reduced functioning in various dimensions of health-related quality of life after surgery, before showing an improvement. In a study in which 454 patients had pre and postoperative measures of quality of life recorded, measured by the SF-36, QoL was worse 1 month after surgery, in comparison to 6 and 12 months by which time it had improved considerably (Mangione et al., 1997). In contrast, pain had improved by one month postoperatively and even more so at six months to a level which was maintained through to twelve months. All dimensions of health (psychosocial, health perceptions etc.) had improved by twelve months, with pain showing the highest level of reduction. It is suggested by the authors that surgery which is classified as more life threatening, often show more positive results a month after surgery, and that this may be attributed to the fact that patients feel pleased to still be alive (Mangione et al., 1997).

Borstlap et als. (1994) study of 62 patients with osteoarthritis and rheumatoid arthritis of the hip and 35 patients with rheumatoid arthritis of the hip showed that although pain relief and mobility progressed after THR over twelve months, pain relief improved most during the first three months of recovery and was maintained at six and twelve month follow-up. Furthermore, mobility was seen to improve most between three and six month follow-up. These findings suggest that the time-scale for recovery, with specific reference to pain relief and increased mobility, is not infinite, with most change occurring within the first six-postoperative months. Osteoarthritis patients also showed increased morale signified by reduced levels of depression, as well as reduced anxiety and more cheerful mood in comparison to rheumatoid patients.

Laupacis and colleagues (1993) assessed the outcome of total hip arthroplasty amongst 188 patients at 3 months, 6 months, 1 year and 2 year after surgery. Apart from the use of the Sickness Impact Profile (SIP, Bergner et al., 1981) which produces a global rating of overall wellbeing, the majority of measures used were disease-specific, which focused on patients' level of disability, ability to perform specific functions and amounts of pain incurred during functional activity. Patients showed improvement on all measures by three months, apart from the SIP item monitoring 'ability to work'.

Rorabeck et als. (1994) study of 250 THA patients used a combination of surgical assessments and quality of life assessments which relied on the patients' perspective to assess recovery over three months, six months, and twelve months. Improvements in walking and other functional ability, as well as pain and mobility were detected on all surgical measures. The Sickness Impact Profile, a generic measure, showed patients had improved sleep and comfort after surgery and had increased behavioural function in many dimensions. The authors do not elaborate on the specific dimensions that showed improvement. Global health rating, measured by a utility measure (time trade-off) showed a vast improvement at 2 year follow-up.

Wiklund and Romanus (1991) used objective and subjective measures to evaluate the quality of life one year after surgery amongst 56 patients who had total hip arthroplasty. More specifically, functional outcome was assessed with a surgical scale (Charnely-Merle d'Aubigne score), and subjective emotional, functional and social impact of treatment was assessed with a quality of life scale: the Nottingham health profile. This profile is subdivided into two parts. The first part assesses perceived distress in emotional, functional and social domains, and the second part assesses the impact that an individual's heath has on emotional, functional and social domains of quality of life. The surgical scale showed patients had reduced pain, and increased function and motion ability one year after surgery. The quality of life measures showed patients, preoperatively, had more pain, lack of energy and sleep, reduced mobility and increased emotions and feelings of isolation compared to a normal 'healthy' reference group, matched on age and sex, who represented average scores in the mentioned domains. Patients' health was also shown to affect their ability to function and participate, specifically in housework, holidays, hobbies, and to a lesser degree in social and sexual life. At one year assessment THA patients showed remarkable recovery in all these dimensions so that they were nearly level, if not equal to the reference group. With reference to the effect of health on patient's quality of life, postoperatively THA patients very closely matched to the reference group in sexual and social roles. THA patients showed reduced day-to-day and leisure activities because of ill-heath compared to the reference group. Overall, fatigue together with pain, sleep, social isolation and wellbeing improved one year after surgery for THA patients (Wiklund & Romanus, 1991).

An indirect way of assessing patients' satisfaction with surgery is to assess their emotional state before and after surgery (Ware Jr. 1987). Studies that have asked directly about patient satisfaction with their outcome, or indirectly by probing mood and other emotional state and wellbeing have overall found satisfaction to be high amongst joint arthroplasty patients.

Synder (1991) showed that, of 40 female hip arthroplasty individuals assessed between one and three years after surgery, many felt 'very positive' (60%) or 'positive' (30%) about their outcome, while only 20% felt it was 'negative'. Most patients (85%) reported no discomfort from pain after physical strain and 15% reported experience of pain after walking long distances. The majority of patients reported an improvement in physical mobility and personal attractiveness compared to before their surgery. Some 60% of patients felt that the operation had satisfied their hopes, while 20% felt it had surpassed them. Surgery generated optimism as 20% of patients assumed full recovery of their physical ability, and 35% hoped to accomplish it within the future. As time progressed after their surgery, patients had increased family orientated goals, personal attractiveness, ability for professional and social activities, and paid less attention to their health condition. It is important to note that the exact time patients were seen was not designated, and hence monitoring of outcome at different time points may have created biased results (Synder, 1991). In another investigation, 89% of THA patients assessed 9 months after surgery, had fulfilled expectations about relief from pain and improved mobility, rating their outcome very or extremely successful (Halworth, Ellis, Ackroyd, 1981).

Petrie. Chamberlain and Azariah's (1984) investigation with 51 osteoarthritis patients scheduled for THA. found patients reported improved wellbeing, life-satisfaction and subjective health accompanied by reduced distress and pain. six to eight weeks after surgery.

Gogia, Christensen and Schmidt's (1994) study with 22 THA patients, a simple self-rating scale was developed to assess pain and function one day before and at 3 and 6 months after surgery. A variety of functional activities related to daily living were assessed, with emphasis on degree of difficulty during functional activity and how comfortable patients felt during physical activity. All patients studied had been scheduled to follow the same physiotherapy protocol which started the day after surgery. Surgery was performed by 1 surgeon. Outcome was based on the total score of each patient. 18 out of 22 (82%) and 20 out 22 (91%) patients indicated "excellent" reduced pain and increased functional status at respective three and six-month follow-up, in comparison to none preoperatively where the majority of patients had "poor" or "fair" functional ratings. Postoperatively, patients scored higher ability and comfort scores on all functional activities compared to preoperatively, indicating the success of surgery in these areas. Pain was dramatically reduced in patients at 6 month follow-up compared to preoperatively, with over 80% of patients reporting themselves to be pain free. Most improvement in patients was found between during the first three months after surgery whereby the majority of patients had pain-free function.

Franzén, Johnsson & Nilsson (1997) followed the quality of life of 187 patients, between 10 to 20 years after a primary hip arthroplasty. They used a generic measure of quality of life (the Nottingham health profile) to compare the stated surgical group and a control group which they had matched on age and sex. Follow-up findings showed THA patients to have reduced health in many domains of quality of life compared to the control group. They had increased pain as well as other emotional reactions, together with increased social isolation, and reduced physical mobility, sleep, and energy. Impairment in these domains of health affected individuals ability to carry out housework, and be involved in social and leisure interests.

2.3.3.2.2 Total knee arthroplasty outcome

To date research on short and long-term studies of subjective pain and functional outcome after total knee arthroplasty is extremely limited in comparison to hip arthroplasty.

Functional recovery from total knee arthroplasty two and six months after surgery was investigated by Lichtenstein, Semaan & Marmar (1993). At two months, 155 patients were asked to assess their functional ability and report how this compared to their recovery expectations, which were unfortunately not assessed preoperatively. Approximately 58% of patients reported that they were functioning at two months according to their expectations, and 34% felt that they had not recovered to the extent of their expectations at this time. The six month assessment showed a similar extent of recovery to that at two months, suggesting no further recovery had occurred in between the two assessment times. The fact that patients' expectations were not assessed preoperatively makes the postoperative assessments in this investigation less meaningful than if they had been.

Birdsall et al. (1999) assessed outcome from surgery for 119 primary TKA elderly patients (aged 80 years plus) in comparison to a younger group (aged 65-75 years) of patients undergoing the same surgical procedure: the groups were matched equally for men and women. Patients were recruited across 14 hospitals. Patients were assessed before surgery, and at three and twelve months postoperatively by the Nottingham Health profile which was sent out to them. The follow-up rate for these patients was 100% as patients that failed to complete any part of this study were excluded. Findings showed that both the younger and older patients had improved physical mobility, energy, sleep, pain and emotional state by three months postoperatively, and that these were maintained at one year follow-up, with pain showing more improvement for both groups. Comparing the two groups, in general the mortality rate for the elderly group was higher than the total sample, also the elderly group reported less pain but worse physical mobility in comparison to the younger group at three month follow-up. These findings suggest that those over the age of 80 years, as well as younger patients, have a significant improvement in their overall health after knee arthroplasty (Birdsall et al., 1999).

Pitson et al. (1994) found that TKA patients two months after surgery who had reduced dependency and anxiety levels, also had reduced pain and increased mobility. These findings are interesting as they suggest a positive relationship between psychological and functional dimensions of recovery.

Research which has assessed the psychosocial benefits of TKA is scarce. Indeed, amongst those investigations which have assessed recovery from TKA, none have looked carefully at postoperative fatigue. Similarly to hip arthroplasty, it has recently been shown that TKR patients find this surgery successful, with investigations reporting that almost ninety percent of patients after knee arthroplasty are satisfied with their outcome (Heck et al., 1998; Anderson et al., 1996).

2.3.3.2.3 THA and TKA outcome (comparative analysis)

Studies which have compared outcome from THA and TKR, usually find TKA patients to progress more slowly than THA patients on certain dimensions of recovery.

One immediate postoperative difference between surgical groups is in the level of pain experienced. Giuffre (1991) showed that although both THA and TKA patients reported similar sensations of pain, twenty minutes after surgery, of which the most common were 'heavy' and 'aching', TKA patients in general had a higher sensory pain score, and reported greater intensity of pain over the first postoperative week compared to THA patients. If patient controlled analgesia is considered an indirect measure of pain, TKA patients have shown greater postoperative pain than THA patients through increased opiod intake (Giuffre, 1991; Albert et al. 1991), and have been observed to endure more postoperative discomfort (Albert et al., 1991). Daltroy et al's. (1998) study with 222 THA and TKA patients was also substantive of the above findings. It showed increased intensity of pain for TKA compared to THA patients immediately over the first 4 postoperative days, as well as increased analgesic medication intake during this period.

Another study showed pain to be significantly reduced by the third postoperative day in THA patients (Petrie, Chamberlain & Azariah. 1984). In addition, Aarons et al. (1996b) which combined assessment of immediate outcome with follow-up at 50 days also showed early pain relief for THA in comparison to TKA. In this study, although pain reduced substantially for THA patients 7 days after surgery it was not until 50 days after surgery that TKA patients showed a reduction in pain. Aarons and colleagues found that short-term recovery from surgery was perceived more successful by THA patients in comparison to TKA patients when assessed 50 days after surgery. Early relief from pain is likely to provide a positive psychological impact on early recovery. However, whether it has any influence on later recovery is uncertain.

Studies which have measured postoperative outcome over longer periods of time do not necessarily find a more positive recovery from surgery. For instance, an assessment of 32 THA and 11 TKA patients' activities of daily living between 6 and 35 month postoperatively, found that only 13% of patients perceived functional improvement postoperatively, 65% felt no change, and 5% felt a loss of function postoperatively. Activities which showed the most positive outcome were: walking up stairs, maintaining the garden, and getting in and out of a car (Roush, 1985). This study was conducted by mail assessments which asked patients to evaluate their ability to perform 22 activities. Although these findings are clinically useful, the dimensions recorded above are usually described much more positively with reduced follow-up monitoring time.

Shields, Enloe and Leo (1999) assessed health-related quality of life in 43 THA and 24 TKA patients preoperatively and at 3 and 6 months after surgery. The SF-36 and wellbeing questionnaire, which provided a global assessment of patient's health, were used to assess ensuing quality of life after surgery. Both questionnaires found that most change for patients occurred in between the preoperative period and three months and the preoperative period and six months but rarely between 3 and 6 months, suggesting that most patients perceived change in their health status during the first three months after surgery. Both surgical groups had less pain, increased vitality and physical function by three months with all these variables continuing to improve further at 6-month follow-up, whilst only THA showed further improvement in physical-role limitation from 3 to 6 months. It was not until 6 month follow-up that TKA patients reported improved emotional- role and functional-role limitation. Although responses for the different scales were similar, the SF-36 proved more responsive between 0-3 month follow-up compared to the wellbeing scale.

Research which has used slightly longer follow-up times has seen accelerated recovery of THA over TKA patients. In a study by McGuigan et al. (1995) with 46 THA and 71 TKA patients, psychosocial, physical function and general wellbeing showed greater improvement in THA compared to TKA patients 2 years after surgery. The independence of health and other dimensions of QoL have been demonstrated by some research. Additionally, McGuigan et al. (1995) showed the paradox of improved social, physical function and physical role function, emotional, mental, energy, pain dimensions of QoL, but unchanged health perceptions, at a two year follow-up for both surgical groups.

Research which has monitored recovery from joint arthroplasty over 2 years has found that recovery on all dimensions is not always maintained. This pattern of recovery was found by Kirwan et al. (1994) amongst 335 THA and TKA patients assessed at annual intervals for a period of 5 years. The authors showed that the majority of patients had reduced pain and disability one year after surgery (only 14 patients had become worse in these dimensions) and that this was maintained for the following two years after which these dimensions became progressively worse. Again as has been the case with other studies pain and disability ratings for TKA patients slightly exceeded those of THA patients.

Recent research has shown feelings of success to have implications for recovery. THA and TKA patients who rated their operation to be highly successful were more likely to return to normal activity and have relief from pain one year after surgery compared to those who perceived their operation to be less successful (Bayley et al. 1995). This suggests that increased satisfaction is associated with better physical recovery. Also, Bayley and colleagues finding that surgery provided more pain relief than return to normal activity is consistent with the view, mentioned earlier, that pain relief and changes in locomotion activity are not necessarily linked (Goldberg, 1994). Furthermore, in a multivariate analysis, Bayley et al. (1995) showed that individuals with greater physical function, and reduced physical role limitation and pain, rated their outcome as more successful; while social function, vitality and general health had less influence, and mental health had no influence on success ratings.

In an investigation by Hozack et al. (1997) 151 primary total hip arthroplasty patients were compared with 149 primary total knee arthroplasties and 3 other surgical groups (revision hip arthroplasties, lumbar laminectomy, scoliosis surgery) by clinical and generic outcome measures. For the purposes of this review the differences between primary hip and knee arthroplasty are discussed. Although, there were no preoperative differences between the two surgical groups, at a two year follow-up those patients who had a hip arthroplasty had greater physical and social function, increased energy, and reduced pain level (all measured by the SF-36) compared to patients who had a total knee arthroplasty. The Charnley hip score and Hospital for Special Surgery and Knee Society Scores, were respective clinical measures for hip and knee arthroplasty individuals. Both of these showed a reduction in physical disability, but could not be compared because of incompatibility.

Rissanen and colleagues (1995) in a cross-sectional study assessed recovery of total hip and knee replacement patients at 2 and 5 years after surgery, to find that knee replacements had less improvement overall in comparison to hip replacement patients. Results showed that both surgical groups had a large improvement in HRQL (better energy, sleep, and less pain by 2 years, which was sustained up to 5 years. This study failed to report demographic and other differences between the samples. Also, there was no comparative statistical analysis of the two surgical groups in an assessment of differences between them.

In contrast to those investigations which have shown rates of recovery to differ for THA and TKA. Liang et al. (1986) showed a lack of differences in functional recovery at six month follow-up, amongst 22 total hip and 23 total knee arthroplasties. Both surgical groups had improved health and functional scores at the six month follow-up. Unfortunately, although pain was measured preoperatively, measurement of this variable was not used in the postoperative period. Also, greater preoperative impairment in patients undergoing THA was associated with greater clinical improvement after surgery (Liang et al., 1986).

Others have also shown no differences in long-term recovery for the different surgical groups. A recent study by Ritter and colleagues (1995) which used a non-randomised sample and did not control for demographic factors, compared recovery from 85 total hip and 158 total knee arthroplasties at 6 months, 1 and 2 years after surgery. The TKA patients were categorised into those having unilateral (n=93) or bilateral, single-stage replacements (n=65). Clinical assessment of local joint disease was determined by radiographic and clinical information, while a more subjective assessment of health and overall quality of life was assessed by a nurse two weeks prior to surgery who administered the SF-36 with all patients. Non-threatening comorbid conditions were also assessed. It was found that apart from evaluation of general health, both surgical groups had equal improvement on all functional status and other SF-36 wellbeing dimensions at 6 months follow-up, as well as at one and two year follow-ups. Questionnaires were mailed to patients. Most improvement was seen in pain reduction and increased activities of daily living for patients who had unilateral or bilateral surgery. Comorbid conditions had no effect on outcome.

Ritter and colleagues suggest that the lack of influence from treatment on general health may have been because of previous medical history, pre-existing or current health related conditions (Ritter et al., 1995). As the study by Ritter and colleagues was prospective and non-randomised it is possible that other influences may have confounded results. Also, the 74% response rate at two year follow-up might have created a bias in collected data. It is possible that a large number of those who did not respond were THA patients with greater than average recovery on several dimensions such a transfer bias, suggesting a need for caution in accepting the equal recovery reported by THA and TKA patients.

Social and Psychological functioning has been shown to improve after hip and knee arthroplasty. Up until a recent study by Orbell and colleagues (1998) of patients who had hip and knee arthroplasties for osteoarthritis, mood has generally been found to improve after hip or knee arthroplasty. However, their study, found that a third of patients, despite improvements in functional and pain status, had increased symptoms of depression at three and nine month follow-up. This finding is discordant with research which has found increased depression to be related to increased functional impairment (Mutran et al., 1995). Contrarily, it suggests that the two variables are independent dimensions of recovery. It was suggested by the authors that their findings might be attributed to the particular type of data analysis used. Data from each patient was analysed individually; this is the only study up to date, looking at quality of life from hip and knee arthroplasty, that has used this method. Other significant findings were the lack of change in functional activity between three and nine months.

In terms of postoperative fatigue, Aarons et al. (1996a) found no improvement in physical or mental fatigue 6-8 weeks after surgery in 40 THA and 23 TKA patients. This suggests two things: that fatigue is apparent after total hip and knee arthroplasty, and that it takes longer than two months after surgery to recover from this state.

In summary, these studies provide substantial evidence to back-up the positive long term outcome from THA and TKA, and to a lesser extent the positive short term and immediate outcome associated with these surgical procedures. No research has assessed the influence of immediate functional recovery on later quality of life. The fact that hip and knee patients report similar levels of satisfaction after surgery, despite different degrees of physical ability suggests that other factors besides health are important in satisfaction. Indeed, some studies found that perceived health for THA and TKA was independent of QoL, while others perceived a very close relationship between health and general quality of life. Overall these studies, which have assessed quality of life change after treatment from the patient's perspective, demonstrate the richness and complexity of the concept of quality of life; with findings emphasising its multidimensional quality. Consequently, they provide an account of the exact nature and extent of recovery in general health and other QoL dimensions (Ritter et al. 1995). Although these studies have been informative they have often failed to measure QoL variables relating to pain and function both pre and immediately postoperatively. They have also used patients from several different hospitals (Kay et al., 1983), which increases environmental confounding variables.

Research consistently highlights that much recovery after THA and TKA is achieved in the first three months after surgery. Results from comparative studies generally show consistent evidence in support of a more protracted recovery for TKA compared to TKA. Where deviations from this have occurred, these can be associated with methodological and statistical procedures used in the comparison process. A number of studies highlight the influence of factors, apart from surgery, such as existing health, patients' expectations and longevity of studies which influence subjective outcome.

2.3.4 Conclusion

The research on recovery from joint arthroplasty clearly outlines the efficacy of this treatment for improving quality of life, and demonstrates that research which uses longer follow-up times is more likely to observe significant clinical changes in recovery. The literature overview provided highlighted the lack of information on short-term recovery which may be important in influencing more long-term outcome from surgery. In this investigation an assessment of recovery from the patients' perspective was considered necessary as a definitive index of surgical outcome by which to assess the exact nature and extent of recovery in general health and other QoL dimensions.

Total hip and knee arthroplasty surgery represent elective surgical groups that have a varied and protracted recovery in several psychosocial and physical dimensions. Also, these operations are more common amongst elderly patients, and hence yield a relatively homogenous group. Thus, these surgical groups provided an excellent model by which to test the main hypothesis of this thesis. Quality of life before and after total hip and knee arthroplasty was monitored, along with other indices of recovery. It was necessary to combine both hip and knee arthroplasty in statistical analyses, in this investigation, in order to maximise numbers to test a wider hypothesis (see Chapter 1). However, preliminary to combining surgical groups, quality of life was assessed separately for both hip and knee arthroplasty patients, to check whether these forms of surgery were similar with respect to psychological factors.

There is no research which has assessed the effects of the physiological response of the hip and knee arthroplasty procedure on recovery and future QoL. One of the main aims of this thesis is to ascertain whether psychological interventions have any short or long term implications on functional, psychosocial recovery, and general wellbeing. In particular, hormonal and metabolic responses are assessed to show definitely whether these might mediate the effects of psychological interventions and therefore indirectly influence quality of life. Quality of life and recovery were assessed separately for both hip and knee arthroplasty patients, as it cannot be assumed that all forms of surgery are similar with respect to psychological factors.

There has been no research which has assessed the relationship between immediate functional recovery and its influence on later quality of life resulting from surgery. As there are no extant outcome measures which assess patients' progress during this time, a tool was developed specifically with the intention of being used for these purposes (see Chapter 4). Clinically, the measurement of immediate functional recovery may have important implications as it is possible that early rehabilitation might affect more long-term recovery.

Quality of life measures should be used in addition to other indices of recovery. In light of the physical and psychosocial effects of arthritis, it was considered essential to use a generic measure of QoL. It was also considered appropriate to use a disease-specific scale, validated specifically for THA and TKA patients which may be more sensitive to surgical interventions than a general population measure because it would ask patients about specific health effects relating to the knee or hip operated on.

A generic QoL questionnaire widely used as a tool for measuring outcome of interventions, designed to improve QoL, is the Short-Form Health Survey (SF-36 - Ware & Sherbourne, 1992). There were several reasons for using the SF-36 generic measure as opposed to other well known measures often used. The SF-36 is brief and easy questionnaire to administer, which concentrates on day to day aspects of functional living, including psychological, somatic, and vocational aspects. Also, many questions on the SF-36 are performance as opposed to capacity-oriented, and therefore provide a more accurate description of functional outcome (Bell et al. 1990).

The Mental Health Inventory (MHI -Ware et al., 1979) was another generic measure also used. The MHI scale used was that of positive affect, as this was not covered by items on other questionnaires, used in this investigation, assessing psychological adjustment to surgery. Other generic measures used included two utility measures, which asked patients to make a single rating of satisfaction or happiness with life. The utility measures used were Cantril's Ladder (Cantril, 1965), and the Face scale (Andrews & Withey, 1976). The Face and Cantril's Ladder scale provided the opportunity for patients to give one linear estimation of their overall subjective rating of QoL as opposed to evaluating various dimensions of the construct, as the SF-36 does.

A disease-specific scale known as the Western Ontario MacMasters Universities Osteoarthritis Index (WOMAC- Bellamy et al., 1988) was also used. This scale was validated with patients having total hip arthroplasty or total knee arthroplasty and concentrates on the level of difficulty, and pain experienced when performing major functional and activities of daily living tasks.

In summary, recovery from total hip and knee arthroplasty was monitored by measures which assessed physiological, functional and psychological adjustment in the immediate postoperative period and up to six months after surgery.

PART 2

Chapter 3

Methodology And Design

Chapter 3

Methodology and Design of a Randomised Control Trial of Effects of Psychological Interventions on the Stress Response and Short and long-term Recovery From Arthropasty

3.1 Introduction and design

This thesis assesses the effect of two distinct psychological interventions on recovery from surgery. The interventions encouraged active or passive coping. Recovery was assessed during the first postoperative week and at one and six-month follow-up. The physiological hormonal and inflammatory response is measured in the first postoperative week, while measures of psychological and bodily state, wellbeing and general quality of life are measured intermittently up to six months after discharge. See Table 3.1 below for a more detailed account of times at which particular recovery variables were measured. A distinctive feature of this study was that it included a six-month postoperative follow-up of patients. Refer to Table 3.1 for an outline of the overall study design.

Table 3. 1 Overall design of Investigation

Day in hospital	**Intervention group**		
	Control	**Passive**	**Active**
Admission	B + Q	B + Q + I	B + Q + I·
Day of surgery	B	B	B
Day 1	B + Q	B + Q	B + Q
Day 2	B	B	B
Day 3	B + Q	B + Q + I	B + Q + I
Day 4 -6	B	B	B
Day 7	B + Q	B + Q + I	B + Q + I
1 month follow-up	Q	Q	Q
6 month follow-up	Q	Q	Q

B = Blood sample Q = Questionnaire I = Intervention (Passive or Active)
Refer to **Table 3.2** for exact blood samples taken, and **Table 3.4** for questionnaires used.

3.2 Method

3.2.1 Subjects

All patients had a history of either rheumatoid arthritis or osteoarthritis. Medical records from a potential patient pool of 217 were consulted, from two hospital sites. These were two local university teaching hospitals in the city of Liverpool; the Royal Liverpool University hospital (RLUH) and Broadgreen hospital. Patients listed for either total hip arthroplasty (THA) or total knee arthroplasty (TKA) were recruited to this study for which it took 2 years and seven months to complete data collection. Patients were selected consecutively from surgeons' waiting lists. Patients were excluded from the study if they showed signs of disorientation, dementia (or any other degenerative disease), pituitary or adrenal disease, severe liver disease, severe renal disease (creatinine > 200µmol $l)^{1}$), and any psychiatric history. Other excluding factors were if patients were not able to understand written or spoken English or were scheduled to have a revision joint arthroplasty which is known to be associated with increased perioperative difficulties and postoperative complications (Barrack et al., 1995). To control for diurnal variation of glucose and hormones, patients were also excluded from recruitment if they were under a consultant who normally started elective surgery after midday. Patients were excluded if they were taking the following medication: insulin or tablets for diabetes control; steroids if they had been taken continuously for the previous three months.

3.2.1.1 Routine preparation for surgery

43% of patients in this study due to have a THA or TKA attended a pre-admission clinic which took place between one and eight weeks prior to the date of admission. These visits may last between four and seven hours. The aim of the pre-admission clinic is to cover a broad range of issues: medical, surgical, social and psychological to help people cope with their impending surgery. Patients and a relatives are invited to attend, and are seen usually by a doctor, nurse, physiotherapist, occupational therapist (O.T), and specialist nurse, i.e. pain control nurse. Other specialists, i.e. social workers or dieticians are available if necessary. During the preadmission clinic specific details are checked, and information provided by such specialists. Initially an examination is performed by a doctor, after which blood tests, x-rays and other procedural examinations are arranged. Any medical treatment needed to prepare the patient for surgery is arranged and information about the operation, possible complications and prevention of complications are explained. Patients are asked by a nurse about other medical problems they have and are informed of postoperative care. Patients, at this stage, are often encouraged to discuss any worries or fears they have about the operation or aftercare. Total hip/knee arthroplasty patients are shown an artificial joint and x-rays by a physiotherapist, and informed what exercises they need to do as soon as possible after their operation. An O.T. advises patients about activities of daily living and provides them with information about precautions during certain activities, while a pain nurse will inform patients of the different types of pain relief available.

A written booklet is given to patients at the hospital. This booklet can be presented at preadmission clinic by a physiotherapist or nursing staff, or it can be sent in the post to patients. The booklet provides practical advice on how to best to prepare for their operation, i.e. by reducing smoking and by reducing their food intake if overweight etc. It also provides information about the surgery (before and after), activities of daily living, general health and specific rehabilitation exercises. Breathing exercises, coughing, and postoperative physical exercises are explained in such a booklet. Diagrams are used to help the patient understand how to sit up, how to walk etc. Patients at Broadgreen Hospital and the RLUH who attended pre-admission clinics were given a booklet, during the preadmission clinic, concerned specifically with preparation for THA or TKA. It outlined what to bring to hospital along with hospital admission details, and provided a clear outline of what to expect after a hip and knee operation which included information on pain, drips, wound healing, eating, drinking, toileting and how to recognise complications. A descriptive and diagrammatic account of rehabilitation exercises to be performed after surgery were outlined.

Patients arrive at the hospital, often by taxi or ambulance and report to patient reception. The following sequence of events outlines a typical routine which the majority of patients experience. They go to a ward to wait in the day room for a free bed; sometimes this can be for as long as five hours. They are clerked in by a junior doctor, seen by their named nurse, and have X-rays and electrocardiograph (ECG), often in the space of one hour. Patients are expected to provide information about medical history, have a physical examination and blood samples taken, and walk through the hospital (if not taken in a wheelchair) in night clothes, wait in another waiting room for at least one hour and undress for a second time. They return and are seen by an anaesthetist and usually by their consultant later in the evening.

3.2.1.1.1 Surgical preparation for THA and TKA surgery

Wong, Wong & Yabsley (1983) provide an account of the surgical procedure for hip arthroplasty. On the day of surgery the patient's legs are cleansed in iodine solution whilst they are on the ward; this is an antiseptic used to assist in reducing the risk of infection. Soon afterwards they are taken to an operating theatre, where they are anaesthetised and positioned on an operating table. An incision of approximately 10cm is made over the anterior edge of the lateral greater trochanter area. The neck of the femur bone is divided in two with a saw, and the head part of the femur is removed. The acetabular cup of the prosthesis is inserted with cement into the acetabulum at approximately 45° to the horizontal, with excess cement being removed after it has dried. The stainless steel metal alloy is inserted with cement into the shaft of the femoral bone. The leg wound is sprayed, irrigated and closed over a Hemovac drain. The patient is placed on their back with an abduction pillow or wedge between their legs to keep the operated hip joint in an abducted position, and the patient is moved to a recovery room immediately after surgery, where they are closely monitored. On recovering from the anaesthetic they are encouraged to cough and deep breath regularly. On return to the ward the patient's wound, vital signs and position are monitored carefully.

The above procedure is similar for individuals having total knee arthroplasty. The initial step in knee arthroplasty is an incision at the front of the knee. Again, the approach will depend on a surgeon's training and preference. Next, the upper leg bone (the femur) and lower leg bone (the tibia) are cut. It is made sure through the use of various techniques that these bones are kept in the proper alignment to the leg's original angles. After this the undersurface of the patella (knee cap) is removed. A metal femoral component is placed on the femur and held in place by cement or tapered bone. This component replaces the groove where the patella lies. Next the tibial components are fixed. The first component is fixed to the top of the tibia by either screws or cement: this component is like a metal tray and is designed to hold a larger component; a plastic spacer. The spacer is attached to the metal tray. Lastly, a patellar component (the kneecap portion) replaces the joint surface on the bottom of the patella that rubs against the femur in the femoral groove.

3.2.1.2 The mechanical structure and surgical procedure of THA and TKA joints

In both THA and TKA an artificial prosthesis is inserted into the body to replace the diseased cartilage and joint bone. A normal hip joint consists of a ball and socket. The socket or acetablum is the cup-shaped bone of the pelvis, and the ball is the head of the thigh bone or femur. Most hip prostheses consists of a femoral component made of stainless steel or a chrome cobalt molybdenum alloy and a cup made of high density polyethylene. These components are usually fixed with cement (methylmethacrylate), or more recently a porous substance which allows bone to grow into the prosthesis. This substance was first used in 1978 with THA, and has been used with TKA since 1982. Cementless methods rely on bone bonding with implants, which is believed to provide a greater durability and increased lifespan for the replaced joints, which is seen as a significant advantage given the increased longevity of patients (Huddleston, 1995).

With reference to the life span of a prosthesis, the most suitable patient for THA is a relatively inactive female of light weight and the most unsuitable is the heavier and more active younger male (Dandy, 1993). Operating technique varies from surgeon to surgeon, with the angle of approach to the diseased joint differing between individual surgeons. Some take the anterolateral approach, others the posterior. With all approaches the same principles apply. All debris and soft tissue from the acetabular surface is removed and the head of the femur is removed. During the operation, the risk of infection is reduced by the provision of ultra clean air within the operating room (resulting in frequent air changes) and the use of prophylactic antibiotics. Postoperative care involves maintaining the hip in abduction (legs spread apart, with knees straight), via the use of an abduction wedge placed between the thighs; this is used to help prevent the risk of dislocation, and is put into place as soon as possible after the operation. Suction drains are usually removed two days after surgery, and patients are encouraged to engage in strict physiotherapy postoperatively from this time point (Dandy, 1993) (See Appendix D).

The normal knee joint consists of a movement between the lower femur and upper tibia; both unconstrained and semi-constrained prostheses types mimic this. In the constrained types, metal and plastic components are secured to femoral and tibial surfaces. This does not have any effect on the stability of the joint and is the type of prosthesis used in individuals who still have stable joints. This procedure is more akin to knee resurfacing, in which thin layers of bone are removed from the femur (thigh bone) and replaced with thin layers of metal matching that of bone removed. Also the upper tibia (shin bone) is removed and replaced with plastic (Huddleston, 1995). Semi-constrained prosthesis consist of replacement joint surfaces, as above, and replacement of the patella (knee-cap), which is resurfaced with plastic. This type of prostheses is often used for patients with advanced disease.

The pieces comprising the artificial joint surface work in contact with each other are similar to a normal joint. Pain relief is achieved by an absence of movement of diseased joint surfaces against each other. Again, similarly to THA loosening of components may occur as the new joint ages, which usually results from a loosening of the bond between bone and cement, resulting in renewed pain, and the need to consider revision surgery.

3.2.2 Procedure

3.2.2.1 Recruitment

Medical records were viewed before patients were admitted, and biographical and medical details were obtained. Patients considered to be suitable were informed of the study after being admitted to hospital. Informed consent was obtained from all subjects 1-3 days before their operation, and the majority of subjects were seen by a researcher at least 2 days preoperatively (N=134). Patients seen on the day before their operation were admitted on this day, or late on in the evening the previous day. Patients were seen at least sixteen hours before their surgery between 10 am and 5 p.m.

Patients were recruited from two hospital sites simultaneously and were randomly assigned, separately in each hospital, to one of three groups: passive (P) or active group (A) or control (C). To minimise interactions between patients from different groups patients were randomised in blocks. A block consisted of a group of consecutive patients who were randomly assigned together to a treatment group. The order of the blocks was random with the constraint that each series of three blocks combined each possible sequence. Blocks of 3 and 6 patients were used respectively in the RLUH and Broadgreen hospital to allow for different recruitment rates. Smaller blocks (3 as opposed to 6 patients) of each intervention group being recruited from Broadgreen hospital, was due to anticipated slower recruitment rate from that site. Newly recruited patients in a bed next to a previously recruited patient, at the scheduled time of block change, were placed in the existing block. This caused a slight unevenness of numbers in the treatment groups. This imbalance was addressed at the end of the study by allocating patients to intervention groups that needed additional numbers. Random number tables were used to assign patients to blocks, before they were recruited.

3.2.2.2 Follow-up

Patients were contacted by telephone one and six months after their operation for a home follow-up visit which was usually conducted by the research nurse. Sometimes it was necessary to see patients in hospital if they had been re-admitted for a second joint replacement, complications from the recent joint replacement or other medical reasons.

3.2.3 Blood sampling, anaesthesia and surgery

3.2.3.1 Blood sample collection

The biochemical response to surgical trauma consists of a hormonal and inflammatory response. Both of these responses were measured. Adrenaline, noradrenaline and cortisol; hormones involved in the physiological stress response were measured preoperatively and postoperatively. Cerial reactive protein and interleukin-6 were measured as markers of the inflammatory response. Also, glucose was measured as an index of metabolic function, and a full blood count measured general health. All these measures, apart from the full blood count were measured periodically during and after surgery to analyse the pattern of the physiological stress response (refer to Table 3.2 for exact times and days of measurement). All biochemical samples were stored at -70 degrees centigrade in the RLUH and Broadgreen hospital biochemistry departments before being analysed in large batches periodically throughout the study.

The majority of blood samples were taken by a senior anaesthetist and a research nurse. Several other anaesthetists at Broadgreen hospital and RLUH also took blood samples from patients. Senior house officers, anaesthetists or phlebotomists took samples in their absence. Preoperatively baseline blood samples were taken from all patients after they had consented to take part in the study. Subsequent samples were taken postoperatively as close to 09.00 hours as possible. The usual site for blood extraction was from a vein in a forearm. Where this was not possible due to absence of a suitable vein, a hand vein was used. On the day of surgery because of the use of a tourniquet for TKA, patients' sampling times varied (see Table 3.2). A sample was taken either at one hour after incision (THA) or immediately before tourniquet release (TKA), whichever was sooner. In TKA an additional sample was taken 30 minutes after release of the tourniquet to assess for any effect on blood assay results which may have been caused by the tourniquet. (See Table 3.2, for details of blood samples taken). During surgery a cannula was inserted into patients' arms or hands to assist with taking blood samples during the first 24 hours after the start of surgery. A second intravenous cannula was sited to facilitate blood sampling in the early postoperative period, when samples were by direct venepuncture at 0900 Hours.

Various types of tubes were used to collect blood samples so that particular analyses could be carried out. A fluoride tube was used to collect blood used for glucose analysis, a lithium heparin tube for CRP and catecholamine analysis, and a plain serum bottle for cortisol and interleukin-6 analysis.[1] Each tube was filled to include at least 10ml of blood, apart from the glucose tube which required 2ml of blood for analysis. Catecholamine samples were always transported on ice, and aliquots of plasma and serum were separated from glucose, catecholamine, CRP, I-mg and IL-6 blood samples within 30 minutes of collection. This was done by centrifugation. Lymphocyte and white blood cell samples were collected in a EDTA anticoagulant tube.

[1] Specific collecting tubes were used on the advise of Professor Alan Shenkin in the Department of Clinical Biochemistry, RLUH.

Table 3. 2 Blood sampling times and assays analysed.

Sample number	Timing	What was assayed
PREOPERATIVE		
1	Admission - immediately after informed consent	glucose, catecholamines, cortisol, CRP, IL-6, full blood count (FBC)
DAY OF SURGERY		
2	Hip - 1 hour knee - 1 hour or immediately before tourniquet release	glucose, catecholamines, cortisol, CRP, IL-6
3	hip 2 hour	ditto
	knee 30 minutes after tourniquet release	ditto
4	4 hour	ditto
5	8 hour	ditto
6	12 hour	ditto
POSTOPERATIVE		
7	Day 1	glucose, catecholamines, cortisol, proteins (CRP, α-mg), IL-6
8	Day 2	cortisol, CRP, IL-6
9	Day 3	ditto
10	Day 4	ditto
11	Day 5	ditto
12	Day 6	ditto
13	Day 7	glucose, cortisol, IL-6, CRP

Monitoring commenced before induction of anaesthesia and included continuous electrocardiography, non-invasive arterial blood pressure, pulse oximetry and capnometry/capnography. Anaesthesia was induced in most cases with thiopentone; otherwise propofol was used. In 2 cases (id 7 and id 101), etomidate was used. Muscle relaxation was provided by atracurium, and anaesthesia was maintained with nitrous oxide (66%) in oxygen, supplemented with isoflurane. Enflurane was sometimes used instead of isoflurane. Intraoperative analgesia was provided by intravenous morphine (2.5-28mg) and occasionally with intravenous fentanyl (50-250mcg).

No patient received a local anaesthetic nerve block, in order to avoid any obtunding effect this might have upon the stress response. Postoperative analgesia was usually provided by morphine administered via a patient controlled analgesia device (PCA) within the following parameters: 1 mg bolus, 5 minute lockout, no background infusion. This was continued for 1-2 days postoperatively, and was discontinued at the discretion of the nursing staff. In some cases intermittent intramuscular injection of morphine was used. This happened when a PCA was not available for use, or when a patient was not capable of administering their own pain relief after surgery because of a confused mental state or physical disability.

Intravenous fluids were administered peri-operatively. During surgery sodium chloride (0.9%) was given at a rate of 6 ml/kg/hour. Minor blood loss was replaced with twice the estimated volume of sodium chloride (0.9%); more major blood loss was replaced with blood at the discretion of the anaesthetist. Postoperative fluid therapy was with sodium chloride (0.9%) 2 ml/kg/hour, and blood was transfused as necessary.

The surgical and anaesthetic teams, along with operating theatre staff, were blind to the psychological treatment patients received. The senior anaesthetist and research nurse recorded information from the patients' anaesthetic chart. This included: the type of prosthesis, the time of starting surgery and the duration of the operation, whether or not a tourniquet was used, and (if used) the duration of tourniquet inflation, intravenous fluid therapy in theatre, vital signs (maximum and minimum blood pressure and heart rate), the total dose of opiates given, whether or not patient controlled analgesia was used, and total dose of postoperative opiate (morphine, pethidine). Analgesic drug use on days 1-5 postoperatively was recorded and included the daily dose of specific drugs.

During follow up of patients the use of sedative drugs was recorded according to the following categories: none, occasionally, on a nightly basis. This was recorded at the one and six month follow-up visits, together with the daily dose of analgesic drugs by asking patients about their medication consumption. Recovery variables included pyrexia and complications; these were recorded on days 1-7 postoperatively. Fatalities were also recorded.

3.2.3.2 Biochemical analysis of blood samples

The detection limit is the lowest concentration of chemical that can be measured. The co-efficient of variation (CV) is the standard deviation divided by the mean. The CV expresses the variability of a method. For IL-6 analysis, a sandwich enzyme immunoassay technique was used (Quantikine Immunoassay Kit, R & D systems, UK). For detection, a monoclonal IL-6 capture antibody and an enzyme-linked polyclonal IL-6 antibody (CV at 17pg/ml:63%: CV at 101pg/ml:3.3%, detection limit 0.7pg/ml). Catecholamines were analysed by an 'in-house' method. Following clean-up and concentration on Alumina, and separation by HPLC, the catecholamines were quantified by electrochemical detection. CRP was analysed by immunoturidmetric method. (Tina-quant Boehringer-Mannheim, CV at 420nmol/l:7.2%; detection limit 5nmol/l). Glucose was analysed by a method which involved glucose oxidase and peroxidase. The hydrogen peroxidase produced from glucose, reacted with 4-aminophenazine to form a chromogen, the absorbance of which is proportional to glucose concentration (CV at 3.0mmol/l:20%, CV at 15.5mmol/1:1.9%, detection limit 0.11 mmol/l). White cell and lymphocyte count were measured by standard full blood count analysis in the RLUH hospital haematology department ($x10^9$ per litre).

3.2.4 Psychological questionnaires

3.2.4.1 Administration

Immediately after blood samples had been taken, patients in all treatment groups completed a batch of questionnaires before having the intervention. As the majority of admission blood samples were taken in the morning, the majority of baseline questionnaires were completed between 9 a.m. and midday. Patients were given questionnaires to complete by themselves, apart from when a patient specifically asked for help to fill in the questionnaire, or when it was apparent that patients needed help with filling out questionnaires. These were collected immediately after completion or at a later time, depending on patient access.

Baseline questionnaires measured subjective bodily state, mood, physical functioning and quality of life (QoL). Apart from quality of life and health belief questionnaires, most questionnaires were repeated at specific times during patients' stay in hospital. Initially, patients were asked to fill out bodily state questionnaires on day 2 but because of lack of response due to sickness this procedure was terminated early on in the study. See Table 3.3 for specific days patients completed questionnaires.

Table 3. 3 Questionnaire administration times in hospital and at follow-up

	Day questionnaire administered					
Questionnaire	**pre-op**	**day 1**	**day 3**	**day 7**	**1 month**	**6 month**
Bodily state						
Recovery Inventory (RI)	✓	✓	✓	✓	✓	✓
VAS	✓	✓	✓	✓	✓	✓
Fatigue scale (phys. and men.)						
Mood						
POMS	✓		✓	✓	✓	✓
Quality of Life						
SF-36	✓				✓	✓
Mental Health Inventory	✓				✓	✓
Face scale	✓		✓	✓	✓	✓
Cantril's ladder	✓		✓	✓	✓	✓
Physical function						
WOMAC	✓				✓	✓
Fatigue scale	✓				✓	✓
Physiotherapy questionnaire *	Completed postoperatively during patients' stay in hospital					
Health belief						
Locus Of Control	✓				✓	✓
Health Opinion Survey	✓				✓	✓
Coping						
Ways Of Coping				✓	✓	
Other						
manipulation check				✓		

Fatigue scale (phys. and men.) - physical and mental fatigue; POMS-Profile of Mood states.

SF-36 - Short from health Survey; WOMAC-Western Ontario McMaster Universities Osteoarthritis Index. * see chapter 4.

3.2.4.2 Details of questionnaires

Questionnaires were chosen to measure bodily state, mood, quality of life, and physical functioning. The SF-36 Quality of life questionnaire, however, contains all these dimensions. All questionnaires were rated by patients. Documented below are details of questionnaires used. Times at which specific questionnaires were used, and ranges of score and response scales for these questionnaires can be found respectively in Table's 3.3 and 3.4.

Questionnaires chosen for use in this investigation have all, apart from one, been extensively validated, and were appropriate for measuring psychological, social and functional dimensions of recovery from surgery. Many have been widely used in research which assesses recovery from surgery.

The questionnaire used in this investigation which has not been extensively validated was created specifically to monitor immediate functional recovery after surgery. Up to date, there are no extant instruments for measuring this. In order to assess the impact of early functional status on later functional status as well as other dimensions of recovery, it was necessary to create a measure that would allow the relationship of these to be assessed; this was named the Physiotherapy scale.

Bodily state. These questionnaires were completed once preoperatively and postoperatively on day 1,3,7 and 1 and 6 month follow-up. A visual analogue scale (VAS) consisting of three sub-scales, measured intensity of pain, distress experienced as a result of that pain and ability to cope with the pain (Manyande et al., 1992; Guilford, 1954). Each sub-scale was presented as a visual analogue line. Patients marked on the line their degree of pain, distress and ability to cope. Higher scores indicated greater pain intensity, distress and inability to cope with pain. The Recovery Inventory (RI-Wolfer & Davis, 1970) records information that is routinely noted by nursing or hospital staff that look after patients. Patients recorded their subjective experience of sleep, appetite, strength and energy, bowel condition, ability to do things for themselves, ability to get out of bed and move around, and interest in what is going on around them. Higher scores showed a better state. The fatigue scale (Chalder et al., 1993) measured physical and mental fatigue symptom severity.

Higher scores indicated greater mental and physical fatigue. The last two items on the fatigue scale, which asked patients to make comments on their physical and mental state, were omitted from data analysis, leaving sixteen items for analysis.

Mood. The Profile of Moods States (POMS- MacNair at al., 1971) measures mood on seven sub-scales (refer to Table 5.4). Patients rated whether or not they were feeling the emotions listed 'at the present moment'; scores range from 0 - 4. Higher scores indicated greater intensity of mood. The Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983) comprised two scales: anxiety and depression. Higher scores on both scales indicate greater intensity of anxiety or depression. As immediate factors are known to influence the mood of patients, questions were phrased as trait as opposed to state questions. Here patients would be asked to rate their mood etc. over the past week, or the past month instead of for the day.

Quality of life. Quality of life questionnaires were essential for monitoring subjective wellbeing and other aspects of physical and psychosocial recovery. They were also considered a definitive outcome measure for surgical procedures which entailed a lengthy recovery period. The Face Scale (Andrews & Withey, 1976) is a pictorial scale and consists of seven stylised faces drawn from right to left to represent a continuum of a very happy person or a very sad/miserable person. Faces are rated 1-7, from left to right. Patients are asked to rate which face comes closest to expressing how they feel about life. Cantril's Life Satisfaction Ladder (Cantril, 1965) is a pictorial scale; it shows a ladder with several rungs. Patients were asked to mark what feelings they had about their present life and allocate them to a rung on the ladder (Andrews & Withey, 1976). Higher scores indicate a better subjective Quality of life. Face and ladder scales were completed pre and postoperatively. The Short-Form Health Survey (SF-36 Ware et al., 1994) questionnaire is a measure of global health and has eight domains. Each sub-scale of the SF-36 is scored separately. The SF-36 comprises the following subscales: physical functioning; physical role limitation, mental role limitation, social function, mental health, energy, pain and health perception. The Mental Health Inventory (MHI; Ware et al., 1979) measures psychological distress and well-being in four domains: anxiety; depression; behavioural/ emotional control and general positive effect. It was decided that the general positive effect scale was to be used for this study as negative emotions were adequately measured by the POMS. For each one of the eleven questions in the positive affect scale there are six options in the response scale. Higher scores on all questionnaires indicate a better quality of life.

<u>Physical Functioning.</u> Western Ontario McMaster Universities Osteoarthritis Index (WOWAC; Bellamy et al., 1988) has three major scales which probe the clinically important symptoms of pain, stiffness and physical function. The scale was validated using patients undergoing total joint arthroplasty for osteorarthritis (0A) of the hip/knee, and hence was seen as appropriate for this study which used THA and TKA as surgical models. Pain and physical function scales (apart from one item) were significantly responsive at six weeks postoperatively. The stiffness scale obtained significant responsiveness at six months postoperatively. Patients were specifically asked to rate degree of functional difficulty, pain and stiffness with reference to the operated joint and not other existing conditions.

The WOMAC scale was not designed to provide information on the process of rehabilitation after THA and TKA. At present there is no assessment procedure for systematically recording patients' progress in hospital, therefore the Physiotherapy scale was designed specifically for this study in order to measure this. Since physiotherapists are the main people concerned with evaluating this progress, the scale was devised in conjunction with them to systematise the observations that they were making unsystematically. The scale that was developed documents patients' functional progress (subjective and objective) throughout their hospital stay. It documents functional outcome in terms of the number of days postoperatively that it takes for a patient to achieve specific functional milestones. In addition, physiotherapists rated pain and motivation experienced by patients during mobilisation, the first and last time that they came into contact with them (Refer to Chapter 4 for a detailed account of the development and implementation of this tool).

Health beliefs and coping. The ways of coping questionnaire, locus of control and health opinion survey were needed in order to evaluate psychological processes which, as discussed in chapter 1, may influence outcome from surgery or how patients respond to interventions. The Health Opinion Survey (HOS - Krantz et al., 1980) has two subscales: informational and behavioural. The 'information' scale assesses the desire to ask questions and to be informed about medical decisions. The 'behavioural involvement' scale assesses desire for self-treatment and active behavioural involvement. The Health Locus of Control Scale (HLC) measures patients' perceived source of health-related behaviours (Lau & Ware, 1981). Subscales of the HLC are: provider control (8 items); self-care (8 items); health-threat (5 items) and chance (6 items). The original scale devised by Lau and Ware comprised 27 items. For the purposes of this investigation the scale was reduced to 20 items (see below) to reduce the burden on patients. All 4 sub-scales were represented in the modified form of the questionnaire used for this investigation (Refer to Table 3.4 for an account of the number of items in each subscale and Appendix C for the questionnaire used).

The method of shortening the questionnaire was that used in a previous study (Salmon, Woloshynowych & Valori, unpublished manuscript). The principal components analysis reported by Lau and Ware (1981) was used to identify those items which were most indicative of the subscales. All items with loadings of .40 or more were retained, leaving a total of 20 items. Scoring was on a scale of 1 to 7, from 'Strongly Disagree' to 'Strongly Agree'. Scoring of negatively scored items was reversed before scores were summed for each subscale.

Coping. The Ways of Coping questionnaire (Folkman & Lazarus, 1988) has 8 sub-scales. For the purposes of this study the following six sub-scales were used: seeking social support; focusing on the positive; detachment; problem-focused coping; wishful thinking; to indicate which strategies people were using to deal with the event of surgery. Self -blame; tension-reduction and keep to self scales were not used. See Table 3.4 for range of scores for all the above questionnaires.

A manipulation check designed for this study, asked patients for their feelings on the following: 1) how relaxed they had been during their stay in hospital 2) how much control they had over their recovery 3) how helpful the researcher was. Patients rated each item from 0-4. (refer to Appendix 3.2). Respective responses for each item were as follows: 1) 0 = 'not at all', 1= 'a little', 2 = 'quite a lot', 3 = 'very much'; 2) 0 = 'none', 1= 'a little', 2 = 'quite a lot', 3 = very much; 3) 0 = 'quite helpful', 1 = 'very helpful', 2 = 'neither unhelpful or helpful', 3 = 'very unhelpful', 4 = 'quite unhelpful'.

Table 3. 4 Range of scores for questionnaires used

Questionnaires (no. of items for various sub-scales is placed in parenthesis)	**Min. score**	**Max. score**	**Response gradient for individual items**
BODILY STATE			
VAS -Intensity, distress, coping	0 0 0	100 100 100	1 = no pain/no distress/not coping at all 100 = the most pain imaginable/ the most distress imaginable/ ability to cope completely
Health Inventory	8	48	1= very poor 6 = excellent
Fatigue (mental (8) and physical (8))	16	64	1 = less than usual to 4 = more than usual
MOOD			
Profile Of Mood State - total mood	0	250	
tension-anxiety (9)	0	36	1= not at all 2 = a little 3 = moderately 4 = extremely
depression-dejection (15)	0	60	Ditto
anger-hostility (8)	0	32	Ditto
vigour (8)	0	32	Ditto
fatigue (7)	0	28	Ditto
friendliness (7)	0	28	Ditto
confusion (7)	0	28	Ditto
QUALITY OF LIFE			
SF-36 Total score (not in results)	0	100	Higher score indicating a better Quality of life
General Health Perceptions (5)	2	25	1= excellent to 5 = poor
Physical functioning (10)	10	30	1 = yes limited a lot 3 = no not limited at all
Mental Health (5)	5	30	1 = poor mental heath 6= good mental health
Mental Role Limitation (3)	0	3	1 = all of the time to 5 = none of the time
Physical Role Limitation (4)	0	4	1 = yes limited a lot 3 = no, not limited at all
Bodily Pain (2)	2	11	1= not at all/ none 5 = extremely/very severe
Energy tiredness (4)	4	36	1= all of the time to 6 = none of the time
Social functioning (2)	2	11	1 = not at all to 5 = extremely
MHI (Positive Affect)	1	66	1-6 higher scores inferring more positive mental health
Cantril	1	9	1-9 - higher number shows a better quality of life
Face	1	7	1-7 - higher number shows a better quality of life
PHYSICAL FUNCTIONING			
WOMAC			
Function (18)	0	62	0= not at all to 5 = extremely difficult
Pain (5)	0	20	0 = not painful at all to 5 = extremely painful
Stiffness (2)	0	8	0 = not stiff at all to 5 = extremely stiff
HEALTH BELIEF			
Health Locus of control (HLC)			
Provider (6)	1	42	1= strongly disagree to 7 = strongly agree
Self (4)	1	28	Ditto
Threat (4)	1	28	Ditto
Chance (6)	1	21	Ditto
Health Opinion Survey (HOS)			
Informational (7)	0	7	0 = no 1= yes
Behavioural (9)	0	9	0 = no 1= yes
COPING			
Ways of Coping (WOC)			0 = does not apply 1 = used somewhat 2 = used quite a bit 3= used a great deal
Problem-focused (11)	0	33	
Wishful thinking (5)	0	15	
Detachment (6)	0	18	
Seeking Social Support (4)	0	12	
Focusing on the positive (4)	0	12	

3.2.5 Statistical analysis

Statistical programmes used for data analysis were Genstat 5 (Rothampstead, 1995) and SPSS for windows, 6.1.2 release, 1995. Genstat was used to calculate all Analysis of Variance (ANOVA) results, and was preferable to SPSS because of its facility to interpolate missing data. Interpolation of missing data was important in this investigation, as a repeated measures design was used. SPSS would have resulted in statistical analysis of a smaller sample number.

Skewed distributions for biochemical and psychological variables were transformed ($\log_{10} + 1$) where necessary in order to normalise distributions and homogenise variances. All biochemical indices, except white cell and lymphocyte counts were transformed. Psychological indices overall were normally distributed. However, data were transformed for SF-36 role limitation scales (mental and physical), and for Profile of Mood States depression and anger sub-scales. For the SF-36 scales transformed, old values at 0 remained the same, and those between 1 and 100 were recoded as 1. For the anger and depression sub-scales of the POMS, old values between 0-2 were recoded as 0, and those greater than 2 were recoded as 1.

In analysis of variance (see below) between subject factors analysed are the independently manipulated variable, intervention group (control, Passive or active/imagery), along with type of surgery (hip or knee), gender (male or female) and hospital (RLUH or Broadgreen). Intervention group is central to the design of the study; type of surgery was considered important because of the possibly different psychological and physiological response to surgery; gender and environment have been considered important demographic variables in the stress response.

One-way simple factorial ANOVAs assessed preoperative differences for each of the between subject factors at admission for all variables measured. Where measures were repeated postoperatively, they were analysed by two-way ANOVAs which examined *main effects* of each of the between subject factors (type of surgery (J), gender (G), hospital (H), intervention group (G), *change over time* and *interactions with time*. Separate analyses were performed for each between-subject factor. Where effects were significant, post-hoc t-tests were performed on mean scores as necessary to ascertain where differences lay. Where data were missing, degrees of freedom were adjusted.

Pearson product moment correlations were used to assess the relationship between physiological, functional and psychological dimensions of recovery. In order to maximise the reduction of significant 'spurious' correlations due to pathology and physiological stress response differences between the surgical groups, osteoarthritis patients who had a total hip replacement were chosen for analyses.

A series of correlations assessed the relationship of putative predictor variables with outcome variables. Firstly, the relationship of psychological state and coping strategies with the hormonal and inflammatory response was assessed. In order to limit calculations, and reduce risk of Type 1 errors, only peak hormone and inflammatory concentrations, together with the value before and value after this, were correlated with coping behaviours. (This strategy also applied for other correlations using biochemical measures). These correlations showed the extent to which the physiological response to surgery may be influenced by different coping styles.

The second and third series of correlations were performed to test the hypothesis that a raised neuroendocrine and inflammatory response would be detrimental to recovery, both psychological and functionally. The second set of Pearson product moment correlations assessed the relationship of predictor hormonal and inflammatory variables with short and long-term psychological recovery. Indices of psychological recovery used were mood (tension and positive affect), pain intensity and fatigue. The third set of Pearson product moment correlations assessed the relationship of predictor hormonal and inflammatory variables with functional and psychological recovery. Within this, the relationship of hormonal and inflammatory response variables with time to reach immediate functional milestones, pain experienced and motivation was analysed. Also, the relationship of the hormonal and inflammatory response with short and long term functional recovery was analysed by correlating the former with WOMAC - pain, function and stiffness outcome.

Fourthly, the relationship of preoperative psychological adjustment with postoperative psychological adjustment was assessed. This was performed to test the theory which claims that a negative emotional state preoperatively has a negative effect for psychological adjustment after surgery. As anxiety and tension are clinically uncomfortable states the existence of these preoperatively, along with other negative mood indices (confusion, depression, fatigue, reduced friendliness and positive affect), the relationship of these with postoperative tension and anxiety were assessed.

Fifthly, the relationship of preoperative psychological and functional state with postoperative emotional and functional state was assessed. In particular, preoperative predictor variables of emotional state, fatigue and physical function were correlated with immediate functional milestone progress, and long-term functional recovery, as measured by the WOMAC pain, function and stiffness sub-scales. These correlations were performed to provide innovative results in two areas. It was important to measure the relationship of what was believed to represent a 'definitive index' of immediate functional recovery with preoperative psychological variables which were suspected to be influential in functional recovery. Also, it was important to assess the influence of early postoperative functional progress on later functional progress after discharge from hospital. Patients' responses to the ways of coping checklist sub-scales were correlated with postoperative psychological state after one week in hospital. Coping strategies, although measured retrospectively on day 7 for the postoperative week, were classed as predictor variables. This was to assess if a dynamic psychological constructs such as coping, can affect psychological outcome measures in surgery.

3.2.5.1 Qualitative and quantitative subsidiary analysis

Qualitative methods were used to interpret patients' responses to psychological interventions, which have implications for the broader hypothesis of this thesis. Also, immediate functional recovery from surgery was analysed according to specific aims which arose out of the development of a tool developed to monitor such recovery. Refer to chapters 4 and 5 for an account of the aims, analysis and results of these subsidiary investigations.

3.3 Development and implementation of psychological interventions

3.3.1 Rationale for psychological interventions

As outlined in chapter 1, of all interventions used, relaxation and guided imagery techniques have proved to be most beneficial in fostering a faster recovery from surgery. Although these interventions are fundamentally different with guided imagery usually encouraging a more involved and active approach to treatment and recovery, and relaxation usually a more passive approach, both have been shown to have several therapeutic benefits (see chapter 1). Cognitive coping interventions that have encouraged patients to be more involved in their health care usually entail one to one or group interaction with patients; such interventions have consistently shown positive effects on recovery (see chapter 1). Also, the use of tapes has been extremely effective in interventions.

3.3.1.1 Involvement in health care and treatment

Williamson (1992) suggests three possible ways for shifting control to patients. They can be given direct control over some of their treatment (e.g. patient controlled analgesia - PCA); provided with some way of exercising control over the staffs' work (for example, remaining conscious during operations or be given regional instead of general anesthetic), have access to health and computer records, or quite simply ask for what they feel they need or want. It can be suggested that popular literature on total hip and knee replacement (Phillps, 1992) is also produced with the intention of 'empowering' the patient and making them feel more in control about their pending surgery.

In this investigation, patients in the active intervention group were encouraged to be more involved with their treatment through the encouragement of choice, promotion of a sense of control, establishing realistic goals, and the use of control-enhancing communication skills. It is argued that these techniques can enhance patients' sense of control (Teitleman & Priddy, 1988). This investigation attempted to manipulate patients' perceptions of control over hospital procedures, the amount of information they could obtain, and personal recovery during their stay in hospital, and after discharge. In particular, the active intervention in this investigation attempted to increase involvement and active coping in patients by: encouraging them to seek information about their treatment and care; providing a one-to-one interaction with a researcher where they were given rational for preparing realistically for their surgery and recovery, and were they were given the opportunity to voice any concerns or worries. Patients were given a tape to assist with mental preparation for surgery, which included procedural and sensory imagery about their recovery which included engaging the individual in postoperative rehabilitation exercises through imagery; these are major feature in recovery from joint arthroplasty (Rogers & Reich, 1986).

3.3.1.2 Passivity in health care and treatment

Although patients today may be regarded as consumers of their health care, it likely that clinical paternalism and lack of patient knowledge severely restrict patients ability to take control of their health care, thus reinforcing a passive role for them. Passivity amongst patients can also be encouraged by the use of specific techniques such as relaxation (in the western world) and meditation and yoga (in the eastern world). These techniques can reduce physiological arousal, oxygen consumption, heart-rate and blood pressure. Recent research with practitioners of such techniques has established that there are three dimensions to these strategies which include: reduced tension and anxiety, passive engagement and passive disengagement (Smith et al., 1996).

3.3.2 Designing the interventions

There were two parts to each intervention. Firstly a 1:1 interview was conducted, in private, by the researcher with the patient as soon as possible after they were admitted to hospital. All interviews took place one or two days before surgery. Dialogue was recorded on audiotape for 38 patients out of 108 patients who received an intervention. At the end of the interview patients were given a tape (see appendix

F) to assist them with this. Patients were asked to listen to them at least three times before their surgery. If it was possible to communicate with patients after surgery they were seen on day 3 and day 7 postoperatively. If it was not possible to communicate with patients as a result of sickness or severe medical complications on day 3 and day 7, they were seen the next day. (Refer to Chapter 5 and Table 3.1) Interventions lasted between 40-60 minutes, and patients were encouraged to interact with the interviewer.

The design of the interventions used in this investigation were influenced by the design of interventions used by Manyande et al. (1992 & 1995), as our aim was to create similar interventions seen in those studies to influence the physiological response. In this investigation the passive intervention used a relaxation technique and was intended to encourage passive coping, while the active intervention used guided imagery and was intended to encourage active coping. Principle components of the passive and active interventions are tabulated below (Table 3.5).

Table 3. 5 Principle components of each intervention

Active Intervention	Passive Intervention
Ask questions wherever possible	Do not ask questions
Make sure staff know your individual needs	Fit into the hospital routine
Do as much as possible for yourself	Let others look after you
Be as involved as possible with your treatment	Trust and rely on them to make decisions
Make plans and set targets	Don't think about the future
Prepare mentally for what is going to happen and let the researcher and staff know your worries and concerns	Don't worry about what is going to happen

3.3.2.1 Passive group

This intervention took place with patients as soon as possible after admission to hospital, and was designed to discourage active coping. At the beginning of the interview, patients were told that they would not have had much choice in the amount of time they have had to wait to come into hospital for their surgery, and that this would be the case even now they had been admitted to hospital. The researcher commented that this was unfortunate but that there was no other way of organising everything. The high probability of more waiting and unpredictability over the next couple of weeks was highlighted. The general message to patients was that they needed to accept what happened to them whilst they are in hospital, not to question the rules and behaviour of the hospital, and to be as co-operative as possible. Patients were informed of the value of accepting their inability to influence treatment and management. Patients in the passive group were told that it was very difficult for them to be in control of anything whilst in hospital, and were given examples of situations in which they had little control. (see below) Postoperatively, interventions were reinforced verbally with patients on day 3 and 7.

The following points were outlined to patients:

1) Not to ask questions. Patients were told that it was better not to ask questions about procedures. They were warned that doing so would cause them stress and make it difficult for them to be as relaxed as possible, which would not help them to have a good recovery. It was suggested that asking questions would not help them to relax which was important for recovery.

2) To accept the situation they are in. Patients were asked to accept what staff, unprompted, told them, and told that all the information they needed would be given to them. They were asked to let the experts make decisions for them; to let staff take care of all their needs. Patients were informed that the more they accepted the situation, the more relaxed they would be.

3) Trained experts are the best judge of patients' needs. Patients were told that staff would look after their different needs and that they knew what was best for them. Patients were told to trust staff and let them make decisions for them. It was emphasised that staff knew much more than anyone else, for example, patients were asked if they had experienced pain, and if they said yes, they were told that the nurses knew the best ways of dealing with this, and it was best to leave it completely up to them.

4) <u>They will have patient controlled analgesia (PCA).</u> Patients were informed that this would help control their pain for them; and that they should press the button if they had pain and then leave it to the PCA machine to deal with their pain. Patients were told that the PCA assigned to them would be taken away after a day or so, with nurses attending to their pain relief after this.

5) <u>Taking each day as it comes and not anticipating the future.</u> Patients were told that it would not be helpful for them to worry about future events as this may cause unnecessary stress, which would not promote a smooth recovery. They were told that there was no point in worrying problems until they happened.

<u>Day 3 postoperatively:</u>

Previous messages were reinforced to patients, for example, that nurses would take care of patient's pain relief and make decisions for them about there hospital care. Patients were asked to continue to follow advice and instructions. Patients were informed that they did not need to worry about anything, as staff would do this for them, and that the best thing they could do to help their recovery was to keep relaxed.

Day 7 postoperatively

Patients were praised for their achievements. Patients were informed that they would be given a discharge date and that the best thing to do on when they arrived home would be to relax and let time take its place in the process of recovery. Patients were told to follow the useful advice that they have been given, and were reassured that any help it was felt they required, would be arranged for them. Patients were informed that a research nurse would call them and arrange a visit to assess their progress. Again the fact that there was no need to ask any questions as everything has been taken care of for them was referred to. Refer to Appendix 3.1 -3.4 for an outline of intervention interviews and tape recorded messages.

3.3.2.2 Active group

This intervention was intended to encourage the use of active coping and the exercise of choice and control by the patient. At the beginning of the interview patients were reminded of their lack of choice in the amount of time they had to wait to come into hospital for their surgery. They were told that it would be different now they have entered hospital and that over the next couple of weeks they could expect to have more control and responsibility than they think. The general message to patients was that they needed to be as involved as possible and to see themselves as in charge and in control during their stay in hospital. In the interview patients in the active group were encouraged to take control in hospital and were given a number of suggestions on how to do this.

The following points were outlined to patients:

1) Positive reasons for being involved with treatment

Patients were told they would recover faster if they were more involved with their treatment, and were asked what being involved meant to them.

2) Ways to be involved with their treatment:

a) Asking questions. Patients were told that they would be recognised as an individual by the staff, and that staff expected and encouraged patients to ask questions. Patients were told that if they wanted help they would be expected to ask for it, because they were the expert on their needs. It was suggested to patients that they made sure they informed staff of their needs.

b) Making decisions. Patients were told that they needed to make decisions whilst in hospital. For example, they were asked if they had been in pain, and if they said yes, were told that the staff could help with this; they could offer them pain killers but they had to decide whether or not to accept them, and to decide on the amounts taken over a period of time.

c) Being independent. Patients were told that they could check any aspect of their treatment. If they wanted to know about something, for example, a result of a test, it was emphasised that it was acceptable for them to check this by asking a member of staff. They were told not to wait to be told.

d) Being directly involvement with their treatment. Patients were asked if they knew about patient controlled analgesia (PCA). If they answered yes, they were asked to explain what they knew, and if they said no they were informed about it. It was emphasised that PCA is a machine offered to patients, which allows them to have direct control over their pain relief treatment; and that the machine relies on the decision being made by the them, to administer their own pain medication. Patients were informed that the PCA would be removed after a day or so, and that they would need to decide whether or not to accept pain medication when it was offered to them by nurses.

e) Preparing and rehearsing for the future. Firstly, the association between relaxation and mental preparation was outlined, and the importance of relaxation for rehearsal and preparation was emphasised. The power of '*mind over matter*' was stressed. The beneficial effects of preparation and rehearsal on subsequent performance was explained, with patients being informed that research had shown how imagining and preparing for future events related to their surgery and recovery (immediate and short term), enabled them to deal with them better on waking after their operation. Patients were asked to imagine what they would feel like before and after their surgery. They were given suggestions, for example, about how hungry and thirsty they may feel beforehand, and how painful and uncomfortable they may feel afterwards.

5) Patient's role in rehabilitation. Patients were told that they would be helped initially to walk but soon after would be encouraged, and expected, to do as much as possible by themselves. Physiotherapy was used as an example to indicate that the real value of the exercise was when patients practised it by themselves. The relationship between exercise, improvement of the circulation and building up of muscle strength was emphasised.

Day 3 postoperatively

Patients were asked how they felt, and given positive feedback about their operation success. Previous messages were reinforced. If patients had been seen by a physiotherapist they were asked how they found the exercises. It was reinforced that patients could use the exercises to help circulation and patients were encouraged to work on the exercises. Patients were asked if they had any questions for a particular person or questions in general, and if they had any concerns or worries. If they did they were told to ask questions to appropriate members of staff. Patients were again reminded that they had a crucial role to play in their recovery. Patients' control of their analgesia and other needs was stressed. Lastly patients were asked to identify targets they wanted to achieve over the following week.

Day 7 or 8 postoperatively

Patients were asked how they had found the exercises over the past few days. Previous points were re-emphasised and patients were prompted to think about the future. They were asked if they had been given a discharge date and asked to describe what they expected to be doing in 1 months time, and then, 6 months time. They were asked about their experience in hospital, and to what extent they felt they had been involved in their treatment. They were informed that they could write to the director of the hospital to tell him or her about any thoughts on this, both good and bad. Patients were advised to keep to the goals and targets that they had set and reminded of their ability to contribute to a successful recovery. Patients were informed that the research nurse (who they had met) would contact them to arrange a follow up visit to assess their progress.

3.3.2.3 Tapes

3.3.2.3.1 Passive group

The mental relaxation tape exercise was used for patients in the passive intervention group. This relaxation exercise is based on Benson's stress reduction technique (Benson, 1975) which specifically involves focusing on improving the efficiency of breathing, and being mentally aware of tension in the body and 'letting it go'.

The relaxation tape (given to patients in the passive intervention group) comprised 16 minutes of mental exercises which concentrated on calm breathing and keeping the whole body relaxed. Patients were asked to concentrate on the breathing and sensations in various parts of their body starting with the hands and progressing to the arms (lower and upper), the shoulders, the head and face, the back, the feet and legs, and then the whole body. They were told to attend to sensations in each part of the body in turn i.e. the temperature and tingling sensations, and to let go of any tension in that area and feel how relaxed it was (refer to Appendix G). A relaxation tape was left with the patient, who was asked to listen to it at least three times before their surgery. They were also told to listen to the same tape after surgery.

3.3.2.3.2 Active group

A condensed version of relaxation exercises, combined with guided imagery of events surrounding surgery was given to patients in the active group. Imagery was compiled from the comments of hospital staff familiar with THA and TKA, and patients who had experienced joint arthroplasty. The imagery tape referred to sensations immediately prior to and after surgery for instance, feelings of hunger, which were followed by step by step rehabilitation exercises in conjunction with sensory experiences which may result from carrying these out. Patients were encouraged to visualise themselves as they recovered, and to and rehearse their future rehabilitation. (Refer to Appendix I). The rehabilitation imagery for THA and TKA patients differed because of the different exercises they performed after surgery. Physiotherapists were consulted to help with the construction of these exercises. Patients in the imagery intervention group listened to a different message before and after surgery, to accommodate the pre and postoperative changes they needed to be informed about. The imagery tape lasted 22 minutes. Patients in the active intervention group listened to a different message before and after surgery, to accommodate the pre and postoperative changes they needed to be informed about.

3.3.3 Recorded interventions

38 out of 41 patients who were asked provided informed consent to have the interview audiotaped recorded. More specific methodology on recorded interviews can be found in Chapter 5.

After a number of interviews it was apparent that specific patterns in what patients said were occurring. It was decided, after recruitment of patient 58, that patients in the passive and active intervention groups would be recorded during their interview, to enable what was actually being said to be analysed systematically. Although it was the aim to record as many patients as possible, this was not possible for two reasons. Firstly, recording at the beginning of the project was subject to availability of recording equipment. Secondly, the surrounding environment sometimes made recording difficult. If the interview was conducted in a private room or the hospital day room, the intervention was recorded. If the interview had to be conducted on the ward, and the ward was quiet, which was not usually the case, the intervention was also recorded.

PART 3

Chapter 4

Development of an Instrument for Assessing Postoperative Functional Recovery In Hospital

Chapter 4
Development of an Instrument for Assessing Postoperative Functional Recovery In Hospital

4.1 Introduction

One of the main aims of this thesis, explained in chapter 1, is to assess the relationship between psychological, physiological and functional dimensions of recovery. The main study needed a way of measuring immediate and intermediate functional recovery from surgery because of the largely untested assumption that physical therapy during this period is important to eventual recovery. In terms of existing functional measurements there were was no measure of immediate functional progress, at the outset of this research, which could be used to assess recovery for total hip and knee arthroplasty. Consequently, an instrument was designed to measure this. Before testing for interrelationships of immediate functional indices with later recovery, particularly those pertaining to function and quality of life, it was necessary to check the validity and sensitivity of the developed instrument to known patterns of recovery, and variations in clinical practice.

Within the existing literature on recovery from surgery, use has been made of subjective and objective indices of recovery. Subjective indices are often ambiguous; patients may appear happy and comfortable, but this may only be a reflection of their wish to be good 'cooperative' patients (Waterworth & Luker, 1990). Similarly a patient who seems to require fewer pain killers may not necessarily have less pain, but may be less forthcoming in asking for analgesia (Johnston, 1994). Such ambiguity suggests a need for different recovery measures to be monitored during the patient's stay in hospital.

The most commonly used index of recovery after major elective joint replacement is the individual's functional status at a defined time. The problem with this method of measurement and clinical assessment is that it does not provide information about the process or course of recovery. Clinically, functional assessment tends to be an ongoing, incremental, but often unsystematic process. Postoperative rehabilitation is claimed to be a very important part of the recovery process (Harris & Sledge, 1990), yet the influence of rehabilitation on this process has rarely been systematically recorded. It is striking that there has been little research which has assessed immediate and intermediate postoperative functional achievements prior to discharge on recovery.

Questionnaires and rating scales are commonly used to monitor functional recovery. The measures that are currently in use are based on potential capability for movement rather than the functional implications of this. Bellamy and Campbell (1989) in their review of rating scales used to measure outcome after total hip arthroplasty (THA) and total knee arthroplasty (TKA), described the contents of many different rating scales used. Pain and physical functioning, as indications for surgery, carried the greatest weighting on disability indices. Many of the rating scales for hip and knee arthroplasty, such as the Gade Index, Judet Index, D'Aubigne and Postal Index, Shepherd Index, Harris Index, Charnley Index and Western Ontario McMaster Universities Osteoarthritis Index (WOMAC), assess pain, movement, stability or walking. A crude index of overall functional outcome is achieved from such descriptive and numerical scales which, although important in coding gross musculoskeletal, pain and functional changes, hide measurement problems.

Although these scales have multidimensional indices (e.g. pain, physical function, joint geometry etc.), Bellamy and Campbell argued that these indices are not clearly defined. The item content for any particular index can vary immensely across different measures. There are also descriptive ambiguities on items, which may be interpreted differently by ratters, hence compromising the reliability of certain scales. It is also argued that methods for scoring, weighting and aggregation are variable and lack adequate justification (Brinker, Houston & Barrack, 1987; Bellamy et al., 1989).

Overall the majority of clinical outcome scales, like quality of life scales that measure functional ability (Laupacis et al., 1993), focus on longer term *outcome* rather than the *process* of rehabilitation (NIH Consensus, 1995). Taking the example of the Short Form Health Survey (SF-36-Ware et al., 1994), this quality of life scale provides an account of gross outcome measurements of functional recovery but cannot be used to monitor specific milestones relevant to recovery in hospital.

Most functional measures of surgical recovery, including those used in hospitals in this investigation as well as others, are not helpful in determining the process of recovery. Apart from one piece of research that has looked at the feasibility of monitoring day-to-day functional outcome in total hip arthroplasty patients, there are no extant scales that monitor day-to-day functional achievements postoperatively, and which therefore provide an ongoing index of functional achievements (Zavadek, 1995).

Such a scale may have clinical value for both staff and patients, and provide patients and staff with an outline of expected rehabilitation. A tool which measures day-today basic objective functional milestones, representing the process of recovery, along with psychological factors which may influence this process after THA and TKA, is needed in order to provide a more elaborate account of immediate and long-term recovery. The long, routine postoperative stay for elective surgery patients at both hospitals was conducive to an assessment of functional rehabilitation. Since physiotherapists are the main group of individuals involved with evaluating functional progress, the form was devised in conjunction with them to systematise their observations.

Although secondary to the main aim, it was anticipated that such incremental functional assessment may help to clarify some points which were purely speculative. These were mainly concerned with the different rehabilitation regimes employed by different surgeons based on their personal preferences and/or the time of the week at which individuals had their surgery. Variations in practice allowed for a naturalistic study of whether these factors had any influence on immediate and eventual recovery.

Firstly, speculation by staff had suggested that earlier basic functional transfers e.g. transfer from a bed to a chair, as opposed to later transfer may have an effect on future recovery. This was important because of the variation amongst surgeons' clinical preferences concerning timing of on/off chair transfer in THA patients which are not substantiated by research but based on tradition and belief, and are usually adopted by new surgeons. Some surgeons argue that sitting prior to 48 hours might be detrimental to the hip joint and might be impractical before all drains have been removed and before postoperative sickness has worn off. Others however, suggest that a longer length of time is required before transfer for the soft tissue around the joint to start to heal. These transfer times are recorded in protocols and are expected to be adhered to closely in clinical practice. Staff carrying out these routine clinical practices are expected to consult a patient's surgeon if they feel that it is not possible to work according to clinical protocol; a surgeon's approval is sought for any deviation from surgeon rehabilitation preference. It can be presumed therefore, that functional achievements co-ordinated by physiotherapists, are likely to be guided by surgeon clinical practices.

Secondly, it was also anticipated that patients who had operations earlier in the week, would have a 'headstart' over those whose operation was later in the week because of the number of days in the week left within which transfer could be initiated. As there are no physiotherapists working at the weekend to aid with transfer, it was assumed that those who had surgery towards the middle and end of the week would be likely to get out of bed later, and walk for the first time, compared to patients who had operations at the beginning of the week.

In devising an assessment tool the 4 main criteria were as follows. Firstly, it should be simple and easy to use so that patient progress could be monitored with minimal interruption to staff during their normal hospital routines. Another criterion was that all functional achievements should be defined precisely and objectively. These two aims were straightforward and necessitated simple methods by which to record information which had only been previously recorded in an unsystematic way. A third criterion was that the scale should be based on current clinical practise and assessments to improve its face validity. Hence, it should expose sources of variability that are clinically important although previously unaddressed. The tool was eventually based on the attainment of immediate and intermediate functional milestones so as to accurately reflect the outcomes of physiotherapy and investigate their influence on more long-term recovery. This leads to the fourth criterion which is that rehabilitation measured in this way should, on the usual assumption that short-term rehabilitation is important to eventual recovery, correlate with functional ability and quality of life 6 months after surgery.

The main aim of this study was to investigate whether immediate and intermediate functional outcomes, as measured by the assessment tool, are related to longer-term recovery. A secondary aim was to investigate, using this tool, whether variations in routine clinical practice according to surgeon's preferences or day of surgery influence proximal (pre-discharge) recovery and distal (post-discharge) recovery.

4.2 Methods

4.2.1 Sample

A sample of 229 patients undergoing elective total hip arthroplasty (THA) or total knee arthroplasty (TKA) patients were recruited. Patients in the trial were recruited consecutively from surgeons' waiting lists and were under the care of 13 surgical teams and 14 anaesthetic teams. 90 patients were treated at the RLUH and 139 were treated at Broadgreen Hospital.

Standard anaesthetic and surgical practice were applied according to the main study protocol for the majority of patients (refer to chapter 3 for a more detailed account of psychological, surgical, anaesthetic and biochemical methods for patients involved in the main investigation). Other patients included those also having elective knee and hip replacement at the same two hospitals, who could not be recruited to the study because of procedural reasons or because of exclusion criteria (N=71), e.g. presence of insulin-controlled diabetes, other major physical illnesses, epidural anaesthesia or steroid medication during the previous six months. Other exclusion criteria for this investigation were revisions or re-operations, inability to speak English and bilateral surgery.

Of the 229 patients recruited, 163 underwent total hip arthroplasty (THA) and 66 underwent total knee arthroplasty (THA). THA patients had a mean age of 68.5 years, 108 were female and 55 male. 157 had osteoarthritis and 6 had rheumatoid arthritis. TKA patients had a mean age of 66.7; 39 were female and 27 male. 46 had osteoarthritis and 6 rheumatoid arthritis. One patient died six weeks after surgery. All 229 patients were assessed while they were in hospital. Of these, a subsample of patients (N=160) who had consented to participate in the randomised control trial of a pre-operative psychological intervention (see Chapters 5 & 6) were seen at 6 month follow-up. None of the variables reported here was affected by psychological management (refer to chapters 5 & 6).

4.2.2 Procedure

Senior physiotherapists from the RLUH and Broadgreen teaching hospitals were consulted to help draw up a form to document patients' functional progress during their stay in hospital. A form that consisted of eight items which recorded functional milestones considered necessary for most basic activities of daily living, and four subjective ratings by the physiotherapist to assess the effect of psychological influence on physical recovery, was devised. The final instrument was completed after several meetings between psychologists and physiotherapists who discussed what should be included on the instrument (see Appendix 3). Recorded functions were walking, transferring on/off a chair, on/off a bed, on/off a toilet and up/down stairs as these represented basic functional milestones in rehabilitation after major joint surgery and depict the process of recovery. The numbers of days postoperatively to achieve functions was recorded separately for achievement with and without assistance. The number of days taken independently to walk progressively further walking distances (5, 10, 25 metres) was also recorded. Subjective factors recorded at first and last mobilisation were level of pain complained of by patients (none, a little, moderate, severe) and unwillingness to undertake physiotherapy (very unwilling with no complaints, willing with minor complaint, willing with much complaint, would only continue with much persuasion, would not continue). These behaviours were rated by physiotherapists as they assisted and watched patients doing transfers.

Physiotherapists completed forms which were carried around the wards and completed after seeing patients, or on return to physiotherapy departments. If forms were not completed for patients during their stay in hospital because of staff shortages, standard clinical notes were analysed by the senior physiotherapists, at a later date, in order to complete the objective items on the form.

To assess the relationship of variations in physiotherapy practice to recovery, surgeon transfer times and patients' operation time was recorded. The preferred chair transfer times for surgeons were recorded as either 48 hours, 4 days, 5 days, or 7 days. Patients were also split into 'early' or 'late' groups based on the day of the week they had their surgery. Patients who had surgery between Saturday and Wednesday were categorised as 'early' and those who had surgery on Thursday and Friday as 'late'. Patients whose operations were performed nearer the end of the week made it difficult for them to transfer 48 hours later. The main reason for 'late' transfer, apart from serious complications, was because of limited staff working at this time. Nurses, although able to help with initial walking, did not have such authority for chair transfer.

The subsample of patients in the randomised control trial (N=160) completed various psychological questionnaires preoperatively and 6 months postoperatively (see chapter 3) The following questionnaires were used with this subsample. The pain and visual analogue scale measured intensity of pain and distress caused by pain (Manyande et al. 1992; Guilford, 1954). Physical and mental fatigue were monitored by a fatigue scale (Chalder et al.,1993). Physical and emotional well-being were measured respectively by the Recovery Inventory (RI-Wolfer & Davis, 1970) and the Mental Health Inventory (MHI; Viet & Ware, 1979). Physical function, pain and stiffness were assessed by the Western Ontario McMaster Universities Osteoarthritis Index (WOWAC; Bellamy et al., 1988). (See Chapter 3 for further details of all psychological assessments used which are not reported here) These questionnaires, along with others, were given to patients during a 6 month follow-up home visit by a research nurse who monitored patients psychosocial, somatic and functional quality of life after total hip and knee arthroplasty. Along with completion of questionnaires, peripheral blood samples were drawn from these patients at intervals, from consent to the seventh postoperative day. (See chapter 3 for further details of all biochemical assessments used).

Only patients taking part in the randomised control trial could therefore be used in the analysis of the relationship between functional recovery and emotion and physical wellbeing at 6 months postoperatively. 6 month follow-up was looked at only, for simplicity. No follow-up data were collected for the remaining 69 patients of the total sample (N=229) who did not take part in the RCT.

4.2.3 Postoperative physiotherapy for THA and TKA patients

The major aims of physiotherapy in the first postoperative week are general maintenance of muscles, improved strength and joint range, and an individualised gait re-education programme. Preoperative gait status, although variable between patients, is usually abnormal and therefore a relearning of normal gait is often necessary. As pain levels decrease, gait pattern can be corrected even more effectively. Information on rehabilitation exercises was provided to patients via education booklets; this information was reinforced by physiotherapists. The main stages of rehabilitation were: bed rest and bed rest exercises; initial mobilisation and other transfers; walking and exercise practise; getting ready for discharge.

Immediately after surgery all TKA patients' operated legs were placed in a splint, whilst in theatre or on return to the ward, in order to maintain knee extension. Both surgical groups were expected to leave their beds, assisted, and use a frame 48 hours after surgery; this allowed for intermittent walking. Although TKA patients generally walked as much as pain allowed 48 hours postoperatively (with a back-splint and walking frame) and performed other transfer functions on average earlier than THA patients, they were also expected to do maintenance and circulation exercises postoperatively, during bed rest or resting in bed, in-between intermittent walking. Exercises included buttock contraction and unoperated leg knee flex exercises. Patients were told that bed rest exercises would increase strength in their muscles in preparation for later exercises, and were also advantageous for good circulation and chest care. Knee wounds were inspected approximately 5-7 days after surgery and providing that no problems existed with wounds and patients had achieved a good straight leg raise (SLR), splints were removed and gentle knee flexion commenced. The aim of each physiotherapy session was to increase knee flexion and develop knee control after straight leg raises (SLR) while the patient was on bed rest. TKA patients, although not at risk from dislocation, were informed that they would not be able to kneel for some time. All patients were told to engage in deep breathing exercises, coughing and expectoration if appropriate (refer to Appendix 3.3 for more detail on postoperative physiotherapy).

Daily walking practice with a physiotherapist, for both surgical groups, graduated from frame to crutches or sticks. THA patients were expected to sit in a chair according to each surgeon's requirements, which in this study were either 2, 4, 5 or 7 days postoperatively. Before they transferred from a bed to a chair THA patients were informed of the risks of dislocation, and told that it was important that their operated leg did not cross their mid-line. A pre-requisite for discharge was the ability to walk safely and independently, and climb stairs if required. There was no routine outpatient physiotherapy but home exercises were encouraged.

4.2.4 Statistical analysis

Firstly, data were examined to check whether they formed normal distributions and were therefore amenable to parametric analysis. Relationships between variables were examined using product-moment correlations. Differences between groups were investigated using analysis of variance. The rationale for each individual analysis is given below. Where data were missing, degrees of freedom were reduced accordingly. Analyses were by Genstat 5 (Rothampstead, 1995) 5 and SPSS for windows, 6.1.2 release, 1995.

4.3 Results

4.3.1 Mobilisation data for the total sample

According to anticipated rehabilitation times both THA and TKA patients were expected to walk with assistance (mobilise) approximately 48 hours after surgery. Descriptive data analysis was used to assess this for both THA and TKA patients. 45.8% (N=71/166) of THA patients, as expected, walked with assistance within 48 hours. One patient walked 24 hours after surgery due to a urinary retention complication and was allowed to stand by the side of the bed in order to prevent catheterisation and alleviate the problem. A number of mobilisations took place on day three and four postoperatively (N=60/163). Remaining patients took between 5 days and two weeks to walk with assistance, 15.4% (N=24). One patient walked 14 days postoperatively (Figure 4.1a).

46.8% (N=29) of TKA patients walked with assistance within the first 48 hours. 1 patient walked earlier due to a urinary retention problem. A number of patients walked between 3 (N=13/66) and 4 days (N=6/66) postoperatively. One patient walked 24 hours after surgery due to a urinary retention complication and was allowed to stand by the side of the bed in order to prevent catheterisation and alleviate the problem. The remaining few patients walked by ten days, except one patient who had severe heart problems and walked 34 days after surgery (see Figure 4.1b).

Figure 4.1a

Initial mobilisation for hip arthroplasty patients

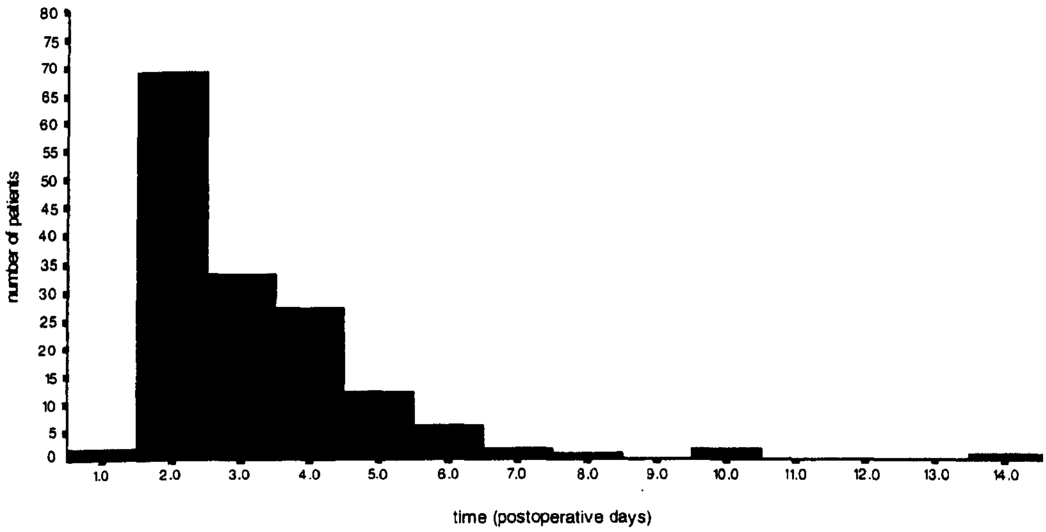
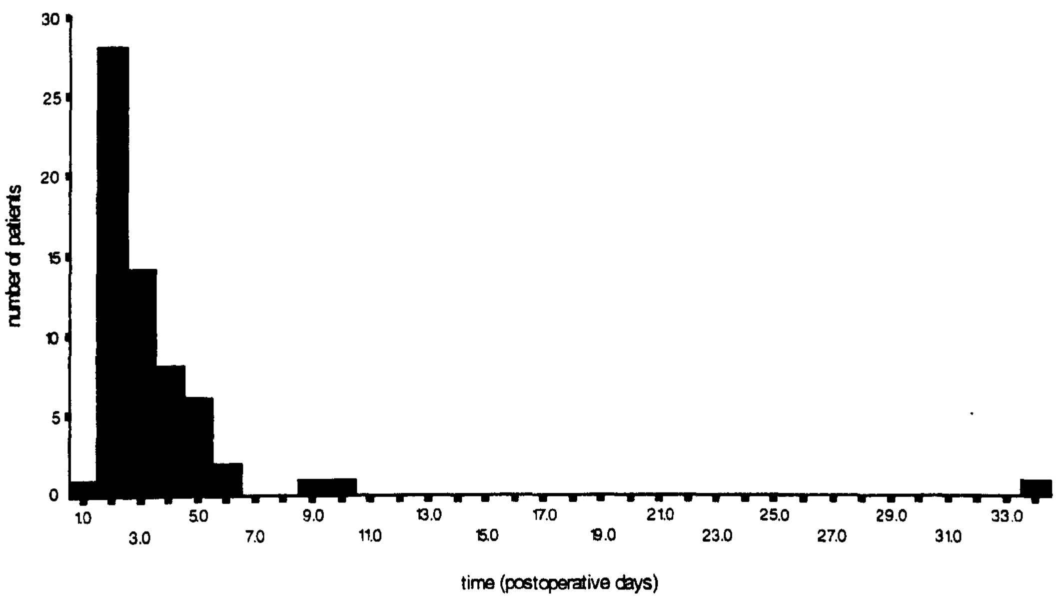


Figure 4.1b

Initial mobilisation for knee arthroplasty patients



4.3.2 Number of days taken to achieve assisted and unassisted basic functional milestones for THA and TKA patients.

The mean times for mobilisation, bed, chair, toilet and stair transfers were compared for the two surgical groups using 1-way ANOVAs. As can be seen in Table 3.1, both groups of patients achieved the functional milestones in the order to be expected from physiotherapy practice.

Table 3.1 Mean number of days taken to achieve assisted and unassisted basic functional milestones in hip and knee patients and F-ratios comparing the surgical groups. *:p<.05; **:p<.01; ***:p<.001. d.f.~ 1,210

Transfer		Hip	Knee	F-ratio
Bed	Assisted	3.63	3.10	2.52
	Unassisted	8.47	6.12	9.96**
Chair	Assisted	5.03	3.10	28.32***
	Unassisted	7.23	5.87	4.25*
Toilet	Assisted	5.84	3.33	26.49***
	Unassisted	7.73	5.60	13.72***
Stairs	Assisted	13.30	14.45	2.17
	Unassisted	13.77	14.43	0.65
Walking	5 metres	3.65	3.84	0.23
	10 metres	4.96	5.47	0.97
	25 metres	7.83	6.95	1.56
Discharge		19.41	20.11	0.56

Patients progressed from the most rapidly attained milestone (getting off the bed) to more difficult achievements (toiletting, stairs and walking 25 metres), with earlier occurrence of assisted compared to unassisted transfer. Time of transfer for THA was significantly longer than that of TKA for unassisted bed transfer, and chair and toilet transfer (assisted and unassisted). No differences were seen between surgical groups on assisted bed transfer, stair climbing and walking milestones. Refer to Appendix 3.1 for a complete record of all transfer times and percentages.

No differences were seen in the number of days THA and TKA patients spent in hospital. At the time of discharge all THA patients, apart from two, achieved independent functional status on all areas assessed. One patient was not able to transfer successfully on/off the bed, toilet or chair independently and another was not able to walk 25 metres with aids. Both of these patients had postoperative complications (refer to Appendix 3.1).

4.3.3 Influence of demographic features on functional achievement

Age, gender, and type of operation. Older patients had longer duration of hospital stay ($r = 0.26$, $p < .001$), and unsurprisingly were slower to use the stairs with or without assistance ($r = 0.26$, $p < .001$). Apart from this, no other demographic variables influenced functional outcome.

4.3.4 The effect of surgeon regimes on number of days to achieve functional milestones in THA patients

It was expected that contrasting surgeon preferences for chair transfer would influence the rehabilitation of THA patients, and that these transfer preferences may affect the progress of other transfers while in hospital. A 1-way ANOVA compared mean times of transfer for THA patients under 'day 2' and 'day 7' surgeons (see Table 3.2, Table 3.3). These two surgeon groups were chosen as they had the majority of patients and represented the least and most amount of days before transfer. F-ratios were adjusted by analysis of covariance for timing of operation ('early' or 'late' in the week).

Table 3.2 Surgeon transfer preferences (for THA), and number of total hip arthroplasties by surgeons within each preference.

Postoperative On/off chair Transfer time	Number of surgeons with preference	THA (N)
day 2 (48 hours)	3	55
day 4	1	16
day 5	1	2
day 7	8	90

Table 3.3 Mean times (days) to achieve milestones in THA patients treated by surgeons with differing regimes for transfer to chair, and F-ratios comparing differences between the times which are both unadjusted and adjusted for 'early' or 'late' surgery. *:$p<.05$; **:$p<.01$; ***:$p<.001$. d.f.~ 1, 135.

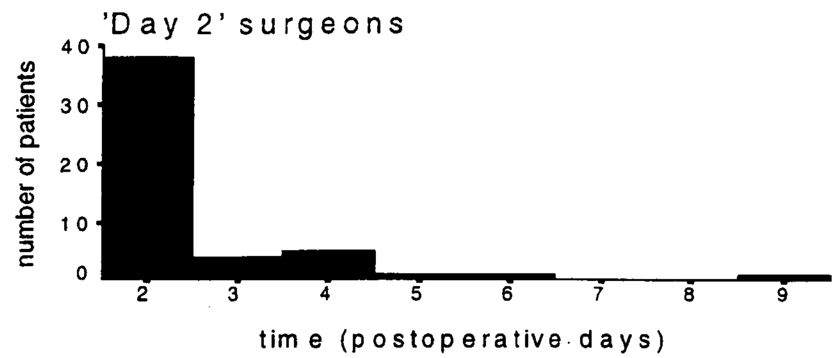
Milestone		Surgeon requirement		F-ratios	
		2-day	7-day	Unadjusted	Adjusted
Chair transfer	Assisted	2.56	6.56	122.74***	115.23***
	Unassisted	5.56	8.11	13.88***	13.61***
Toilet transfer	Assisted	3.52	7.15	39.92***	35.94***
	Unassisted	5.26	8.68	27.11***	24.86***
Using stairs (up)	Assisted	12.52	13.12	0.41	0.15
	Unassisted	12.81	13.74	0.90	0.43
Walking	5 metres	2.98	3.79	5.22*	3.14
	10 metres	4.20	5.06	3.68	2.64
	25 metres	6.31	7.61	3.21	2.86
Discharge (no. of days)		17.82	19.77	3.69	3.07

The majority of patients under 'day 2' surgeons (N= 38/51, 76%) transferred to a chair on the 'correct' day (Figure 4.2a). One patient achieved this transfer with assistance by 24 hours because of a urinary retention complication. The ratio of expected to non-expected transfer for 'day 4' surgeons was 11:16 (69%) and the ratio for the day 7 surgeons was 34:90 (43%). In general patients under 'day 2' group surgeons showed faster bed, chair and toilet transfer. Chair transfer requirements did not affect stair climbing or walking functions (Table 3.3). These differences were not accounted for by different surgeons operating early or late in the week.

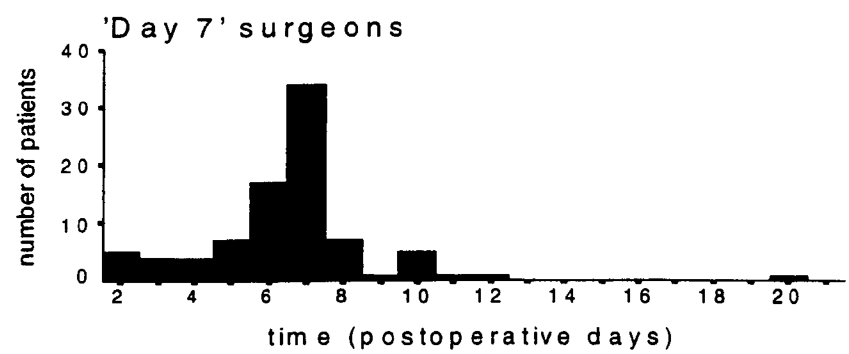
4.3.4.1 On/off chair transfer for patients under different surgeon groups.

Figure 4.2 a-c

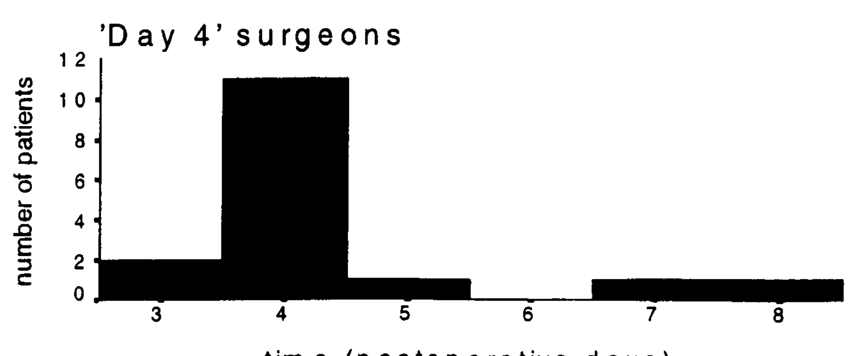
a



b



c



4.3.5 The effect of 'early' and 'late' operation on later achievements

Due to speculation that timing of surgery may affect future recovery in hospital, patients were divided into those who were operated on 'early' and those operated on 'late' in the week. A 1-way ANOVA assessed the possible effects of 'early' or 'late' operation on future functional progress for all transfer items. The data comparing the two groups on functional milestones is presented in Table 3.4.

Table 3.4 Mean days to achieve milestones in total group divided according to timing of operation: 'early' (Saturday to Wednesday) versus 'late'(Thursday - Friday). *:p<.05; **:p<.01; ***:p<.001. d.f.~ 1, 210.

Milestone		Early	Late	F-ratio
Bed transfer	Assisted	3.06	4.03	10.27**
	Unassisted	7.18	8,70	4.89*
Chair transfer	Assisted	4.11	4.97	6.07*
	Unassisted	6.81	7.07	0.15
Toilet transfer	Assisted	4.58	5.82	7.23**
	Unassisted	6.45	8.01	8.70**
Using stairs	Assisted	13.03	14.34	3.42
	Unassisted	13.28	14.78	4.13*
Walking	5 metres	3.14	4.47	13.86***
	10 metres	4.66	5.73	5.26*
	25 metres	7.44	7.77	0.27
Length of hospital stay (days)	19.42	19.89	0.02	0.27

Patients operated on Thursday or Friday, compared to those operated on earlier in the week, were slower to achieve 8 out of 12 recorded milestones (Table 3.4). This comparison is however, confounded by different surgeons operating on different days. Refer to Appendix 3.3 for a breakdown of number of patients who transfer 'early' and 'late' for different surgeon groups.

4.3.6 Relationship between initial mobilisation in hospital and the achievement of later functional milestones

It was assumed that those who got out of bed and walked earlier would have faster transfer on other functional milestones. The relationship of early mobilisation with the achievement of later functional milestones was investigated using product-moment correlations. Also, due to speculation that the physiotherapists could identify psychological factors that influence future functional recovery in hospital, product-moment correlations were used to investigate the relationship of days to achieve later milestones with physiotherapists' initial subjective assessments (pain and unwillingness to attempt physiotherapy), during the last rehabilitation session for both surgical groups. Data from the combined sample (THA and TKA) were used in these analyses.

Table 3.5 Product-moment correlations of physiotherapists' initial assessments and patients early achievements with days to achieve later milestones in THA and TKA patients. *:p<.05; **:p<.01; ***:p<.001. d.f.~210.

Later milestones		**Early milestones and assessments**					
		Chair		**Bed**		**Physiotherapist assessments**	
		Assis.	**Unass.**	**Assis.**	**Unass.**	**Unwillingness**	**Pain**
Toilet	Assisted	0.75**	0.47**	0.55**	0.54**	.06	.09
	Unassisted	0.58**	0.76**	0.57**	0.78**	0.22**	0.23**
Stairs	Assisted	0.22**	0.43**	0.31**	0.50**	0.14*	.08
	Unassisted	0.29**	0.45**	0.31**	0.54**	0.15*	.09
Walking	5 metres	0.30**	0.26**	0.38**	0.30**	.03	.06
	10 metres	0.26**	0.28**	0.27**	0.29**	.18*	.16*
	25 metres	0.32**	0.35**	0.35**	0.33**	0.30**	.24**
Discharge		.15*	.58**	.26**	.58**	.19**	.24**

Assis. = assisted. Unass. = unassisted

The time at which patients transferred from a bed to a chair was clearly related to future toilet, stair climbing and walking activity (Table 3.5). Patients who transferred earlier were faster to perform these functions. The two subjective assessments (made at the beginning of physiotherapy) also predicted slower progress.

4.3.7 The relationship between physiotherapy assessment in hospital and outcome at six-month follow-up.

To test whether psychological and objective factors in the intermediate rehabilitation period had any effects on long term recovery, correlations assessed the relationship of physiotherapists subjective (made during the last rehabilitation session before discharge) and objective assessments (made during patients' hospital stay) with pain (VAS scale), fatigue (fatigue scale), well-being (recovery inventory and mental health inventory), quality of life (Face scale) and physical function (WOMAC) at 6-month follow up. These correlations were performed using data from the subsample of patients (N=160) who were also taking part in the RCT as these were the only patients for whom follow-up data were available.

Time of achievement of a late milestone (unassisted stairs climbing) and physiotherapist's subjective judgements at the end of physiotherapy were analysed using product-moment correlations to see if they predicted physical and mental state at six month follow-up in hip and knee patients (see Table 3.6).

Table 3.6 Relationship between physiotherapy assessment in hospital and psychological assessments at six month follow-up. *:p<.05; **:p<.01; ***p<.001. d.f.~135.

	Pain		**Fatigue**			**Physical & emotional well-being**		**Quality of Life eval.**	**WOMAC**		
Subjective hospital ratings	Inten.	Dist.	Ment.	Phys.	Tot. fatig.	Sub. bod. state	Pos. affect	Face Scale	Pain	Stiff	Phy. Fun.
Unwilling. (on last mobilis.)	.21**	.26**	.25**	.20*	.23**	-.19*	.23**	-.30**	.17	.22*	.11
Pain (on last mobilisation)	.20*	.14	.05	.06	.06	-.21*	-.13	-0.27	.12	.26**	.13
Milestones											
Stairs (unass)	.18*	.20*	.26**	.29**	.30**	.03	-.22*	-0.23**	.07	.02	-.04

Inten.= Intensity of pain. Dist. = Distress caused by pain. Ment. = mental. Phys.= Physical. Life eval. =Life evaluation Sub.bod. state = subjective bodily state Pos. affect = positive affect Phy.Fun.= Physical function. N.B. Correlations with time of toileting, walking 24m and discharge were not significant and are not shown. Partial correlations, are shown, controlling for joint replaced.

As knee patients were worse on many quality of life dimensions and bodily state measurements (refer to Chapter 6) partial correlations were calculated to control for joint replaced. Other demographic variables of age, sex and pathology were not systematically related to outcome. Unwillingness to undertake physiotherapy was a strong predictor of poor long term recovery as patients judged by physiotherapists to be unwilling at the end of physiotherapy reported more pain and fatigue, had greater functional impairment and were less satisfied with their lives at six month follow-up (Table 3.6). Subjective pain ratings on last mobilisation were correlated with intensity of pain, health, satisfaction and functional ability at six-month follow-up. Overall, subjective pain rating was not as predictive as unwillingness to perform physiotherapy (Table 3.6). Interestingly ability to independently climb stairs predicted pain intensity and distress, physical and mental fatigue, emotional well-being and overall quality of life, and stiffness at six months (Table 3.6).

4.4 Discussion

The tool developed proved simple and easy to use and showed that a systematic recording of basic functional milestones (and subjective factors) could be incorporated into hospital routine. The tool detected variation in functional recovery according to type of operation, surgeon preferences and day of surgery, confirming its validity. For instance, initial milestones were achieved approximately two days earlier in knee than hip patients. Also, for hip patients, modal days of transfer from a chair corresponded to different surgeons' requirements for chair transfer, exposing the sensitivity of this method to clinical practice (figure 4.2a-c).

The overwhelming majority of patients achieved a level of functional status considered to be acceptable at discharge time. Although a large proportion of THA and TKA patients achieved basic functional milestones (independent walking and transfer) one week after surgery, there were substantial numbers who needed two weeks and a small proportion who needed longer.

Although this research showed that TKA patients had overall immediate faster functional achievement than THA patients, a study which assessed long term recovery from surgery at 6 months showed that TKA patients have slower functional recovery following discharge (Aarons et al., 1996). In this sample, there was no relationship between how rapidly patients progressed through achievement of functional milestones in hospital and functional progress at six-month follow-up. Hence the importance placed on early achievement of functional milestones in postoperative physiotherapy may be misguided as this does not appear to influence longer term recovery.

The assessment procedure also confirmed variation in recovery which had previously only been speculated upon but never evaluated. For example, although surgical routines were closely followed, some surgeon routines appeared more 'obtainable' than others (figures 4.2 a-c). Patients under 'day 7' surgeons showed more deviation from expected chair transfer times in comparison with patients under 'day 2' surgeons (Figure 4.2a and 4.2c). Where surgeons aimed for 2 or 4 days, the large majority achieved this expectation. However, where surgeons aimed for 7 days, well over one third of patients had already transferred by this time. Such variability suggests a flexibility in physiotherapy practice in order to accommodate to patients' needs. At the present time there is no research which has studied this. Patients who transferred earlier from a chair, both assisted and unassisted, were faster to achieve later milestones including stairs, toilet, walking distance and discharge. The view that assisted mobilisation was largely influenced by physiotherapy practice was also reinforced by the finding that individuals who were operated on 'early' in the week, achieved walking milestones and were discharged more quickly than those operated on 'later'. The adjustment of 'early' or 'late' operation for surgeons' requirements showed no differences in recovery.

Subjective factors were seen to predict recovery in hospital and at six month follow-up. Those patients found to be unwilling and to complain of pain on initial mobilisation had a slower rate of progress on functional milestones in hospital. Subjective factors also predicted six month follow-up; individuals who had more pain on last mobilisation showed worse physical function, psychological and emotional well-being, and quality of life at six-month follow-up.

Patient motivation clearly predicted long-term functional progress; those who were more motivated at last mobilisation showed less pain and fatigue 6 months after surgery. Such findings are consistent with the theory that motivational response to surgery underlies fatigue and other aspects of recovery (Salmon & Hall, 1997). Psychological interventions which help to increase motivation may be important for these patients.

The findings show the influence of external and internal factors of patients on mobility. Such factors as postoperative complications and individual patient compliance are already known to affect functional progress. It is also possible that external factors such as surgeon regimes and time (day) of surgery affect immediate functional progress. Despite the fact that discharge dates tended to be of a slightly longer duration in the hospitals in this investigation compared to other centres (Wang, 1995), these findings can provide surgeons, nurses or physiotherapists with appropriate information to give their patients about accurate recovery expectations, and assist them to detect divergence from the 'normal range' of recovery. The systematic recording of recovery devised here can be embodied into routine practice in any setting and hence allows for widescale quantification as opposed to unsystematic documentation of critical phases in postoperative rehabilitation. In terms of existing recovery assessments from surgery, the tool developed fills a gap in available methods of recording of recovery in hospital for THA and TKA patients, and is therefore a crucial assessment.

The relevance of the above research to the main thesis is that it provides an assessment procedure that is needed for an exhaustive assessment of functional recovery. It also shows the importance of psychological indicators for immediate rehabilitation and more long-term recovery. These findings suggest that it may be fundamental to provide psychological interventions which assist patients to cope with their rehabilitation in order to promote recovery. Interventions which might be helpful might be those that work to improve motivational factors in recovery and those that work to improve pain management.

Chapter 5

Patients' responses to preoperative psychological interventions which attempt to encourage passive or active coping with surgery

Chapter 5

Patients' responses to preoperative psychological interventions which attempt to encourage passive or active coping with surgery

5.1 Introduction

This study is a qualitative analysis of patients' responses to two preoperative psychological interventions which attempt to manipulate perceived control. Perceived control is not a straightforward concept and is often confused in the literature with the concept of personal autonomy. In fact, the concepts of control and autonomy are often used synonymously. An individual has perceived control when they believe that they can determine their internal states and behaviour, can influence their environment and bring about desired outcomes (Wallston et al., 1987). Personal autonomy refers to the ability to act on the basis of one's own reasons, desires and goals (Seedhouse, 1988). Perceived control can be externally manipulated by changing the environment or the way someone perceives their environment; autonomy on the other hand is a more static and intrinsic property of the individual and relatively immune to external manipulation (Rodin, 1983). However, the degree of autonomy of an individual is an important variable to consider in studies of perceived control as it may well affect the way in which the individual responds to an experimental or clinical manipulation. For instance, it is often assumed that increasing choice for an individual will increase perceived control. However, abundance of choice for the individual who has a low degree of autonomy may be as difficult to cope as restricted choice for an individual with a high degree of autonomy.

Control has been studied on an environmental, clinical and experimental level. The effects of varying control have mainly been studied using animal subjects, and those studies that have used human subjects have often been laboratory based. There are, however, very few human studies of perceived control which have been conducted in a naturalistic environment.

Psychological approaches to control are based on concepts derived from animal learning theory. There are two main approaches to control in this literature. The first approach looks at control over the ability to escape from an aversive event (Seligman, 1975; Dantzer, 1993). The absence of a relationship between behaviour and environmental outcome leads to "learned helplessness" (Seligman, 1975) and is believed to have harmful psychological as well as physiological effects in humans (Mikuliner, 1994). This theory has been clinically applied in health institutional care which used interventions that emphasise patient choice (Rodin & Langer, 1977; Wallston et al., 1987, 1991; Stirling & Reid, 1992; Lewis et al.,1993; Langer, 1983). The second approach focuses on control as the ability to cope with an unpleasant event (Thompson, 1981). Here, two types of coping have been distinguished; active and passive (Folkman & Lazarus, 1984). Active coping modifies an event or perception of it and passive coping reduces the emotional distress of an event. For the purposes of this investigation it is presumed that active coping is associated with increased feelings of control in comparison to passive coping.

It is usually assumed that instrumental control over the environment is positive (Lewis et al., 1993). Indeed, clinical research has suggested that patients who are encouraged to take control show positive behavioural effects (Langer et al., 1983), incur more positive effects on their physical and mental health (Schulz & Alderman, 1973; Slivinske & Fitch, 1987), and generally have improved outcome and better adjustment (Wilson-Barnett & Fordham, 1982). However, relaxation and reassurance which have been regarded as discouraging control, have also been reported to improve surgical recovery (see chapter 1). In fact, recent research has shown that enhanced control is not always perceived as positive or desirable, or responded to positively (Evans et al., 1993). Personality factors such as behavioural competency, generalised belief expectancies (i.e. beliefs about what is likely to happen in certain situations), self-efficacy (i.e. ability to do something) and motivation, can influence an individual's response to interventions which attempt to manipulate perceived control or choice (Skinner, 1995). It is assumed that individuals want enhanced control but some may find it difficult to accept because of such factors. It has been shown recently that even when patients view an aspect of health care as offering the possibility for their own control, they may prefer to rely on the experts (Waterworth & Luker, 1990).

Cultural and political developments emphasize patient choice and involvement as a means of enhancing control in health care (Brownwell, 1990) with the Patient's Charter officially recognizing this (DoH, 1991). Teitelman & Priddy suggest the following ways of enhancing control: the promotion of choice and predictability, elimination of helplessness-engendering stereotypes, promotions of therapeutic attributions and a sense of responsibility, provision of success experiences early on in care, modification of unrealistic goals and use of control-enhancing communication skill (Teitelman & Priddy, 1988). These can all be seen as concerned with greater involvement of patients. Unfortunately, at present there is no research which has asked patients about how they could be involved in making decisions or participating in their healthcare and treatment, nor how they would feel about this. Some methods of shifting control to patients have been suggested by Williamson (1980). One method is that patients can be given direct control over some of their treatment. An example of this is the use of patient-controlled analgesia (PCA). Another tactic would be to provide some way that patients could exercise control over the staff's work; this may be done by allowing patients to remain conscious during operations by giving them regional instead of general anesthetic or granting patients access to health and computer records. Perhaps the most straightforward method is to encourage patients to ask for what they feel they need or want. Within the nursing field, especially over the past decade, a considerable amount of attention has focused on empowering the patient despite the fact that their is a lack of a clear conceptual definition for this (Vander-Hernst, 1997). The 'named-nurse', where a patient is assigned to one nurse who continuously cares for them, is believed to be important for increasing patient decision making (Turner, 1997), as is collaborative negotiation between patients and nurses on aspects of patient care (Molleman & Van-Knippenberg, 1995). The effects of this patient-centered approach remain largely untested.

The main study for this thesis examined the effect of two psychological interventions, a passive intervention and an active intervention, on recovery from surgery. Both interventions have been previously shown to influence recovery (Thomas, 1995). In this thesis, the interventions differed in the degree of control they encouraged the patient to take in the process of recovery. In the 'passive' intervention, preoperative patients were given a relaxation tape and an interview in which statements were supplied which encouraged passive coping. In the 'active' intervention, preoperative patients were given a guided imagery tape and an interview in which statements were supplied which encouraged active coping. The following is a qualitative study of the responses of patients to these preoperative interviews.

Initially these interviews were monitored to ensure that standard procedures for each intervention were met by the interviewer. As interviews progressed, it became clear that patients' responses were interesting in their own right and a formal qualitative analysis was undertaken. In other studies, it has sometimes been assumed that patients' attitudes will accommodate to the psychological intervention given. It has also sometimes been assumed that increased control is always welcomed. The interviews were recorded and analysed in order to test these assumptions.

5.2 Methods

5.2.1 Subjects

One hundred and sixty patients had consented to take part in a randomised control trial (RCT) which assessed the effect of two psychological interventions on the stress response and recovery rate in surgery (See chapter 3). Patients in the 'active' intervention and those in the 'passive' intervention of this RCT were interviewed preoperatively as part of the process of encouraging an active or a passive coping style respectively (see Chapter 3 for more details of these interventions). Audiotapes of the interviews for 38 of the patients and notes from interviews for 4 of the patients who could not be recorded due to equipment availability) were obtained for qualitative analysis. From these, the interview responses of 30 patients were chosen for detailed analysis. 15 of these patients had undergone the 'passive' intervention and 15 had undergone the 'active' intervention. Demographic details of patients are presented in Table 5.1 and Table 5.2

Table 5. 1 Demographic and surgical characteristics of patients

Intervention group	Number of THA	Number of TKA	Mean age (years)	Sex ratio Male : Female
Passive	11	4	66.1	4:11
Active	11	4	65.6	5:10

THA: total hip arthroplasty TKA: total knee arthroplasty

Table 5. 2 Demographic and surgical characteristics of patients

ID	Intervention	age (years)	sex	surgery
019 *	passive	72	female	THA
030 *	passive	69	male	THA
034 *	active	34	female	THA
048 *	active	74	male	THA
059	active	78	female	THA
066	passive	53	female	TKA
068	passive	74	female	TKA
077	active	73	male	THA
080	active	54	female	THA
083	passive	57	male	THA
084	passive	66	female	TKA
089	active	67	female	THA
092	active	79	female	THA
093	active	79	female	TKA
095	active	72	male	TKA
102	passive	74	female	THA
108	passive	79	female	THA
112	passive	55	male	THA
113	passive	79	female	THA
116	passive	60	male	THA
120	active	66	female	THA
127	active	48	male	THA
140	passive	63	female	TKA
141	passive	41	female	THA
152	active	38	female	TKA
156	passive	78	female	THA
159	active	75	male	THA
160	active	76	female	THA
165	passive	72	female	THA
180	active	72	female	TKA

THA: total hip arthroplasty TKA: total knee arthroplasty * not recorded on audio tape (early interviews)

After several interventions conducted for each of the treatment groups, unexpected recurring themes became apparent, and a decision was made to systematically record this information. Since qualitative analysis requires intensive study of a small number of subjects and provides a large amount of data (Patton, 1990), it was found that 15 interviews within each group were adequate for each analysis.

5.2.2 Procedure and design of interviews and psychological interventions

Individual interviews were conducted one to three days prior to surgery, depending on the day of admission and availability of the patient. Patients had already been randomly allocated to an intervention group (see chapter 3). Patients were asked to give informed consent to record the interview on audiotape. The majority of subjects were seen at least 2 days preoperatively; patients who were seen on the day before their operation were admitted on this day or late on in the evening the previous day. All interviews with patients were conducted at least sixteen hours before their surgery between 10 a.m. and 5 p.m.

The interviews contained statements supplied by the interviewer which were used to encourage either an active or a passive coping response. The messages conveyed in these preoperative interviews were later reinforced on day 3 and 7 postoperatively. Table 5.3 shows the principal components of the interventions and Chapter 3 describes these components in more detail.

Table 5. 3 Principal components of each intervention

Active	Passive
Ask questions wherever possible	Do not ask questions
Make sure staff know your individual needs	Fit into the hospital routine
Do as much as possible for yourself	Let others look after you
Be as involved as possible with your treatment	Trust and rely on them to make decisions
Make plans and set targets	Don't think about the future
Prepare mentally for what is going to happen and let the researcher and staff know your worries and concerns	Don't worry about what is going to happen

Patients were also provided with a tape which reinforced either a passive or active coping style. Interviews lasted on average approximately 35-45 minutes and were conducted with respect and acknowledgement for interviewees' opinions, even if they differed from what was being encouraged. Patients' reactions to what was being discussed, even if they were not in agreement with it, were always acknowleged. Patients were encouraged at the beginning of the interview to comment on how they felt about the message being conveyed to them and to make any general comments about thoughts on their hospital stay. Refer to chapter 3 for a more comprehensive account of all methodology of intervention group allocation and treatment.

5.2.2.1 Analysis of interview material

The method of analysis used established techniques to ensure that the findings were 'grounded' in the data rather than reflecting authors' preconceptions (Patton, 1990; Dey, 1993; Stiles, 1993). Two others contributed to the analysis, as well as the researcher who had conducted all interviews. My supervisor, Professor Peter Salmon of Clinical Psychology at the University of Liverpool (PS) and Professor George Hall an anaesthetist from St. George's Hospital, London (GMH) were the independent qualitative analysts; both were involved in other areas of this thesis. After listening to and transcribing relevant extracts of the interviews, the raters met to discuss emerging themes, before returning to re-listen to interviews and examine other extracts. The contribution to the analysis by individuals from different backgrounds permitted a 'triangulation' of the analysis, and 'cycling' between the data and analysis enabled progressive testing of emerging themes and modification of the analysis. Each taped interview was listened to a minimum of 3 times by each analyst.

It was agreed by the analysts that immediate responses to the researcher's statements which were uninformative about a patient's understanding or acceptance of an intervention should be disregarded. These included responses which merely assented to the interviewer's suggestions (e.g. 'That's right; I agree; Yes, I would do that'), which were commonly contradicted by subsequent statements which suggested that assent had merely reflected an unwillingness to be seen to disagree. Other discarded comments simply described features of the environment without signifying the patient's attitude to them (e.g. 'Well that does happen at the moment...the charge nurse had been and explained everything to me and told me exactly what was going to happen', patient id. 89). Such responses were ignored in favour of statements, often made without specific reference to the researcher's preceding comments, which indicated how patients had construed the researcher's message or the value that they had attached to it. These included statements which were considered to reveal a patient's view by reporting successful or intended ways of coping ('Only me can make myself better' 95) or by recounting impediments to an intended way of coping ('It's not difficult to motivate myself to get better. I know what I have to do but sometimes when you're in hospital your brain turns to jelly' 34).

A preliminary categorisation of reactions to each intervention was tested and clarified by discussion between the raters until no further modification was necessary. Here, each analyst (PS and GMH) first listened to - and transcribed relevant material from - 8 audiotapes (4 from each group). A preliminary categorisation of reactions to each intervention was tested and clarified by discussion, and by listening to 10 further audiotapes, and reading records of the 4 additional interviews which could not be recorded. This was done until no further modification was necessary. Specific quotations used in this chapter to illustrate the category of responses were chosen by all three analysis upon discussion. The comprehensiveness of the final analysis was confirmed by general discussion of the complete transcripts of 8 further audiotaped interviews. A selection of patients' statements in response to the interviewer are shown below to illustrate the different types of reactions that were identified. The quotations shown in the Tables 5.3 and 5.4 are the ones that were chosen by all three analysts as the most appropriate statements to represent the different categories of response.

A selection of interview material is presented here from 15 patients in the passive coping group and 15 patients in the active coping group. Of the 30 interviews selected, 18 were transcribed fully. Patient interviews that were not transcribed showed similar responses to those that were transcribed. As this was a preliminary qualitative study, a formal comparison of the two treatment interventions was not made and a numerical or quantitative analysis of emergent themes was not conducted. Hence, the number of quotations used to illustrate types of response are not matched in numbers for patients.

5.3 Results

Themes which emerged from the patients' responses to the passive and active interventions are presented in table 5.4 and 5.5 respectively. In summary, both groups of patients provided responses that implied emotional disengagement and acceptance of authority, responses that were concordant with the message given by the interviewer in the passive intervention and discordant with the message given by the interviewer in the active intervention. In general, common themes emerged in the responses to the active and passive interventions despite the contrasting messages that had been conveyed in each intervention. There was little overt conflict and disagreement with the interviewer even in the active intervention despite the emergence of discordant themes; patients were overtly compliant and affirmative of the statements supplied by the interviewer even when these seemed to be discordant with their own beliefs.

Patients generally agreed with the passive coping intervention and clearly expressed their reasons for this (See Diagram 5.1). Themes which demonstrated the clearest evidence of acceptance of the message were the following: statements implying emotional disengagement from threat, and striking statements about acceptance of authority, based on beliefs about obedience, beliefs about how one should behave when one is on someone else's territory, beliefs about expertise, and more magical beliefs which were subsumed under the heading of faith (Table 5.4). In several instances, agreement to the passive coping intervention was based on territorial authority; implicit in some comments was the belief that since the hospital was the staff's territory, staff expectations established the rules of behaviour (Table 5.4). It was surprising how many people held the view that they did not want to be seen as a 'nuisance' or appear contradictory to the 'experts'; suggesting the need to be 'model' patients. (see Diagram 5.1). There was only one occasion when a patient commented that she thought there was a need for the patient to ask certain questions, indicating a rejection of the passive intervention (Table 5.4).

In the active coping intervention, patients generally expressed their overall acceptance of the principles conveyed in the active coping message (see Table 5.5). However, an analysis of the content of patients' responses beyond simple affirmatives and statements of agreement revealed that patients' attitudes were largely discordant with the active messages given (see Table 5.1). Unique themes emerged in the active intervention which had not been present in the passive intervention. These included recognition of a need for a *personal service* in hospital, which identified and met their needs; the assertion of these needs was expressed clearly by some patients (Table 5.5 - personal service). Other patients expressed a desire to take control over themselves, rather than the hospital environment or the care they received in it, believing in the importance of willpower and determination in the recovery process (Table 5.5). Also many patients in the active intervention described a need to assertively ask questions about their treatment and condition, whereas they were much more likely to express a reluctance to ask questions in the passive intervention condition.

It was also found that being encouraged to ask questions signified dignity and respect for patients (Table 5.5). As with the response to the passive intervention, many patients were very concerned with how the active intervention message matched the needs of staff thereby showing a qualified acceptance of the message (see Diagram 5.1b). Indeed patients frequently implied that being 'involved' required obedience to staff authority. The main reasons for this were faith, expert authority and territorial authority (Table 5.5). That is, patients trusted in staff completely and frequently assumed them to have expert knowledge in comparison to themselves. Patients often insisted that staff's ownership of the hospital environment made staff rights and expectations of primary importance and that their role as patients was to meet these expectations and help them. Patients were keen not to take up precious staff time, and if they were to ask questions they claimed that they would do so in as unobtrusive a way as possible e.g. by having a pleasant conversation with them at the same time (Table 5.5). Involvement for some was about respect and dignity (Table 5.5).

A direct denial of the active intervention was expressed by statements from several patients of their need to disengage from surgery (Table 5.4). There were also several occasions when patients' self-efficacy to implement the message was low, which they attributed to lack of technical knowledge or uneasiness about acting in a way they had not done on previous occasions. See diagrams 5.1 and 5.2 for criterion of acceptance and rejection of the passive and active coping intervention in terms of the themes that emerged.

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Table 5.4 Patients' responses to the passive coping intervention

Emotional disengagement

'I just want to get it over and done with' **(019)**.

'I try not to think too deep into a thing...you can get yourself a little bit too confused if you think too deep...I try to blank it out if I can but, you know, it always come back doesn't it' ? **(083).**

'I'm sure I think I must try and keep it out of my mind ' **(102)**.

'There's nothing you can do by worrying about things' **(102).**

'Yes, I'm alright it's just been worrying me the fact that I must keep them out of my mind' **(102)**.

Acceptance of Authority

Obedience
'Going to their every whim as you might say, everything they say you've got to go along with **(083).**

'I'll do what they tell me to do. If I've got to flex my muscles and move my heel every day say, for so many hours then I'll do it' **(112)**.

'I'll do exactly what I'm told' **(102)**.

Faith
'They're so kind. They really are angels' **(102)**.

'There's nothing I can do. I'm entirely in their hands' **(083)**.

'You have got to trust people and have faith in them, but at the same time, if you have a lot of trust in hospital staff, maybe you don't question things as much' **(030)**.

'I know they're very good afterwards and they take care of you'**(102)**.

Expert authority
'That's about all I can do really, isn't it. To help yourself is to just go along with what they're doing for you, because they know more about what they're doing for you than you do' **(102)**.

'They'll probably make the final decision. I hope they do. I can't make a decision about how he does an anesthesia, I can't make that decision. That has to be his' **(141)**.

'Yeah they're the professionals. They know more about it than I could do' **(066)**.

'They *(physiotherapists)* get the job done. And when they think that they can't get any more results from that joint then they don't push it any further then, when they think they've got the maximum out of the joint' **(066).**

cont.

Territorial authority
'They've all got their job to do' **(066)**.

'There are lots of people that need to see you , but you never know when they're going to turn up, you just have to take people as they come' **(066)**.

'It's their job on the line isn't it' ? **(165)**.

'Yeah going to their every whim as you might say, everything they say you've got to go along with... As you say you've got to fit it in the end. I know you can object but if it's beneficial to
me it must be better' **(083)**.

'Sometimes when I'm sort of settled in a place, I can sort of cope with it better and know what I've got to do next. When you come into a strange place, you know, you don't know whether you're doing the right thing or whether you're putting people out' **(083)**

PCA related comments:
'I'll probably get by with that...*(response towards use of a PCA machine)* As you say you've got to fit in, in the end. I know you can object but...if it's beneficial to me , it must be better' **(083)**.

'They'll probably make the final decision . I hope they do ...*(Response to idea that staff will be taking care of pain control)* They've been doing it for years. That's their job...the decisions theirs and theirs alone. That's good' **(165)**.

Reluctance to ask questions

'I'm not one for pushing forward and asking questions' **(068)**.

'If ask doctors and nurses about things, you're usually no better off' **(030)**

Discordant response
'...well the only question I'd ask is, how long would I take to recover afterwards. Just thinking back to my two experiences of having an anaesthetic, I didn't feel terribly well after them. Can I have a drink afterwards?, because I couldn't have a drink last time, it was absolutely agony. I mean are you going to use the mask, do you inject into the hand? I mean presumably they're things he's going to tell me, I imagine, I don't know. If he doesn't I'll ask him' **(141)**.

'I think there's probably a balance between the two somewhere. I like to know exactly what's happening. I like to know what's going to happen to me when I come out of there. I don't particularly like surprises (on discovering that she would have a drip postoperatively). But I think I would have liked to have known what's going to happen, how am I going to come out of that operating theatre. Am I going to come out with tubes here, there and everywhere? Do you know what I mean?' **(141)**.

'You've got to trust people and have faith in them, but at the same time if you have a lot of trust in hospital staff maybe you don't question things as much. I think there's probably a balance between the two somewhere. I like to know exactly what's happening...I don't particularly like surprises [on discovering that she would have a drip postoperatively] I think I would have liked to have known what's going to happen' **(141)**

Table 5. 5 Patients' responses to the active intervention

Emotional disengagement

Discordant response
'I'm going to try and forget all about it , the whole thing . Let them get on with it' **(048).**

'Not bothered about the operation either. Just get me over and done with, that's it' **(080)**.

"I'd rather not know, so that my nerves wouldn't build up inside of me' **(080)**.

'Because if there's something wrong, they'd naturally tell you, you know. I'm not into knowing the workings of the body and this and the other. I've never been into anything like that at all' **(080).**

'I didn't know anything about childbirth when I had my first baby. I know very little about the menopause and I'm going through it. I don't really want to know *(referring to the operation)* as long as I feel alright and safe...' **(080).**

'Well I'm not one for asking. I'm not one for asking questions of everyone. I mean I can't, you know how some people can just go talk to someone, well I couldn't do that. If they said to me, I could answer, and they start a conversation that way, but as for starting a conversation with someone, no. No, I'm not one for asking questions. Well in that sense, unless they spoke to me, I could ask them maybe, if they'd asked me first' **(080)**.

'No not really, because since the national trust *(patient obviously meant NHS Trust)* took over...a vast improvement from the patient's care' **(095)**.

Personal service

'But it's getting the service, isn't it? That they're providing really' **(080)**.

'I need some pillows. I've already asked for some pillows. I have not received the pillows. I asked for them three hours ago' **(077).**

'They're actually here to help you, they want to help you a much as possible, after all it's their job to help you. To make you feel as comfortable as you need to be, as comfortable as you can be' **(077)**.

Willpower and personal responsibility

'...start fighting to get me back on my feet' **(180)**.

'I know it sounds a little childish but it's (visiting the toilet) an objective which makes me want to get out and do things for myself' **(159).**

'I know what I have to do, but sometimes when your in hospital your brain turns to jelly' **(034)**.

Qualified acceptance

Obedience
'just...cooperate as much as you can' **(093)**

Faith
'You feel in their hands, I know I'm going to be alright' **(059)**.

'Just put yourself in their hands and god's hands. You know I'm not bothered' **(093)**.

Expert Authority
'I mean I can't contradict what they do, because I can't do any better, can I ? I can't say well I want this and this and that done, because it might be contraindicative' **(120)**.

'They will know more about it than I know. So in asking a question I probably wouldn't really know what they were talking about' **(077)** .

Territorial Authority
'It's up to you to help them' **(089)**.

'I wouldn't ask him (surgeon) that (duration of the operation) because I think he's got enough to cope with' **(059)**.

'as long as it doesn't put them to any trouble or anything' **(092)**.

'When I felt was the right opportunity (and not) if they were very busy' **(089)**.

Asking questions

For finding out
'I feel that the more ask, the more I get to know, is helping me better, to get to know the problem' **(095)**.

To reduce uncertainty
'So I just checked why there were different dosages. So I got the answer...It was alright. That was all I wanted' **(089)**

'to sort of chat to people and gain information without being pointedly asking for it' **(089)**.

'I feel it's a good thing to be involved, but I've just had an experience of that now. I had doctor T here, all the students and everyone. And I had it all set out what I was going to say to him, what I was going to ask him and I've forgotten half of it' **(126)**.

As a source of respect and dignity
'Well it's not just to sit there and to sort of take everything that comes at you...it's to question, and within those questions to try and involve yourself in any way you can. Obviously the bottom of the line is that they do the operation. That's not going to change. But I mean, the first involvement is that I can say I've changed my mind' **(127)**.

Cont.

'Your treated with the height of respect and kindness and that's all you really want really' **(059)**

'Obviously the bottom line is the operation, but I've always felt, that I don't know how Mr. C will be when he comes round. There's been times in the past were I've been dissatisfied, sometimes with my own doctor, or when I've been in hospital. They just talk at you, they've very little time. They might just say 'have you got any questions' as they're on their way out' **(127)**.

'I'm really speaking to give them a hand , but they should answer your questions to the extent of respecting you as an individual, not as a lump of meat' **(127).**

Figure 5. 1 Categorisation of patients' responses to the passive intervention

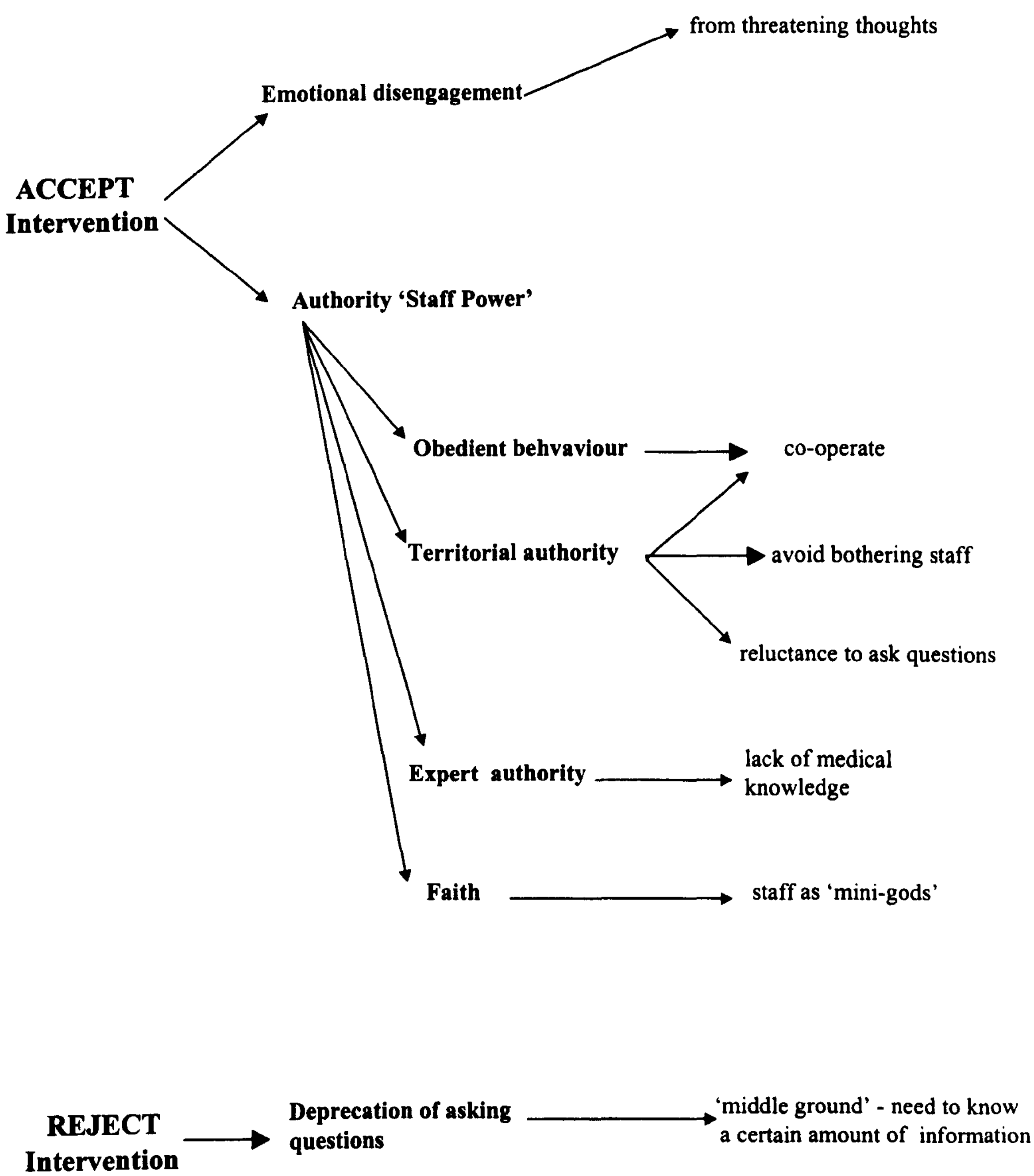
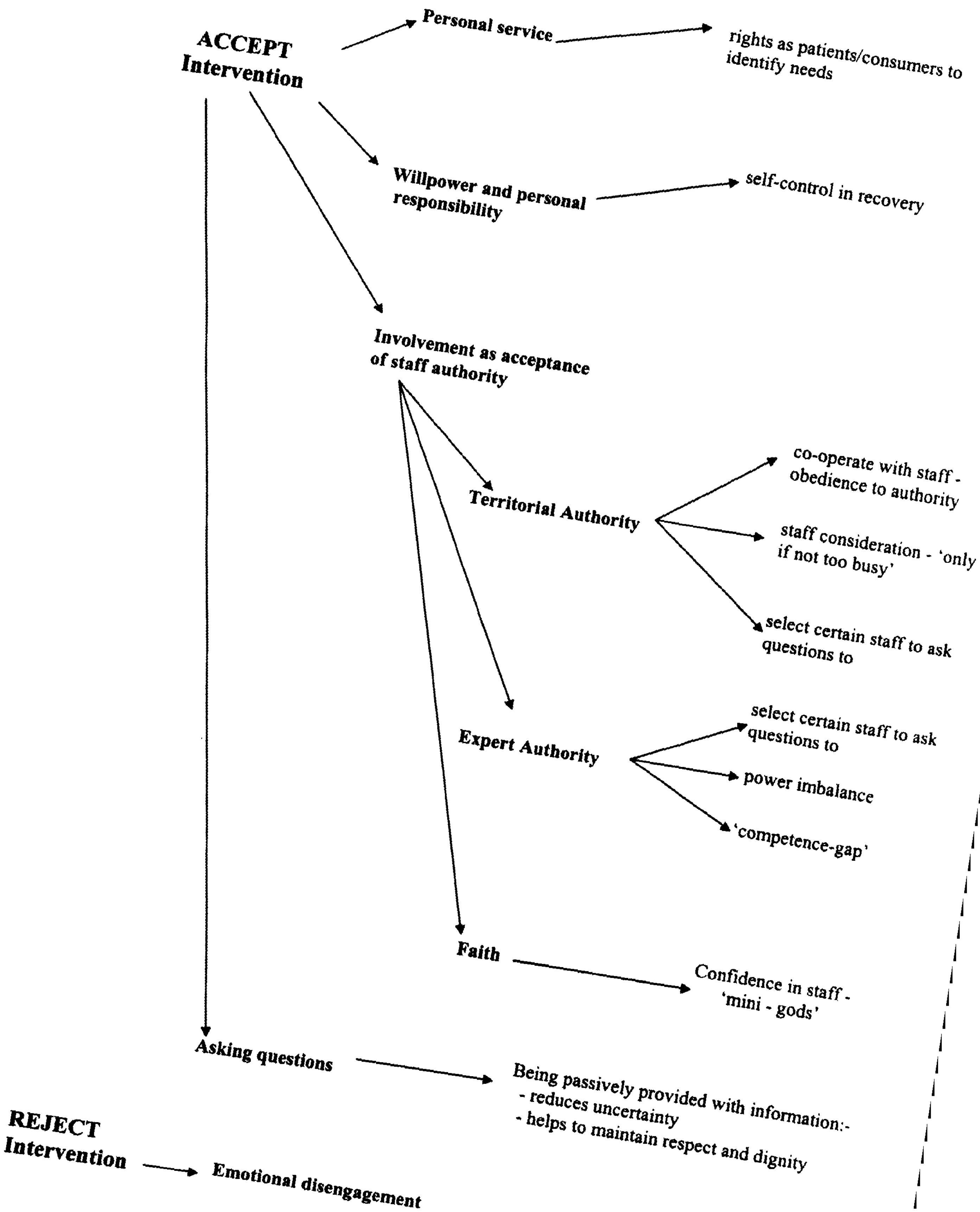


Figure 5. 2 Categorisation of patients' responses to the active coping intervention



5.4 Discussion

The overall response to interventions in this investigation showed a full range of coping responses which included direct action, seeking of information, inhibition of action (denial), and palliative coping. All have previously been described as ways of coping with surgical and other stress (Lazarus & Folkman, 1984).

The majority of patients had an immediate positive and unquestioning response to the passive intervention. The passive intervention was rejected by only one patient who felt it contradicted her need to ask staff questions. Although there was no outright rejection of the active intervention, patients did not generally produce responses that demonstrated that they had accepted the value of active mental planning and rehearsal, or of patients' expert knowledge of their own needs. Although some individuals felt entitled to be active, considering it their 'right' as consumers, others announced that they would comply with the active intervention because they considered that it was the right thing to do or that it was in their best interests to adhere to what they were told to do, even if they found it difficult; such behaviour where patients work in conjunction with the existing hospital structure has been termed 'reluctant collaboration' (Waterworth & Luker, 1990).

Many patients were aware of the Patient's Charter (DoH, 1991) and often spoke with praise regarding recent developments which entailed increased information and contact with staff. Indeed the willingness of patients to embrace the Patient's Charter to a certain extent was illustrated by some unique themes which emerged in the active intervention which had not been present in the passive intervention. These included patient's recognition of a need for a personal service, a desire to take control of themselves, and a need to ask questions. This response may have been encouraged by statements of active participation and coping supplied by the interviewer (see Table 5.1).

However, one of the most interesting findings was the way in which patients subverted the active coping message. It was unmistakable that patients' definition of 'being involved' was fundamentally different from that suggested by the intervention and that patients had transformed the message into one for which the term 'active coping' was no longer appropriate. Although patients generally concurred with the idea of finding out information as an important part of being an involved patient, they suggested that this information would help them 'accept' what was being done rather than take control. An association between seeking information and rejecting control has previously been described (Miller & Brody, 1988). There were other ways in which patients had evidently qualified what was meant by being involved. Patients felt that acceptance of staff authority, and respect for staff's territory, expertise and healing abilities also constituted involvement. Being passively provided with information was also considered a form of involvement. It became clear that what patients interpreted as active involvement actually constituted a more active accommodation to the passive role of being a patient.

In summary, instead of taking control of their treatment, patients suggested that they should more actively submit to the passive role of patient. This 'active passivity' or collaboration with the hospital environment may be important in maintaining perceptions of control in an environment where dependent behaviours are generally reinforced (Baltes & Reisenzein, 1986). This collaboration may indicate that the patients were exhibiting learned helplessness or, may be merely a reflection of generational attitudes to healthcare. The possibility that a younger group would respond differently remains to be tested.

This apparent rejection of the opportunity to take control has been seen in other studies. Other research has shown that, when given the opportunity to be more involved in the treatment of their pain, patients prefer not to be. In a study by Taylor, Hall & Salmon (1996) a lack of control and disempowerment was inferred by patients given the opportunity to provide their own pain relief by patient controlled analgesia.

The population under study in this investigation was an aged group, so there may have been cohort effects in terms of attitudes to health care and in terms of beliefs about illness and recovery which influenced the uptake of the interventions. The responses in this investigation are generally consistent with the findings that elderly people prefer less health-related control than younger adults and prefer health professionals to make decisions for them and also report less desire for control over day to day events (Woodward & Wallston, 1987) whilst in hospital. It is suggested that the process of institutional care itself causes a decline in perceptions of control and willingness to exert control in the elderly (Arling et al., 1984). Older patients scheduled for various surgeries have reported a lower desire for control of their health care, and believed more in the 'power of others' in comparison to younger patients (Wallston et al., 1987; Wallston et al., 1991; Smith et al, 1991). For many, ageing brings with it a lack of control in many areas of life and hence a reduced perception of control and a belief that being old means being a passive object to be manipulated by the environment (Neugarten & Gutman, 1985).

Staff overestimation of the needs and competence of patients (Ransen, 1978) may lead to a self-fulfilling prophecy by which patients come to rely on staff and accept their help willingly (Raps et al., 1982), or cause patients to react defensively and withdraw from help or assistance given (Seligman, 1975). In view of the knowledge that styles of coping change over the life-span (Aldwin et al., 1996; Diehl et al., 1996), only limited interpretations can be made from the results from the present qualitative study as only initial reactions to interventions with a sample of mostly elderly patients were analysed. The generalisability of the results to a wider population is therefore limited.

Personality factors such as self-efficacy (Carver & Scheir, 1987), desire for control (Wallston et al., 1987; Wallston et al., 1991; Smith et al., 1991), and motivation (Frankenhauser & Johansson, 1986) and various coping strategies have been shown to influence individuals' decisions to engage or disengage in certain behaviours. Such internal or dispositional factors probably heavily influence patients' responses to interventions and hence the assessment of these may be useful to help to explain the effects or outcome of an intervention (Evans et al., 1993). These factors were assessed in the quantitative analysis of the wider clinical trial (chapter 6), but because of the small sample size in this qualitative study the interaction of personality factors with acceptance or rejection of the intervention could not be studied.

The responses offered by patients may reflect individual beliefs and preferences, they may reflect cohort effects, or they may reflect other uncontrolled variables such as the hospital environment. Although clinical staff were made aware of research taking place on their wards, they were not asked to change their clinical practice or adapt it in any way to either the active or passive intervention. Thus standard nursing practice and staff attitudes may have affected, and in some cases opposed, the uptake of the interventions. Many of the patients' responses may reflect the power of the hospital environment as much as their attitudes towards it. Patients' responses suggested that they were generally in awe of medical staff's expertise, and were willing to put great faith in it. Patients' responses which showed a resistance to take control, a responsibility to anticipate the needs of staff, or an acknowledgment that they were on someone else's territory may attest to the influence of the hospital environment. The impact of the active intervention may have been diluted by prevailing environmental factors which encouraged a more passive response to treatment. Another way in which the impact of the interventions may have been diluted was through communication between patients in different intervention groups who happened to be in the same hospital room or ward. Also the attitudes of carers or family may have been at odds with the messages given in the interventions.

In other research, interventions that have been designed to change patients' ways of coping have failed to show effects on questionnaires which have measured ways of coping despite showing beneficial associations with recovery (Ho et al., 1988; Manyande et al., 1992; 1995; see chapter 1). It may therefore be the case that these interventions are not working by changing coping style but through other components of the intervention or other mediational factors. One possibility is suggested by the animal experimental literature, in which procedures which were previously thought to act by influencing control over events are now suspected to exert many of their effects by changing the predictability of events (Maier, 1993). It has also been suggested that hesitancy with the coping message might reflect patients' need for predictability or safety which results from dependency on experts (Skinner, 1995). Alternatively, 'coping' interventions may be effective vehicles for social support (Salmon, 1992). A third possibility is that such interventions enhance feelings of respect and dignity, which was found to be important in this investigation. Respect and dignity appeared to be a greater need over information and active involvement of patients, creating a different agenda of what involvement meant for patients compared to what was offered. Such respect and dignity may have been perceived as reassuring and emotionally support by patients, and consequently may have been associated with reduced subjective distress. Such a psychological response would be compatible with the reduced physiological response.

Most studies have not questioned the compliance of the patients with interventions or attempted to measure the psychological uptake of the intervention. The present findings demonstrate that compliance cannot be assumed and that the way in which psychological interventions are taken up by patients is not straightforward. It may be that a more detailed analysis of the way in which interventions are accepted by patients may throw light on which components of an intervention actively assist recovery.

5.5 Conclusion

Firstly, this investigation outlined a range of patient perceptions about being 'passive' and 'active' subjects. The study's results are consistent with other research findings in the literature which show that active control over treatment is not always desirable (Thompson, 1981., Wallston et al., 1994). There was a preference for 'expert' versus patient involvement, which suggested that involvement is not valued by patients. Patients' notions of involvement were different from those understood by hospital staff. Indeed, patients' responses indicated their reluctance to take control over their treatment. The effectiveness of investigations which encourage active involvement amongst patients is questionable; individuals do not always want responsibility for their health and do not feel they can influence their treatment. Overall, patients' responses to interventions show that it must not be taken for granted that interventions communicated to patients will be received in the way intended, as are prescriptions and drugs. Patients' responses suggest that increased perceptions of respect and dignity by patients may be more positive for outcome compared to strategies which attempt to increase the amount of control that they have during their stay in hospital. Such an intervention is likely to be easier to implement and more easily accepted as responses to it are unlikely to be so dependent on dispositional factors. Future attempts to encourage control should take account of these issues. Secondly, the study showed that qualitative analysis is useful for assessing compliance with psychological interventions. Qualitative analysis may also prove a useful tool in the future for isolating the active components of effective interventions.

The poor uptake of the active coping message may have been because of cohort effects or individual dispositional factors. However, it may also reflect the overwhelming power of the hospital environment on patient behaviour. Psychological interventions may be taken up more strongly and be more effective when they are contextually supported. For example, in the present study, ward-based training amongst staff which facilitates either active or passive coping in patients.

The relevance of the above research findings to the main thesis is that it may help to explain differences, or lack of differences, between the effects of the psychological interventions on psychological or physiological responses to surgery. Although previous research has suggested some psychological and physiological intervening variables, no evidence has been made available on the meaning of interventions to individuals. The findings from this investigation helps to provide a better understanding of possible psychological factors responsible for mediating effects on recovery.

Chapter 6 Findings

Influence of psychological interventions on the physiological and psychological response to surgery

Chapter 6 Findings

Influence of psychological interventions on the physiological and psychological response to surgery

6.1 Sample characteristics

From a total of 271 patients considered, 187 were successfully recruited. Reasons for non-recruitment of individuals (N=84) included other present illness, hospital admission delays, other hospital commitments of patients, and straight forward refusal to take part in the study (see Figure 6.1 for specific reasons and numbers). Of these 187, 27 failed to complete the study (figure 6.1). The main reason for discontinuation was due to cancellation because of infection (e.g. upper respiratory tract). Other reasons included X-ray ambiguities and medical problems. A total of 160 patients completed the study. There were 107 THA patients and 53 TKA patients. 37.5% (N=60) were men and 62.5 % (N= 100) were women. 86% (N=138) had osteoarthritis and 13% (N= 21) had rheumatoid arthritis. Pathology was not recorded for one patient. Number of subjects in each group were: control = 53; passive = 53; active = 54. 53% (N=85) of patients were recruited from the RLUH teaching hospital and 47% (N=75) of patients were recruited from Broadgreen hospital. The mean age for THR and TKR patients was respectively 69.4 years (SD∓ 10.09) and 66.04 (SD∓11.10). A manipulation check showed the mean listening time of intervention tapes was 2.8 minutes for patients in the passive group (SD± 1.2) and 3.1 minutes for patients in the active group (SD± 1.5). Average duration of hospital stay was 19.9 days (SD∓ ±6.30).

The majority of patients were living with another person; they were living with a spouse (N=85) or living with a relative (N=12). Those residing alone were either widowed (N=50) or single (N=13). The average waiting time period was 9 months, and the mean duration of time people had been in pain was 5.4 years. 25% (N= 40) of patients had previous joint replacements. The average time since any previous THA or TKA operation was 17 months. 43 % (N= 69) attended a pre-admission clinic - the majority of these patients were from Broadgreen hospital, 87% (N= 65). 75% (N=120) of patients were having a THA or TKA for the first time. 25% (N=40) had experienced a previous THA or TKA. 7% (N= 11) of those recruited had their operations cancelled on a previous occasion.

In relation to the time of hospital admission, 20% (N=32) of patients were seen on the evening before their operation, and 80% (N=133) were seen two or three days before their operation. Across all experimental groups the majority of patients were seen two days before their surgery (Table 6.3). On returning home, the majority of patients had an able-bodied carer living with them (N=106). 12 people were living alone or had home care on a daily basis. If patients were having home care this usually lasted between 1- 4 weeks after discharge. 83% (N=133) had a six month follow-up. 2 patients had died in between one and six month follow-up (Table 6.7). Several biographical, perioperative and surgical variables, which might have influenced surgical outcome, were checked for homogeneity across different treatment and surgical groups (Table 6.1).

Table 6. 1 Comparisons between different treatment and surgical groups on biographical, peri-operative and surgery variables (degrees of freedom: intervention group 2, 151; type of surgery: 1, 151)

	Intervention				Surgery		
Variable	**C***	***P**	***A**	**F-ratio**	**Hip**	**Knee**	**F-ratio**
age (years)	69.83	66.40	68.11	0.28	69.14	66.04	0.01
pain period for joint being replaced (years)	43.4	57.3	80.4	1.36	58.6	64.2	0.10
waiting time period (months)	9.11	9.21	8.55	2.43	8.86	9.18	0.06
start time (hours/minutes)	11.31	10.58	10.67	1.64	10.69	11.19	2.95
duration of surgery (minutes)	97.6	106.4	104.7	1.30	109.7	90.4	13.31*
1 month follow-up (days)	29.4	31.1	33.0	3.88	31.6	30.2	1.41
6 month follow-up (days)	189.1	188.8	186.8	0.30	188.9	186.9	0.2
tourniquet time (minutes)	85.1	83.0	89.3	0.30	N/A	85.5	N/A
Days in hospital	20	19	20	0.36	20	20	0.27

F-ratio and mean scores in the table. * Treatment groups: C-control, P- Passive/Relaxation, A-Active/Imagery
$p < .001$.

Mean duration of surgery was 102.9 minutes. There was a significant difference in duration of surgery between patients having a THA and TKA (respective means and standard deviations: 109, SD∓ ±29.4; 90, SD∓ ±27.4) (Table 6.2). TKA on average took longer. Age, pain period, waiting time period and operation start did not differ significantly for type of surgery or treatment group. There were also no differences in the duration of surgery between the treatment groups. Surgery started for the majority of patients before midday (78%, N=35), whilst the remaining patients were rescheduled by surgeons for unforeseen clinical reasons relating to other patients.

Table 6. 2 Comparison of anaesthetic factors between different treatment groups and different types of surgery (means scores)

	Intervention				Surgery		
Variable	C	P	A	F-ratio	THA	TKA	F-ratio
Intravenous fluids in theatre:							
Blood (units)	0.67	0.88	0.84	0.74	1.1	0.3	30.87***
Other fluids (mls)	1892	1883	1912	0.02	2089	1540	26.45***
Blood pressure:							
Highest - systolic (mmHg)	160	160	162	0.10	160	164	0.76
Lowest - diastolic (mmHg)	102	100	162	0.60	95	109	26.87***
Pulse							
highest (rate per minute)	86	88	90	0.93	87	89	0.31
lowest (rate per minute)	58	59	60	0.83	58	61	3.70

F-ratio in table *p:<.05; **:p<.01**; ***:p<.001

More intravenous blood, and other fluids were given to THA compared to TKA patients perioperaptively. TKA patients had lower blood pressure during the perioperative period compared to THA patients. There were no other anaesthetic differences between treatment groups or different types of surgery.

Figure 6. 1 Recruitment of sample

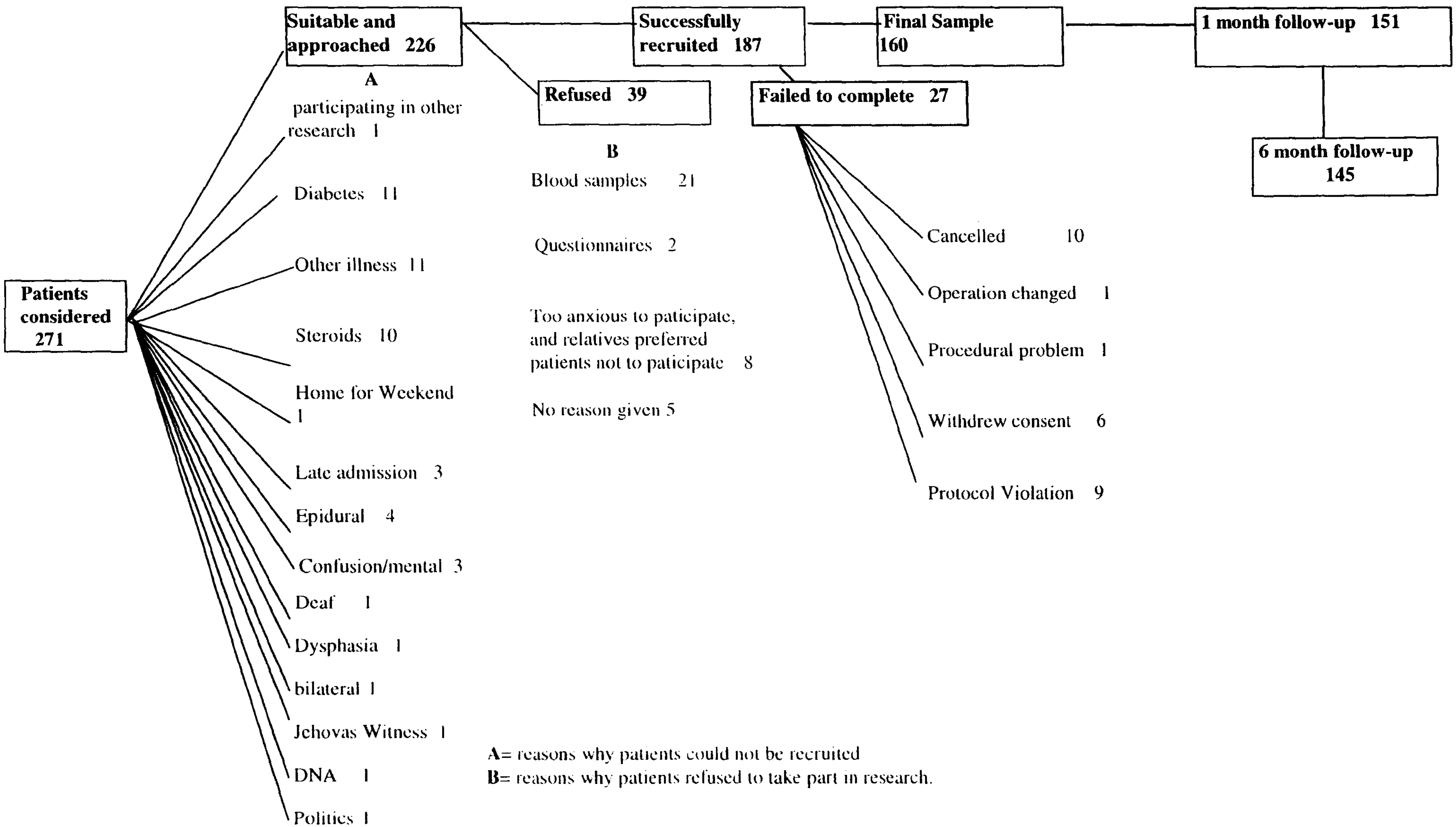


Table 6. 3 The day on which patients received interventions

	Intervention group		
Intervention conducted on:	**control**	**passive**	**active**
2-3 days preoperatively	44	51	39
1 day preoperatively	9	2	15
	51	53	54

[a] Patients seen 2 or 3 days before surgery. Patients seen 3 days preoperatively entered hospital on Friday and had their surgery on Monday. [b] Patients received intervention one day before surgery.

As shown in Table 6.3 the majority of patients in the control and passive intervention groups were seen at least two days prior to surgery. Due to restricted access and late admission slightly more patients in the active intervention group were seen the day before surgery.

6.2 Compliance

6.2.1 Hospital Questionnaires

Table 6. 4 Missing questionnaire data

Time	**not given**	**partly missed**	**Sickness**	**confused**	**refused**
Preoperatively	0	0	0	0	0
day 1	1	0	4	2	1
day 3	2	0	7	2	3
day 7	4	0	2	0	14
1 month	4	0	3	2	15
6 month	0	2	3	2	13
Totals	11	2	19	8	46

If patients missed a whole questionnaire or set of questionnaires on any assessment day this was recorded as missing data (Table 6.4). Main reasons for not completing on the day after surgery were sickness or confusion. The increase in refusal on day 7 was due mainly to patients being unwilling to fill in questionnaires. Patients who refused on day 7, also refused follow up visits, apart from one. Some patients were not able to fill in complete sets of questionnaires due to sickness; these are few and are not included in Table 6.4. Patients were recorded as not given questionnaires at 1 and 6 month follow-up if they had died or it had not been possible for the researcher to see patients on this day; these incidences were few. Two patients did not complete questionnaires fully at 6 month follow-up; this missing data was recorded as partly missed. One patient died before 1 month follow-up and another before 6 month follow-up.

Physiotherapy functional outcome was assessed for 93% (N = 148) of patients. The remaining 7% were not assessed due to staff holidays and time restrictions. Some patients failed to achieve transfer functions. (refer to Chapter 4) Patients in this category (N=2) had the number of days they spent in hospital recorded for this function. Some physiotherapy data were collected retrospectively from clinical records due primarily to staff shortages.

6.2.2 Biochemical data

Data were missing because of patient sickness or patient refusal, or because of unavailability of doctors to take blood samples. A very small proportion of samples that had been taken were not analysable due to small sample sizes (N=12), clotting of sample (N=4), breakage (N= 1) and disappearance (N=1).

6.2.3 Follow-up visits

The follow-up visit was carried out in the home or hospital. 94% (N=150) patients had a one month follow-up. 3% (N= 5) refused because they did not want to fill in any more questionnaires, and 3% (N= 5) felt too ill to continue with the study. The average number of days between the day of discharge, and one and six month follow-up, was respectively: 31.1 (SD∓ ±6.8) and 188.8 (SD∓ ±9.3). For the one month follow up 7% (N=11) of patients were seen in hospital, and 93% (N=149) were seen at home. Patients seen in hospital were seen on a ward (3%) or in outpatient physiotherapy (8%). At 6 months, of the 141 patients followed-up, 97 % (N= 137) were seen at home, and 3% (N= 4) in the hospital.

6.2.4 Compliance to intervention and protocol

When patients were asked how many times they had listened to their tape, 2 patients in the active intervention group reported that they had not listened to the tape. One did not listen because of fear of what was on the tape; the other disliked putting headphones in her ears (this patient was discounted from the study completely because of overall non-compliance). Both these patients were in the active intervention group. Tapes were listened to respectively by patients in the passive or active intervention groups on average 2.6 and 3.0 times preoperatively, and 3.2 and 3.4 times postoperatively (Table 6.5).

Table 6. 5 Mean number of times patients listened to intervention while in hospital

	Passive group		**Active group**	
Tape listened to	Preoperatively	Postoperatively	Preoperatively	Postoperatively
Number of times	2.6	3.2	3.0	3.4
SD	1.20	1.26	1.45	1.59
Range	1-5	1-5	1-5	1-6

Patients were asked on day 1 after surgery how many times they had listened to the tape preoperatively. At the end of the postoperative week they were asked how many times they had listened to the tape postoperatively.

During anaesthesia two patients (ids. 7 and 101) received etomidate, which is an inhibitor of cortisol synthesis. Both these patients had perioperative complications. One developed urinary retention and the other had perioperative cardiac problems. These patients were excluded from biochemical analysis.

6.3 The psychological response to surgery

6.3.1 Analysis strategy

This section documents the preoperative and postoperative psychological variables for the different intervention, joint replacement, gender and hospital groups (between-subject factors). All variables were checked to see if they were normally distributed. With the majority being normally distributed only 4 outcome variables needed to be transformed (log transformed: LOG_{10} (x+1)). Transformed variables included the SF-36 role limitation scales (mental and physical), and the Profile of Mood States depression and anger sub-scales. Refer to Chapter 3 for information about transformations.

One-way simple factorial ANOVAs assessed preoperative differences for each of the four between-subject factors, namely health belief, quality of life, mood and bodily state measures. Intervention levels were: passive, active, or attention control group (Tables 6.8 to 6.11). Type of surgery was either THA or TKA, hospital was either the RLUH or Broadgreen, and sex was either male or female. Preoperative analysis was performed to check baseline status of patients, and to check that for each of the 4 between subject factors (treatment group, type of surgery, gender, and hospital) patients were similar on all variables that would also be assessed postoperatively.. Where the main effects of intervention group was significant, differences were examined by *post hoc t*-tests.

After preoperative analysis, a postoperative analysis for each of the between-subject factors (treatment group, type of surgery, gender, and hospital) on outcome variables was performed to assess differences in the response to surgery, and to assess progress of patients over time. Repeated measures ANOVAs were used for variables measured more than once postoperatively. ANOVAs assessed main effects, change over time and interaction with time postoperatively for all psychological variables. Significant interactions of between subject factors with time were examined by *post hoc t*-tests; and these were performed also where the main effects of intervention group was significant.

The main effect of time was included in each postoperative analysis and its effects are identical in each, subject to minor differences arising from interpolation of missing data by the computer program. Therefore change over time is described for type of surgery but is disregarded for analyses of sex and hospital. In the section which highlights the postoperative effects of intervention groups on the psychological response, because the effect of different interventions is central to this investigation, main effects as well as main effect of time and interaction with time are commented upon.

Initially, all results were tested for significance at $p < 0.05$. Due to the large number of variables in this investigation the probability of accepting false positives (Type 1 error) in the data is increased. Therefore, patterns of significance in results, as opposed to isolated variables, were examined. In order to reduce the extent of Type 1 error it was considered appropriate for the final assessment of results to select only those findings with $p < 0.01$ or less, as being significant.

6.3.2 Preoperative comparisons

6.3.2.1 Health belief measures

Table 6. 6 Preoperative comparisons for health belief questionnaires.

Variable	Hospital	Gender	Type of surgery	DF[a]	Intervention Group	DF[b]
Locus of Control (LOC)						
chance	1.11	3.77*	0.11	1,158	0.87	2,157
general threat	0.77	2.31	0.08	1,158	0.40	2,157
provider control	0.33	0.49	0.15	1,158	1.79	2,157
self control	0.32	8.15**	1.48	1,158	0.02	2,157
Health Opinion Survey (HOS)						
informational	0.33	3.03	6.89*	1,158	0.36	2,157
behaviour	0.95	0.16	0.44	1,158	3.88*	2,157

F-ratio in table *p:<.05; **:p<.01**; ***:p<.001. DF[a] - Degrees of freedom for analysis of hospital, gender, type of surgery. DF[b] - Degrees of freedom for analysis of intervention group.

Females attributed health factors more to chance than males (respective means: 20.7, 22.6) and had less self-control regarding their health compared to males (respective means: 21.1, 19.0). There were no differences on health information seeking or health behaviour between men and women (Table 6.6). No differences were seen between the two hospitals for health-belief and opinion questionnaires (Table 6.6). TKA patients reported more information-seeking than TKA patients on the Health Opinion Survey (respective means: 33, 3.17 (Table 6.6).

Control group patients reported more behavioural involvement in health care compared to those in the active ($t = 2.79$, $p < .05$) and passive ($t=2.58$, $p < .05$) group (respective means: 3.21, 2.38, 2.23). Refer to Appendix 2 for complete mean scores for health beliefs and all other psychological variables that are reported below.

6.3.2.2 Quality of life

Table 6.7 Preoperative comparisons on quality of life questionnaires

Variable	**DF[a]**	**Hospital**	**Gender**	**Type of surgery**	**Intervention Group**	**DF[b]**
SF-36 (Total)	1,158	3.26	9.15**	1.19	0.89	2,157
physical function	1,158	0.35	7.90**	0.46	0.24	2,157
physical role-limitation	1,158	0.06	17.20***	2.60	0.42	2,157
mental role-limitation	1,158	2.69	1.52	3.33	0.41	2,157
social function	1,158	0.30	9.37**	0.26	2.80	2,157
mental health	1,158	2.89	11.79**	0.17	0.61	2,157
vitality	1,158	1.07	7.93**	0.78	0.50	2,157
pain	1,158	1.52	1.40	0.12	2.84	2,157
health perception	1,158	5.14*	0.39	6.60*	0.84	2,157
MHI - positive effect	1,158	0.87	9.43**	2.85	0.59	2,157
Face scale	1,158	1.00	1.26	0.07	0.59	0.59
Cantril's ladder	1,158	2.35	6.33*	0.00	0.15	0.15

F-ratio in table *p:<.05; **:p<.01**; ***:p<.001. MHI -Mental Health Inventory. Df[a] - Degrees of freedom for analysis of hospital, gender and type of surgery. DF[b] - Degrees of freedom for analysis of intervention group.

Overall, men and women differed on several quality of life domains (Table 6.7) measured by the SF-36. Men reported superior physical function (male versus female mean: 24.9, 16.0), less physical role limitation (male versus female mean: 22.9, 10.0), better social functioning (male versus female mean: 56.5, 41.0) and mental health functioning (male versus female mean: 73.3, 62.5), greater levels of vitality (male versus female ratio: 51.2, 41.4) and positive affect (male versus female mean: 43.7, 37.8) than women. The response to Cantril's ladder also showed men to experience a 'higher' quality of life compared to women (respective means: 6.62, 5.86). Patients at Broadgreen hospital reported more positive health perceptions, compared to those at the RLUH (respective means: 74.8, 67.3). THA patients had more positive health perceptions compared to TKA patients (figure 6.2). There were no preoperative differences between patients in the control, passive or active intervention group on any quality of life measures.

6.3.2.3 *Mood*

Table 6.8 Preoperative comparisons for mood

Variable	DF[a]	Hospital	Gender	Type of surgery	Intervention Group	DF[b]
Profile of Mood States (POMS)						
anger	1,158	3.44	0.96	0.39	0.88	0.88
confusion	1,158	5.32*	0.54	5.63*	0.34	0.34
depression	1,158	3.88*	1.52	1.02	1.70	2,157
lack of energy	1,158	2.65	0.03	1.93	1.25	2,157
friendliness	1,158	0.12	0.05	3.27	0.47	2,157
tension	1,158	3.57	1.86	1.58	0.72	2,157
vigour	1,158	0.54	3.17	1.90	0.60	2,157

F-ratio in table *p:<.05; **:p<.01**; ***:p<.001 Df[a] - Degrees of freedom for analysis of hospital, gender and type of surgery. DF[b] - Degrees of freedom for analysis of intervention group.

There were no preoperative differences between men and women on any mood variables (Table 6.8). Patients at the RLUH experienced more confusion (RLUH versus Broadgreen means: 6.4, 4.9) and depression (RLUH versus Broadgreen means: 8.8, 6.0) on the Profile of Mood states (POMS) compared to patients at Broadgreen hospital. TKA patients were more confused preoperatively compared to THA patients (figure 6.3).

There were no preoperative differences between the control, passive and active intervention group on mood measures (figure 6.8).

6.3.2.4 Bodily state

Table 6. 9 Preoperative comparisons on bodily state questionnaires

Variable	DF[a]	Hospital	Gender	Type of Surgery	Intervention Group	DF[b]
Visual Analogue Scale (VAS)						
Intensity of pain	1,156	0.49	2.87	0.38	1.95	2,155
distress caused by pain	1,156	1.52	1.12	0.15	0.66	2,155
ability to cope with pain	1,156	4.23*	0.98	1.11	1.90	2,155
Recovery Inventory (RI)	1,156	2.83	3.37	0.04	0.02	2,155
Fatigue						
physical	1,151	4.46*	11.45***	0.48	0.63	2,157
mental	1,151	2.42	0.03	5.91*	0.78	2,157
W.O.M.A.C						
pain	1,151	3.98*	5.79*	0.00	7.09***	2,157
stiffness	1,151	2.80	1.10	0.15	1.07	2,157
physical function	1,151	3.32	8.59**	5.50*	1.93	2,157

F-ratio in table *p:<.05; **:p<.01**; ***:p<.001 Df[a] - Degrees of freedom for analysis of hospital, gender and type of surgery. DF[b] - Degrees of freedom for analysis of intervention group.

On bodily state measures men reported better overall general health as measured by the Recovery Inventory, were not as physically fatigued as women as measured by Chalder et als.(1993) fatigue scale, and had less difficulty with physical functioning and less pain as measured by the W.O.M.A.C scale (respective means: 30.0, 28.4; 23.8, 26.4; 11.7, 13.2) (Table 6.9). There were no preoperative gender differences for intensity, distress and ability to cope with pain as measured by a VAS scale. Patients at Broadgreen hospital reported greater ability to cope with pain, and experienced less physical fatigue than patients at the RLUH (respective means: 52.0, 54.0; 12.0, 13.2). TKA patients reported greater mental fatigue but less functional difficulty on W.O.M.A.C in comparison to THA patients. (figure 6. 5 and 6.6) There was a difference between intervention groups on pain experienced during activities (W.O.M.A.C scale); patients in the passive group reported less pain than those in the control ($t = 2.54$, $p < .001$) and active group ($t = 3.46$, $p < .001$) (figure 6.6c).

6.3.3 Postoperative comparisons

6.3.3.1 Effects of type of surgery and change over time

Table 6. 10 Postoperative comparisons between THA and TKA patients on coping measures

Variable	Type of Surgery (J)	DF[a]	Time (T)	JxT	DF[b]
Ways of coping (WOC)					
problem-focused	1.50	1,152	2.12	0.11	1,126
wishful thinking	2.53	1,152	1.52	0.45	1,124
detachment	0.13	1,152	0.00	1.55	1,126
support	0.00	1,152	0.78	0.99	1,125
positive thinking	0.88	1,152	0.01	0.13	1,124

F-ratio in table *p:<.05; **:p<.01**; ***:p<.001. DF[a] - Degrees of freedom for analysis of type of surgery - main effects. DF[b] - Degrees of freedom for analysis of interaction of surgical group with time.

There were no differences between different surgical groups (THA and TKA) on patient coping, which remained stable over time (Table 6.10). Refer to Appendix 2a for complete mean scores.

Table 6. 11 Postoperative comparisons between THA and TKA patients on quality of life measures

Variable	**Type of Surgery (J)**	**DF[a]**	**Time (T)**	**JxT**	**DF[b]**
QUALITY OF LIFE (SF-36)					
physical function	1.82	1,151	113.78***	6.55*	1,142
physical role limitation	9.26**	1,151	123.02***	3.97*	1,141
mental role limitation	7.93**	1,151	11.31***	1.06	1,141
social function	0.91	1,151	124.67***	6.75*	1,141
mental health	5.41*	1,151	5.91*	1.31	1,139
vitality	1.73	1,151	24.31***	1.07	1,139
pain	35.24***	1,151	2.67	0.32	1,141
health perception	7.04**	1,151	1.26	0.76	1,142
positive effect	0.24	1,151	5.05*	0.96	1,140
Face scale	0.86	1,156	9.41***	0.11	3,419
Cantril's Ladder	2.73	1,156	9.66***	0.05	3,417

F-ratio in table *p:<.05; **p>.01**; ***:p<.001. DF[a] Degrees of freedom for analysis of type of surgery - main effects. DF[b] - Degrees of freedom for analysis of interaction of surgical group with time.

THA patients had less physical and mental role limitation, less pain, and improved mental health and health perceptions than TKA patients. Domains of quality of life that did not improve from surgery to six-month follow-up were bodily pain and health perception (Table 6.11). A greatly increased quality of life after surgery was seen for patients having both types of operation on most dimensions of the SF-36, and on the Face scale and Cantril's ladder (Table 6.11 and figure 6.2 a-i -SF-36).

THA patients however, reported accelerated progress in physical and social function, reduced physical role limitation by comparison with TKA, at specific times in the postoperative recovery period, indicated by an interaction of type of surgery with time (Table 6.11). THA had increased physical function(t=2.64, p<.01), physical role limitation (t=3.85, p<.001) and social function (t=2.33, p<05) at six month follow-up than TKA (Table 6.11 & figure 6.2). THA patients had greater postoperative quality of life in comparison to TKA patients on specific dimensions of the SF-36 (Table 6.11). Other measures of quality of life (Face scale and Cantril's ladder) showed no differences between the different surgical groups (Table 6.11 - Time (T) and figure 6.2a,b,g).

Table 6.12 Postoperative comparisons between THA and TKA patients on mood measures

Variable	**Type of Surgery (J)**	**DF[a]**	**Time (T)**	**JxT**	**DF[a]**
MOOD (POMS)					
anger	1.66	1,153	2.79*	1.62	3,414
confusion	3.07	1,153	12.50***	1.98	3,413
depression	0.77	1,153	8.43***	1.41	3,414
lack of energy	5.92*	1,153	12.12***	0.89	3,414
friendliness	0.00	1,153	36.44***	0.52	3,414
tension	2.85	1,153	18.76***	0.72	3,413
vigour	2.86	1,153	25.43***	0.95	3,413

f-ratio in table * P:>.01; **:P<.01**; ***:P<.001. DF[a] -Degrees of freedom for analysis of type of surgery - main effects. df[b] - degrees of freedom for analysis of interaction of surgical group with time.

Apart from total knee replacement patients reporting increased energy postoperatively in comparison to total hip replacement patients (figure 6.3), there were no other main effects on mood variables (Table 6.12). Type of surgery did not interact with time for mood variables (Table 6.12). There was a reduction in anger, confusion, depression and tension, and an increase in energy, friendliness and vigour for both surgical groups (figure 3.1a-i).

Figure 6.2 Pre and postoperative QoL comparisons between surgical groups

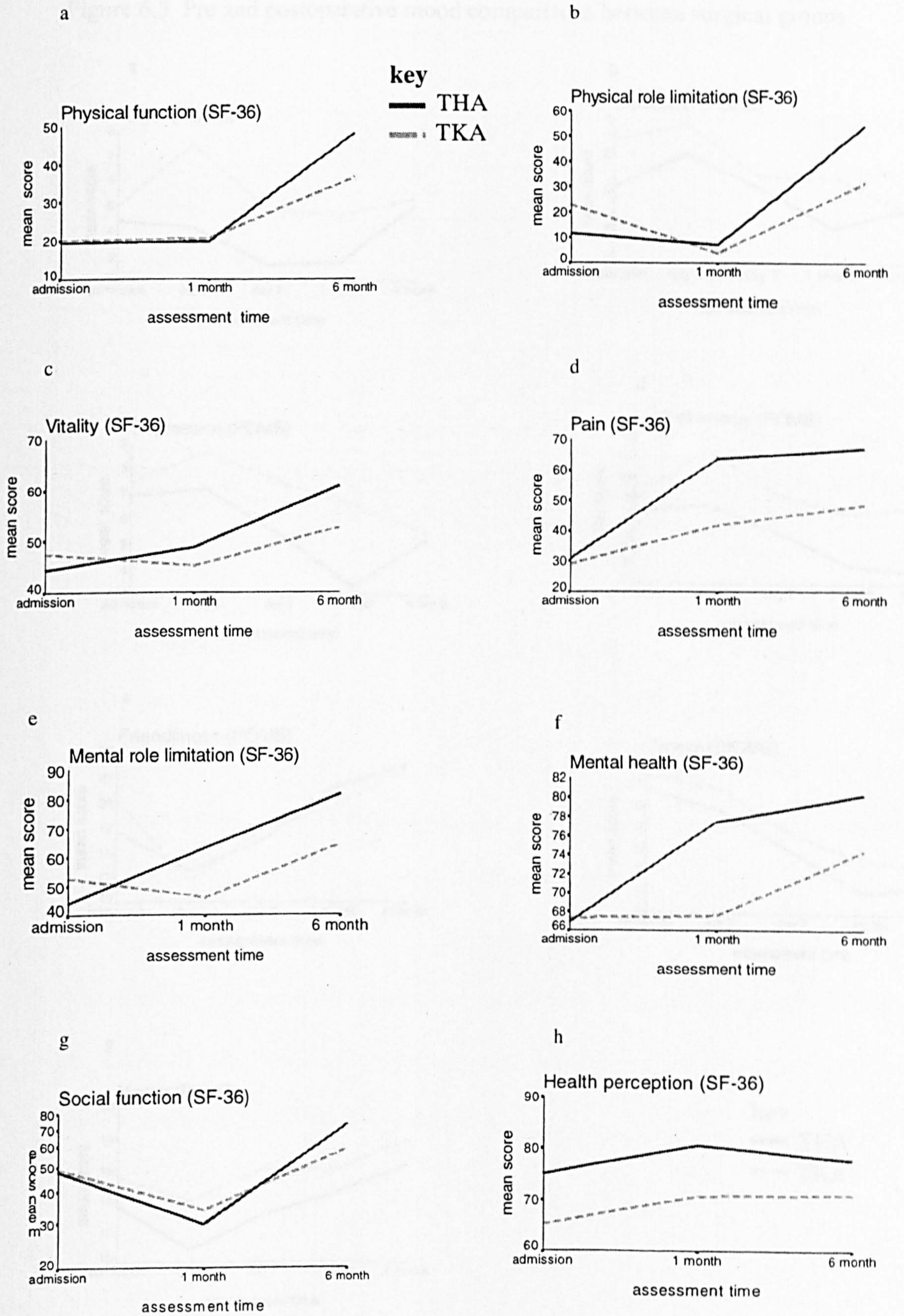


Figure 6.3 Pre and postoperative mood comparisons between surgical groups

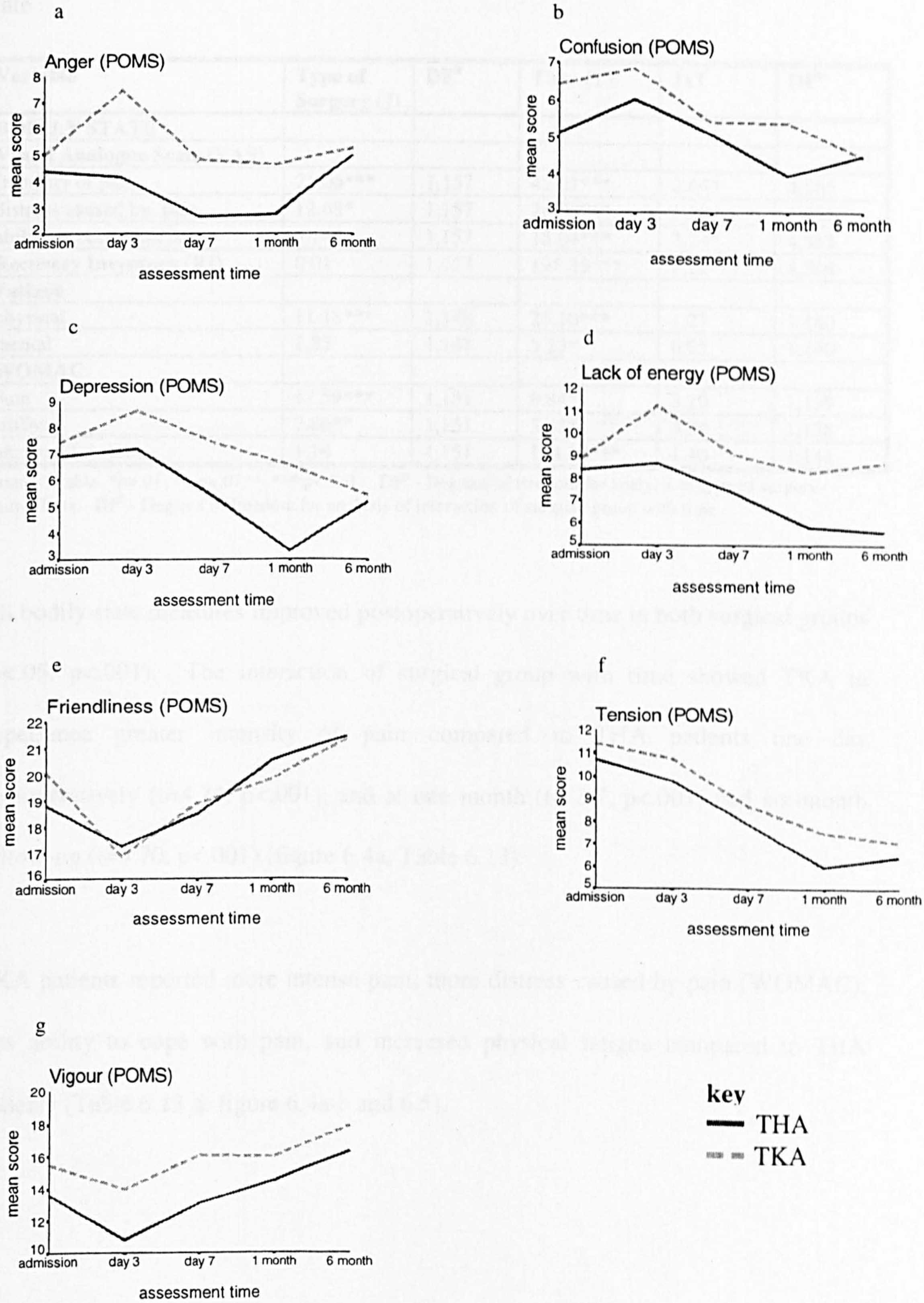


Table 6.13 Postoperative comparisons between THA and TKA patients on bodily state

Variable	Type of Surgery (J)	DF[a]	Time (T)	JxT	DF[b]
BODILY STATE					
Visual Analogue Scale (VAS)					
Intensity of pain	21.06***	1,157	42.01***	2.64*	4,566
distress caused by pain	12.68*	1,157	24.06***	1.19	4,465
ability to cope with pain	5.14*	1,157	15.04***	3.23*	4,565
Recovery Inventory (RI)	0.01	1,157	195.33***	2.22	4,564
Fatigue					
physical	11.18***	1,148	25.10***	1.27	1,140
mental	1.83	1,148	5.23*	0.95	1,140
WOMAC					
pain	17.59***	1,151	6.84*	3.20	1,139
stiffness	7.86**	1,151	5.43*	3.04	1,138
physical function	1.14	1,151	114.38***	1.40	1,141

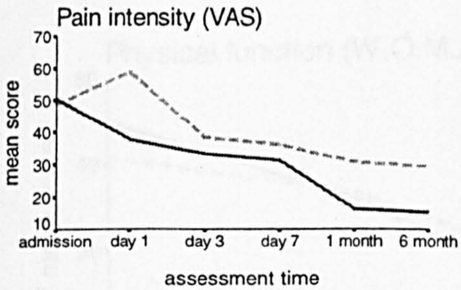
F-ratio in table *p>.01: **:p<.01**; ***:p<.001. DF[a] - Degrees of freedom for analysis of type of surgery - main effects. DF[b] - Degrees of freedom for analysis of interaction of surgical group with time.

All bodily state measures improved postoperatively over time in both surgical groups (p<.05. p<.001). The interaction of surgical group with time showed TKA to experience greater intensity of pain compared to THA patients one day postoperatively (t=4.74, p<.001), and at one month (t= 3.7, p<.001) and six-month follow-up (t=3.70, p<.001) (figure 6.4a, Table 6.13).

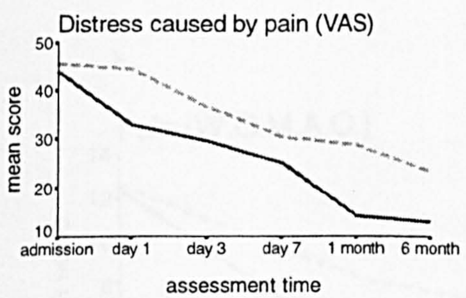
TKA patients reported more intense pain, more distress caused by pain (WOMAC), less ability to cope with pain, and increased physical fatigue compared to THA patients (Table 6.13 & figure 6.4a-c and 6.5).

Figure 6.4. Pre and postoperative pain comparisons between surgical groups

a



b



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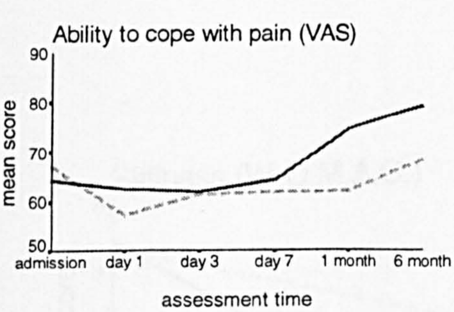


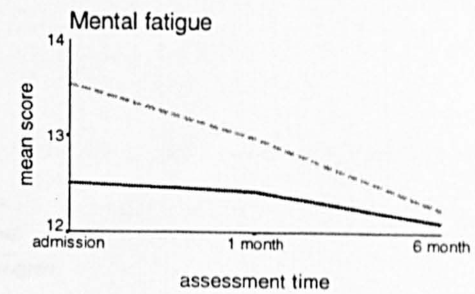
Figure 6.5 Pre and postoperative fatigue comparisons between surgical groups

key

THA

TKA

a



b

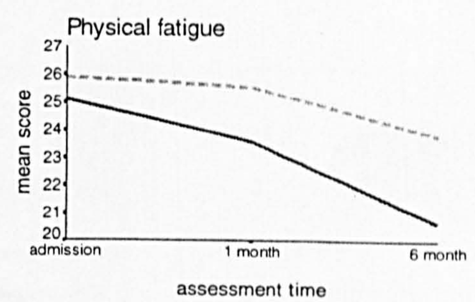
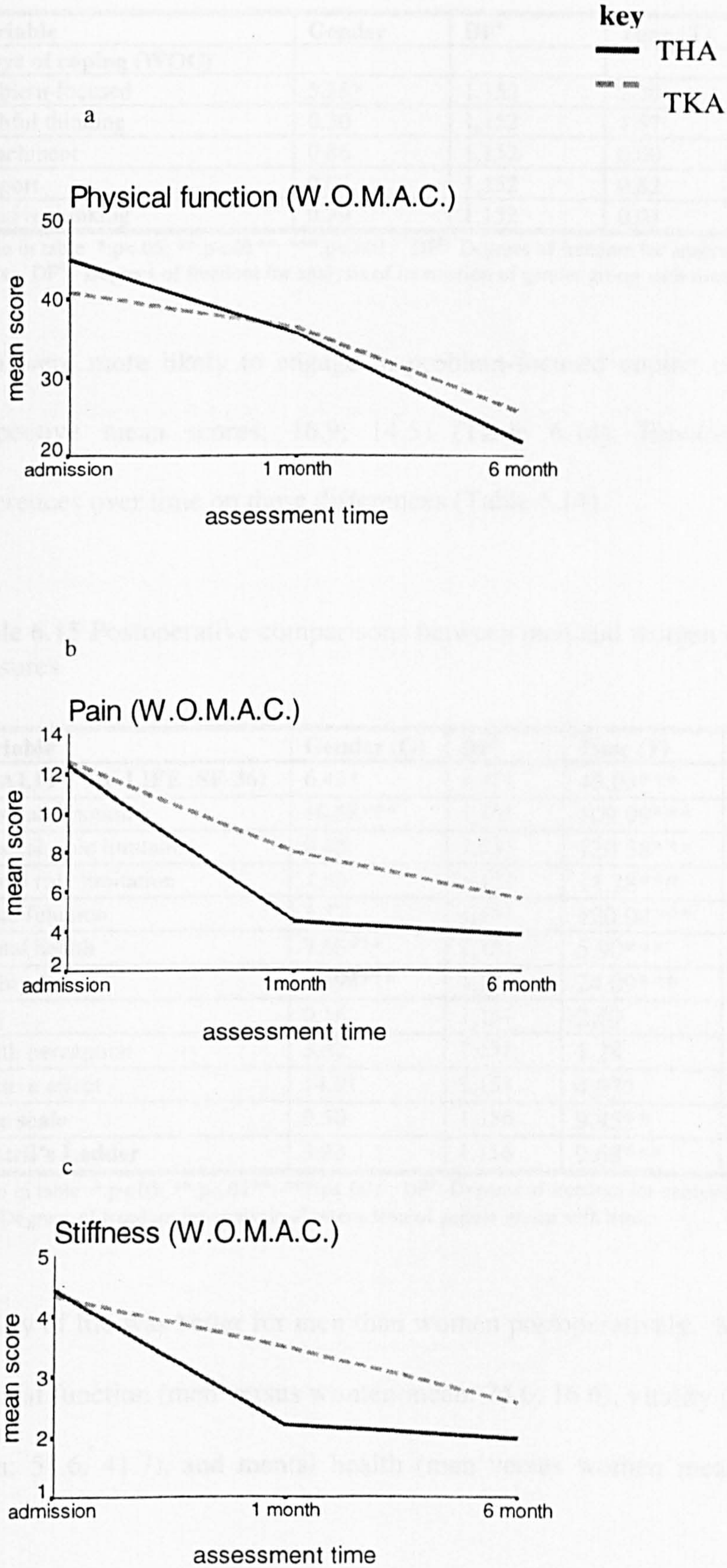


Figure 6.6 Pre and postoperative comparisons of physical function difficulty, pain and stiffness during physical activities (W.O.M.A.C scale)



6.3.3.2 *Effects of gender*

Table 6. 14 Postoperative comparisons between men and women on coping measures

Variable	Gender	DF[a]	Time (T)	GxT	DF[b]
Ways of coping (WOC)					
problem-focused	5.55*	1,152	2.20	3.27	1,126
wishful thinking	0.30	1,152	1.57	0.40	1,124
detachment	0.86	1,152	0.00	1.98	1,126
support	0.07	1,152	0.82	0.76	1,125
positive thinking	0.39	1,152	0.01	0.56	1,124

F-ratio in table *:p<.05; **:p<.01**; ***:p<.001. DF[a]- Degrees of freedom for analysis of gender - main effects. DF[b] - Degrees of freedom for analysis of interaction of gender group with time.

Men were more likely to engage in problem-focused coping compared to women (respective mean scores: 16.9, 14.5) (Table 6.14). However, there were no differences over time on these differences (Table 6.14).

Table 6.15 Postoperative comparisons between men and women on quality of life measures

Variable	Gender (G)	DF[a]	Time (T)	GxT	DF[b]
QUALITY OF LIFE (SF-36)	6.43*	1,151	43.08***	0.01	1,142
physical function	10.58***	1,151	109.99***	0.46	1,142
physical role limitation	0.45	1,151	120.38***	0.04	1,141
mental role limitation	1.63	1,151	11.28***	0.22	1,141
social function	1.37	1,151	120.04***	0.21	1,141
mental health	7.63***	1,151	5.90***	0.01	1,139
vitality	10.95***	1,151	24.09***	0.21	1,139
pain	0.16	1,151	2.69	0.41	1,141
health perception	3.62	1,151	1.28	0.02	1,142
positive effect	14.91	1,151	4.97*	0.35	1,141
Face scale	0.30	1,156	9.45**	1.16	3,419
Cantril's Ladder	3.23	1,156	9.68***	0.82	3,417

F-ratio in table *:p<.05; **:p<.01**; ***:p<.001. DF[a] -Degrees of freedom for analysis of gender - main effects. DF[b] - Degrees of freedom for analysis of interaction of gender group with time.

Quality of life was better for men than women postoperatively. Men reported higher physical function (men versus women mean: 24.6, 16.6), vitality (men versus women mean: 51.6, 41.7), and mental health (men versus women mean: 73.1, 62.9) than women (Table 6.15). Differences between men and women did not interact with time (Table 6.15).

Table 6. 16 Postoperative comparisons between men and women on mood measures

Variable	Gender (G)	DF[a]	Time	GxT	DF[b]
MOOD (POMS)					
anger	0.38	1,153	2.84*	0.64	3,414
confusion	0.15	1,153	12.42***	1.06	3,413
depression	0.37	1,153	8.67***	5.54***	3,414
lack of energy	1.99	1,153	12.09***	0.45	3,414
friendliness	0.92	1,153	36.28***	0.22	3,414
tension	1.24	1,153	18.73***	0.65	3,413
vigour	16.50***	1,153	25.43***	0.41	3,413

F-ratio in table *:p<.05; **:p<.01**; ***:p<.001 Df[a]- Degrees of freedom for analysis of gender - main effects. DF[b] - Degrees of freedom for analysis of interaction of gender group with time.

Men reported more vigour than women (respective means: 16.2, 12.3) (Table 6.16). Gender interacted with time on mood measures; women reported more depression than men at six month follow-up (respective means: 6.2, 4.2), t=2.5, p<.001 (Table 6.16).

Table 6.17 Postoperative comparisons between men and women on bodily state

Variable	Gender (G)	DF[a]	Time (T)	G x T	DF[b]
BODILY STATE					
Visual Analogue Scale (VAS)					
Intensity of pain	1.46	1,157	41.76***	1.01	4,566
distress caused by pain	0.60	1,157	24.10***	0.96	4,465
ability to cope with pain	0.22	1,157	15.11***	1.30	4,565
Recovery Inventory (RI)	5.71*	1,157	194.85***	1.02	4,564
Fatigue					
physical	2.08	1,148	25.25***	0.06	1,140
mental	1.23	1,148	5.17*	0.02	1,140
WOMAC					
pain	0.51	1,151	6.55*	0.47	1,139
stiffness	0.00	1,151	5.30*	1.15	1,138
physical function	4.44*	1,151	113.87***	0.17	1,151

F-ratio in table *:p<.05; **:p<.01**; ***:p<.001 DF[a] - Degrees of freedom for analysis of gender - main effects. DF[b] - Degrees of freedom for analysis of interaction of gender group with time.

Men reported better physical wellbeing than women (respective means on the Recovery Inventory: 27.3, 25.7) and had less functional difficulty on a physical level as measured by the WOMAC (respective means: 27.0, 31.2) (Table 6.17). Gender did not interact with time (Table 6.17).

6.3.3.3 Differences between hospitals

Table 6.18 Postoperative comparisons between hospitals on coping measures

Variable	Hospital (H)	DF[a]	Time (T)	HxT	DF[b]
COPING					
Ways of coping (WOC)					
problem-focused	0.45	1,152	2.07	0.64	1,126
wishful thinking	1.53	1,152	1.56	0.01	1,124
detachment	0.01	1,152	0.00	0.58	1,126
support	0.08	1,152	0.88	0.40	1,125
positive thinking	0.54	1,152	0.01	0.62	1,124

F-ratio in table *p>.01; **:p<.01**; ***:p<.001. DF[a]- Degrees of freedom for analysis of hospital - main effects. DF[b] - Degrees of freedom for analysis of interaction of hospital group with time.

There were no differences between hospitals on patient coping, and no interactions with time (Table 6.18).

Table 6.19 Postoperative comparisons between hospitals on quality of life measures

Variable	Hospital (H)	DF[a]	Time (T)	HxT	DF[b]
QUALITY OF LIFE (SF-36)	0.00	1,151	43.818***	0.01	1,142
physical function	1.02	1,151	109.99***	0.00	1,142
physical role limitation	0.85	1,151	120.46***	0.05	1,141
mental role limitation	0.17	1,151	11.46***	2.26	1,141
social function	0.00	1,151	120.16***	0.11	1,141
mental health	0.41	1,150	5.87*	0.13	1,139
vitality	0.09	1,151	24.16***	0.46	1,139
pain	0.09	1,151	2.64	0.09	1,141
health perception	3.59	1,151	1.30	0.25	1,142
MHI -positive effect	0.29	1,151	4.92*	0.72	1,140
Face scale	0.42	1,156	9.41***	0.05	3,419
Cantril's Ladder	0.47	1,156	9.81***	0.87	3,417

F-ratio in table *:p<.05; **:p<.01**; ***:p<.001 DF[a] -Degrees of freedom for analysis of hospital - main effects. DF[b] - Degrees of freedom for analysis of interaction of hospital group with time.

There were no differences between hospitals on quality of life measures (Table 6.19). Also, there was no interaction with time.

Table 6. 20 Postoperative comparisons between hospitals on mood measures

Variable	Hospital (H)	DF[a]	Time (T)	HxT	DF[b]
MOOD (POMS)					
anger	12.41***	1,153	2.83*	3.00*	3,414
confusion	3.62	1,153	12.53**	0.85	3,413
depression	6.93**	1,153	8.48**	2.99*	3,414
lack of energy	3.46	1,153	12.21***	0.70	3,414
friendliness	0.78	1,153	36.44***	0.43	3,414
tension	7.31	1,153	19.44***	4.72**	3,413
vigour	0.82	1,153	25.33***	0.33	3,413

F-RATIO IN TABLE *:P<.05; **:P<.01**; ***:P<.001. DF[a] -Degrees of freedom for analysis of hospital - main effects. DF[b] - Degrees of freedom for analysis of interaction of hospital group with time.

Patients at the RLUH hospital reported overall greater increased anger and depression postoperatively by comparison with those at Broadgreen hospital (respective means: 5.0, 3.6 ; 7.9 , 5.1) (Table 6.20).

An interaction of hospital with time was seen for anger, depression, and tension. Patients at the RLUH reported more tension than patients at Broadgreen on days three (t=3.07, p<.001) (respective means:11.7, 8.6), and seven (t=3.69, p<.001), (respective means: 10.4, 6.6); more depression on day seven (t=1.92, p<.05), (respective means: 8.0, 4.7), more anger on day three (t=3.60, p<.001) (respective means: 6.3, 3.5), day seven (t=3.13, p<.001) (respective means: 4.4, 2.7), and at one month follow-up (t=2.64, p<.001) (respective means: 4.2, 2.9) (Table 6.20).

Table 6.21 Postoperative comparisons between hospitals on bodily state

Variable	Hospital (H)	DF[a]	Time (T)	HxT	DF[b]
BODILY STATE					
Visual Analogue Scale (VAS)					
Intensity of pain	0.26	1,157	41.78***	0.56	4,566
distress caused by pain	0.09	1,157	24.13***	1.25	4,465
ability to cope with pain	0.00	1,157	15.08***	1.47	4,565
Recovery Inventory (RI)	0.89	1,157	195.05***	0.87	4,564
Fatigue					
physical	0.15	1,148	25.23***	1.04	1,140
mental	0.24	1,148	5.16*	2.85	1,140
WOMAC					
pain	0.02	1,151	6.41*	0.05	1,139
stiffness	1.16	1,151	5.10*	0.15	1,138
physical function	3.07	1,151	114.57***	0.76	1,141

F-ratio in table *:p<.05; **:p<.01**; ***:p<.001. DF[a]- Degrees of freedom for analysis of hospital - main effects. DF[b] - Degrees of freedom for analysis of interaction of hospital group with time.

There were no differences between patients at different hospitals on any bodily state measures (Table 6.21). Hospital did not interact with time (Table 6.21).

6.3.3.4 Differences between intervention groups

Table 6.22 Postoperative comparisons between intervention groups on coping measures

Variable	Group (G)	DF[a]	Time (T)	G x T	DF[b]
COPING					
Ways of coping (WOC)					
problem-focused	0.29	2,151	2.10	0.16	2,151
wishful thinking	0.25	2,151	1.51	0.63	2,151
detachment	0.24	2,151	0.00	1.25	2,151
support	0.44	2,151	0.89	2.72	2,151
positive thinking	1.30	2,151	0.01	0.37	2,151

F-ratio in table *:p<.05; **:p<.01**; ***:p<.001. DF[a] -Degrees of freedom for analysis of intervention - main effects. DF[b] - Degrees of freedom for analysis of interaction of intervention group with time.

There were no differences in coping strategies between control, passive and active intervention groups (Table 6.22).

Table 6.23 Postoperative comparisons between intervention groups on quality of life measures

Variable	Group (G)	DF[a]	Time (T)	G x T	DF[b]
QUALITY OF LIFE (SF-36)	0.08	2,150	43.02***	1.34	2,141
physical function	1.13	2,150	109.28***	0.45	2,141
physical role limitation	0.35	2,150	119.51***	0.33	2,140
mental role limitation	0.45	2,150	11.30***	0.92	2,140
social function	0.30	2,150	119.42***	0.03	2,140
mental health	0.18	2,149	5.87*	0.84	2,138
vitality	0.39	2,149	23.98***	0.39	2,138
pain	0.45	2,150	2.54	2.78	2,140
health perception	0.58	2,150	1.49	3.31*	2,141
positive effect	0.65	2,146	4.81*	1.99	2,139
Face scale	0.28	2,155	9.16***	1.39	6,416
Cantril's Ladder	0.24	2,155	9.63***	2.04	6,414

F-ratio in table *:p<.05; **:p<.01**; ***:p<.001. DF[a] -Degrees of freedom for analysis of intervention - main effects. DF[b] - Degrees of freedom for analysis of interaction of intervention group with time.

There were no overall differences on quality of life variables between control, passive and active intervention groups (Table 6.23 and figure 6.7). An interaction of group with time was seen for health perceptions. Patients in the control group were more positive at 6 month follow-up compared to those in the passive and active groups (respective *ts* = 1.6 and 1.8, p <.05).

Figure 6.7 Quality of life comparisons between intervention groups

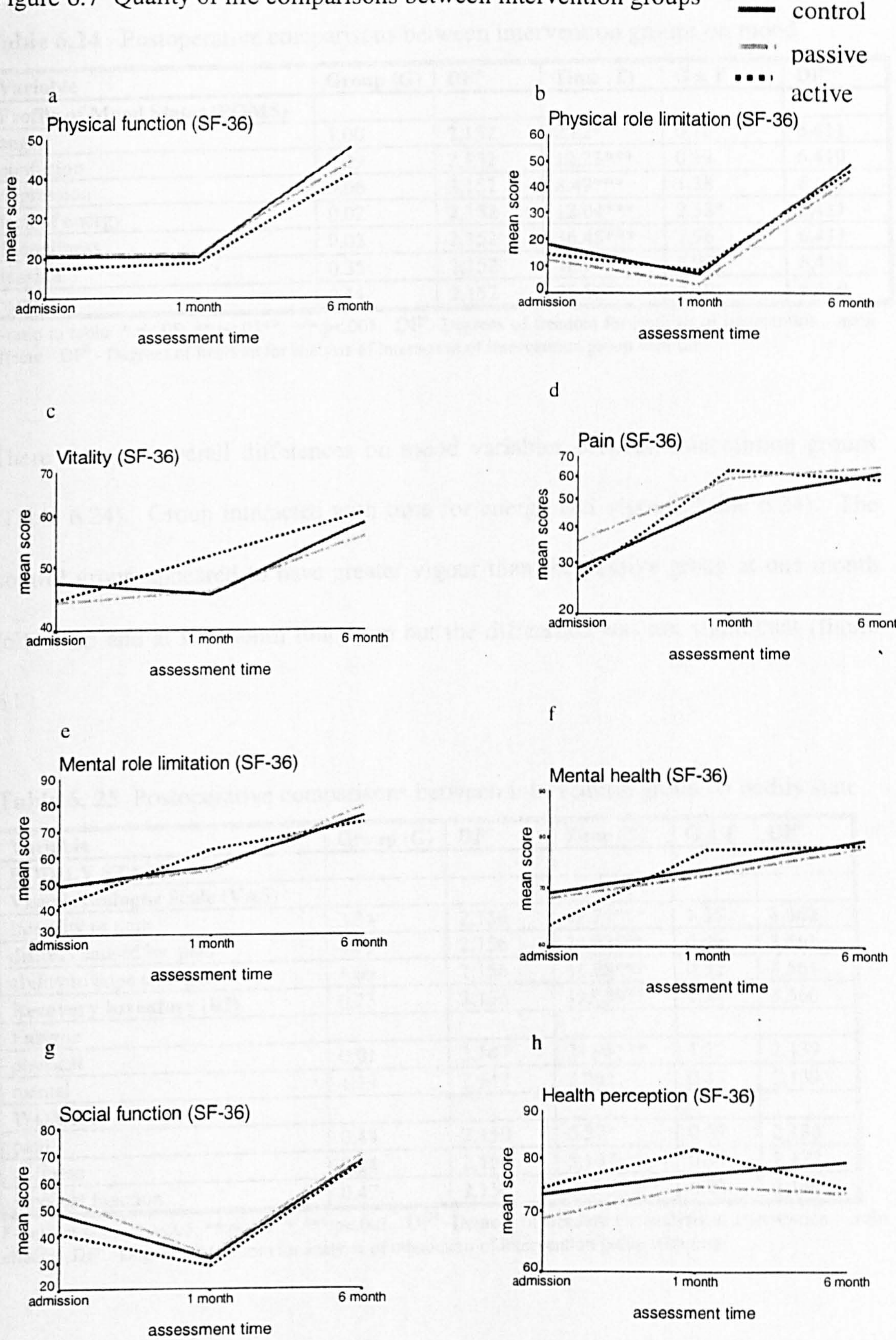


Table 6.24 Postoperative comparisons between intervention groups on mood

Variable	Group (G)	DF[a]	Time (T)	G x T	DF[b]
Profile of Mood States (POMS)					
anger	1.00	2,152	2.82*	0.76	6,411
confusion	0.29	2,152	12.23***	0.59	6,410
depression	0.06	2,152	8.49***	1.38	6,411
lack of energy	0.02	2,152	12.04***	2.38*	6,411
friendliness	0.03	2,152	36.45***	1.96	6,411
tension	0.35	2,152	18.90***	1.93	6,410
vigour	0.11	2,152	25.56***	2.19*	6,410

F-ratio in table *:p<.05; **:p<.01**; ***:p<.001. DF[a] -Degrees of freedom for analysis of intervention - main effects. DF[b] - Degrees of freedom for analysis of interaction of intervention group with time.

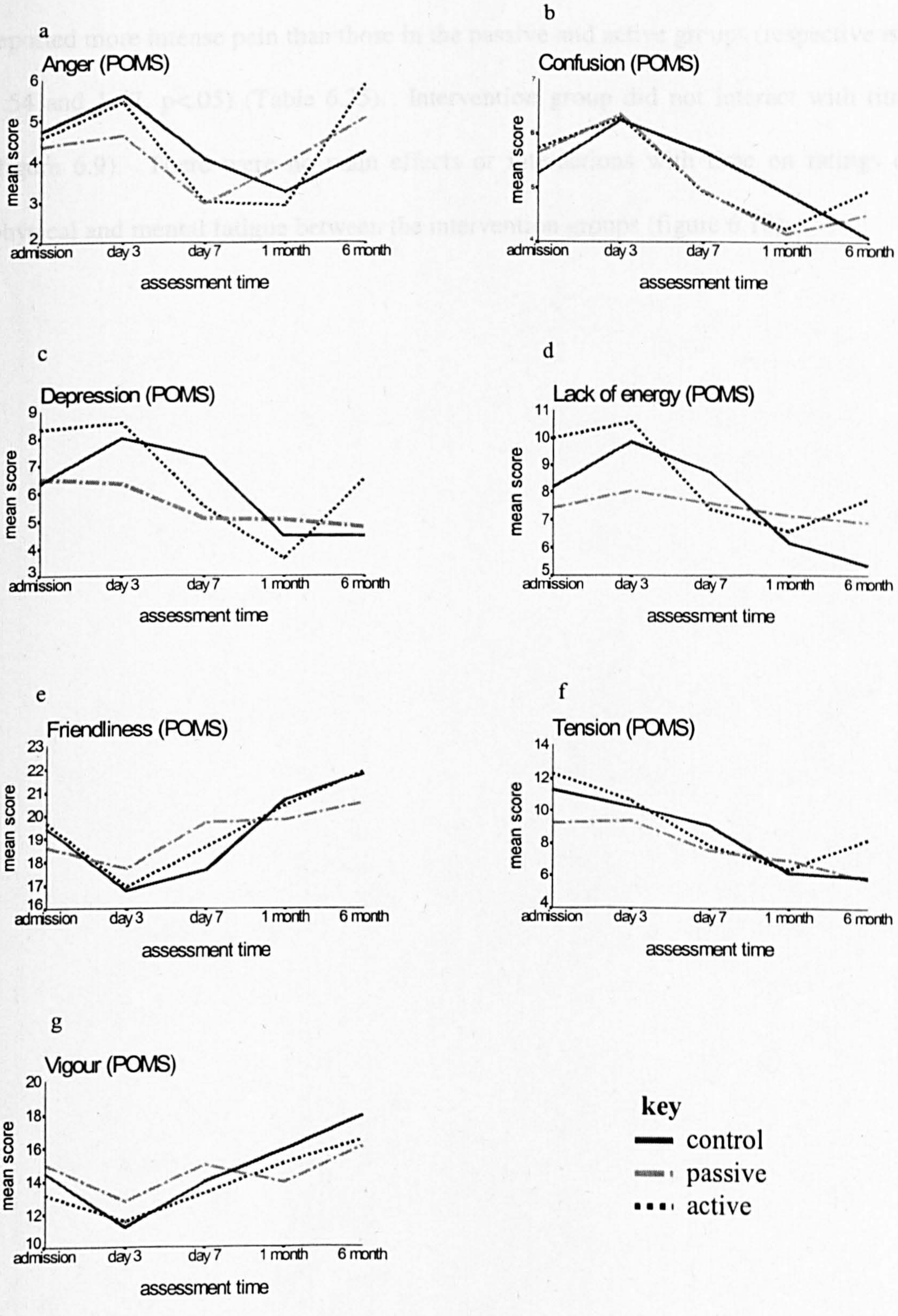
There were no overall differences on mood variables between intervention groups (Table 6.24). Group interacted with time for energy and vigour (Table 6.24). The control group appeared to have greater vigour than the passive group at one month follow-up and at six month follow-up but the difference was not significant (figure 6.8).

Table 6. 25 Postoperative comparisons between intervention group on bodily state

Variable	Group (G)	DF[a]	Time (T)	G x T	DF[b]
BODILY STATE					
Visual Analogue Scale (VAS)					
Intensity of pain	3.34*	2,156	41.74***	1.25	8,562
distress caused by pain	4.30*	2,156	24.03***	0.99	8,561
ability to cope with pain	1.69	2,156	14.88***	0.52	8,561
Recovery Inventory (RI)	0.25	2,156	195.59***	1.31	8,560
Fatigue					
physical	0.01	2,147	24.98***	1.22	2,139
mental	1.39	2,147	5.05*	0.42	2,139
WOMAC					
pain	0.49	2,150	6.37*	0.87	2,138
stiffness	0.24	2,150	5.13*	0.59	2,137
physical function	0.47	2,150	113.32***	0.23	2,140

F-ratio in table *:p<.05; **:p<.01**; ***:p<.001. DF[a] -Degrees of freedom for analysis of intervention - main effects. DF[b] - Degrees of freedom for analysis of interaction of intervention group with time.

Figure 6.8 Pre and postoperative mood comparisons between treatment and control group



Although patients in all intervention groups had reduced postoperative pain intensity (VAS), and distress from pain (VAS), patients in the control group consistently reported more intense pain than those in the passive and active groups (respective *t*s= 1.54 and 1.47, $p<.05$) (Table 6.25). Intervention group did not interact with time (figure 6.9). There were no main effects or interactions with time on ratings of physical and mental fatigue between the intervention groups (figure 6.10).

figure 6.9 Pre and postoperative pain differences between intervention groups

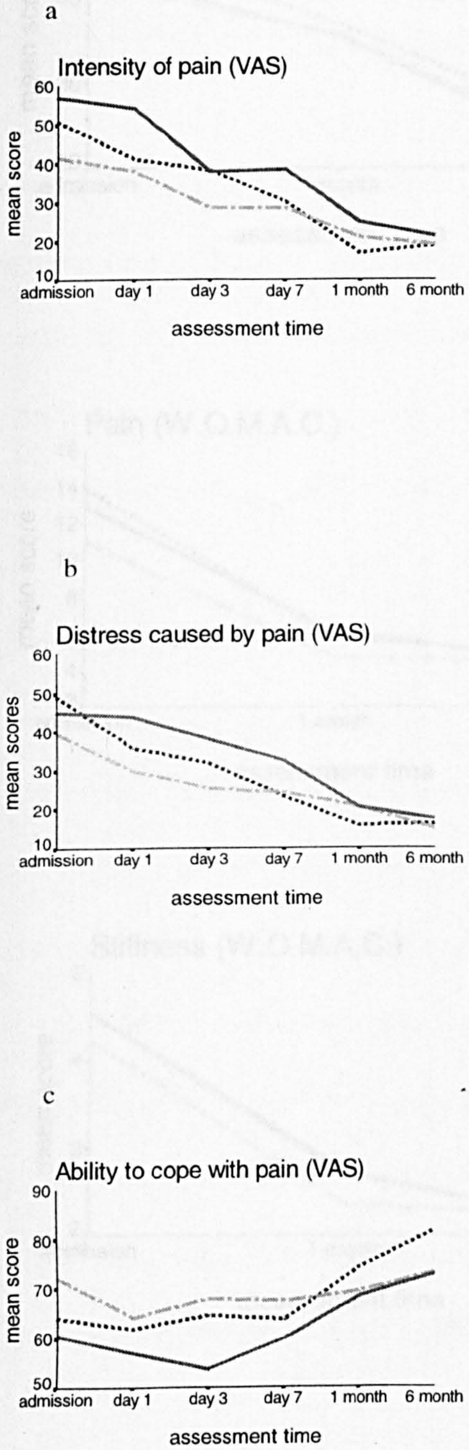


Figure 6.10 Pre and postoperative fatigue differences between intervention groups

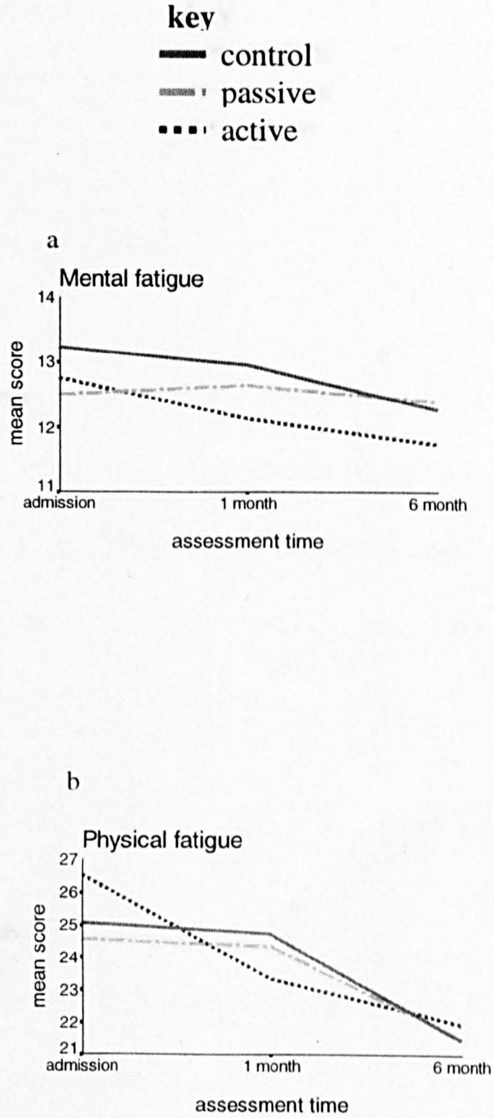
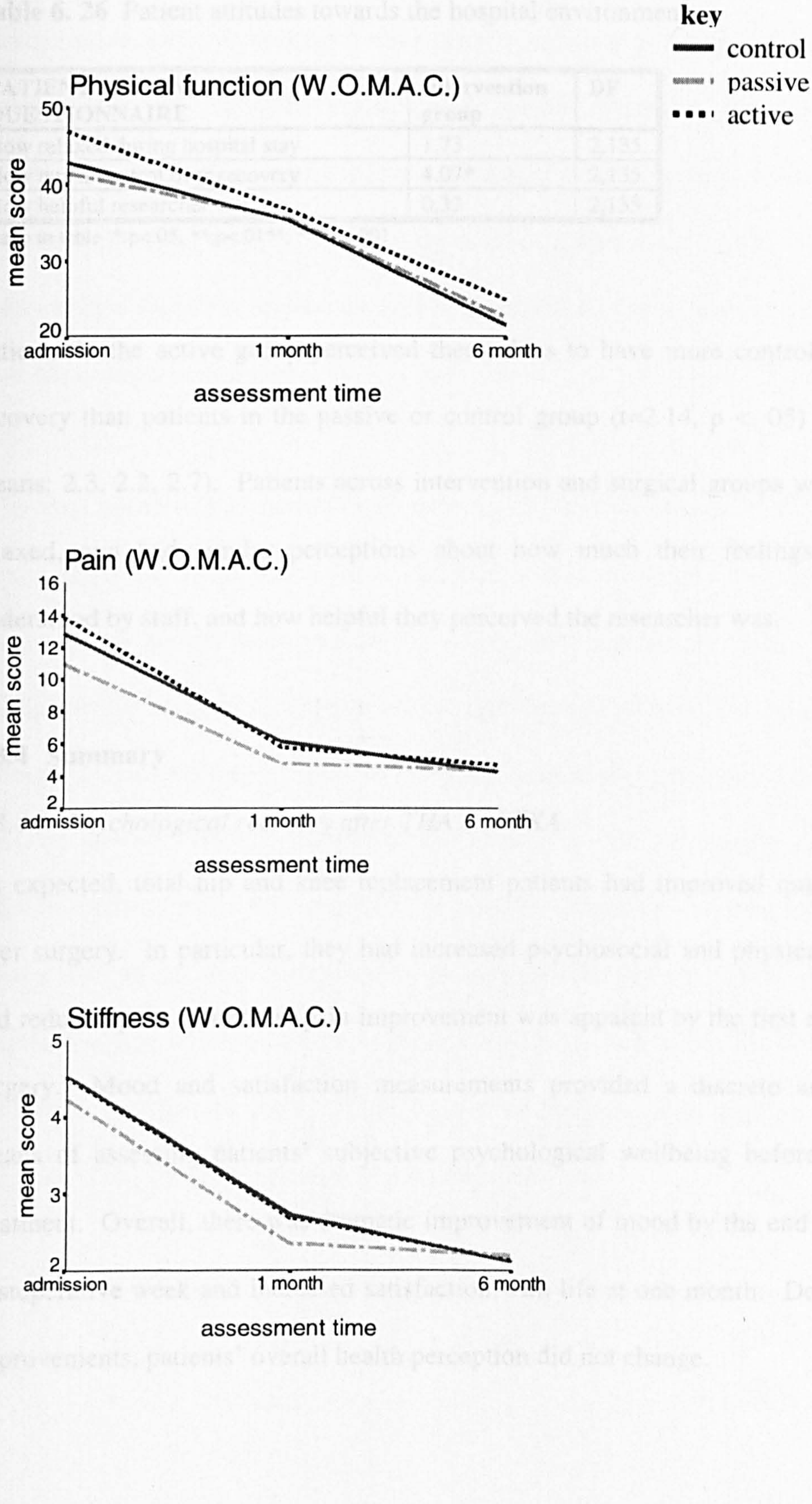


Figure 6.11 Pre and postoperative comparisons for physical function, pain and stiffness between intervention groups (W.O.M.A.C scale



6.3.3.5 Manipulation check

Table 6. 26 Patient attitudes towards the hospital environment

PATIENT FEELING QUESTIONNAIRE	Intervention group	DF
How relaxed during hospital stay	1.73	2,135
How much control over recovery	4.07*	2,135
How helpful researcher was	0.33	2,135

F-ratio in table *:p<.05; **:p<.01**; ***:p<.001

Patients in the active group perceived themselves to have more control over their recovery than patients in the passive or control group (t=2.14, p <. 05) (respective means: 2.3, 2.2, 2.7). Patients across intervention and surgical groups were equally relaxed, and had similar perceptions about how much their feelings had been understood by staff, and how helpful they perceived the researcher was.

6.3.4 Summary

6.3.4.1 Psychological recovery after THA and TKA.

As expected, total hip and knee replacement patients had improved quality of life after surgery. In particular, they had increased psychosocial and physical function, and reduced pain. Dramatic pain improvement was apparent by the first month after surgery. Mood and satisfaction measurements provided a discrete and indirect means of assessing patients' subjective psychological wellbeing before and after treatment. Overall, there was dramatic improvement of mood by the end of the first postoperative week and increased satisfaction with life at one month. Despite these improvements, patients' overall health perception did not change.

Although energy and vigour levels deteriorated shortly after surgery for both surgical groups, this was transient and showed improvement by the end of the first postoperative week, as well as further improvements at short-term follow-up, with patients showing increased vigour at 1 month follow-up compared to their preoperative level. This, along with the finding of reported energy improvements by one month after surgery, which surpassed preoperative levels, suggest that postoperative fatigue is present for only a short period of time in those who have had total hip or knee replacement.

It became apparent that measures of recovery did not all change in the same way; some improved while others were unaffected or took longer to improve. For instance, the steady improvement of mood and satisfaction with life, shown throughout the study for both hip and knee replacement patients, did not reflect other changes in patients' state, such as physical fatigue and functional ability which declined postoperatively. Similarly, the quality of life differences between the surgical groups were not reflected in overall subjective well-being and life-satisfaction ratings; knee patients were as happy as hip patients. This was the case despite findings of increased preoperative subjective well-being for THA patients compared to TKA patients. This clearly emphasises that patients' subjective response is not simply a refection of their physical state.

A closer analysis of recovery showed that whereas both THA and TKA procedures improved physical and psychosocial function, pain and physical function improved more slowly, and to a lesser degree, in TKA patients compared to THA patients in the long-term. Better recovery for hip replacement in comparison to knee replacement was interesting as preoperatively TKA patients had less functional difficulty compared to THA patients. TKA patients showed less ability to cope with their pain than THA patients, reflecting the heightened levels of pain experienced by the former group.

Although hip and knee replacement provide similar models of recovery, differences in the speed of recovery in certain areas of health-related dimensions of quality of life make it necessary to be cautious in considering the two groups as representing an homogenous sample. Consequently, it is possible that the interventions used in this study might have affected each group differently. To check for this effect, additional analyses were done to see if the intervention interacted with surgical group. There was no interaction and therefore results are not reported here.

6.3.4.1.1 The effect of gender and environment

The finding that men and women showed similar satisfaction with life after surgery postoperatively was interesting as pre and postoperative levels of physical function, mental health and vitality and vigour showed men to exceed in these areas of quality of life over women. Preoperatively men also reported greater positive affect than women did. Men also showed better postoperative physical wellbeing compared to women. Overall these findings suggest that men had better psychological and physical wellbeing over women both before and after surgery. Preoperatively patients at one hospital reported more ability to cope with pain and less fatigue, compared to the other hospital. It is difficult to say how much influence the hospital environment could have had on these factors as these were measured soon after admission. However, effect of hospital environment on anger and depression postoperatively, despite similar preoperative ratings, suggests that the environment contributed to mood changes.

6.3.4.2 Homogeneity of the sample

Although occasional differences were apparent between men and women, the RLUH and Broadgreen hospital, and total hip and knee replacement patients, the different groups were generally homogenous across all the variables preoperatively, with groups only differing in details.

In view of differences in psychological status postoperatively, between surgical groups, interactions of intervention groups with type of surgery on outcome measures were checked statistically but not found to be significant; these results are not reported here. Subsequently, as hip versus knee arthroplasty, men versus women, and the RLUH versus Broadgreen hospital generally only differed in detail, they were combined for analyses of the effect of psychological intervention on the psychological response to surgery.

6.3.4.3 The effect of psychological preparation

With reference to the central hypothesis of this study, it was apparent that psychological preparation did not affect long-term recovery from surgery. There were no subjective emotional, mood or satisfaction rating differences and only isolated occasions where subjective physical state, and quality of life were affected by psychological interventions which encouraged an active or passive patient role. Isolated findings, with a probability of $p < .01$, were that pain intensity was greater in the control group than in either of the intervention groups, and health perceptions, that is what individuals thought about their general health, were improved for those in the control compared to treatment groups. Unfortunately difference in pain was not seen consistently for other measures that assessed pain and therefore may be spurious, and with the large number of variables in this investigation is considered to represent a Type 1 error.

In absolute summary, the findings of this investigation portray psychological interventions to be independent of short and long-term psychological adjustment, quality of life and general recovery from surgery.

6.4 The physiological response to surgery

6.4.1 Analysis strategy

Data distributions were normalised and variances were homogenised, by transforming all biochemical measures (log transformed: $LOG_{10}(x+1)$, except white cell and lymphocyte counts which had normal distributions. Degrees of freedom were adjusted accordingly for missing data.

Statistical assessment of the physiological response to surgery was similar to the assessment of the psychological response. One-way simple factorial ANOVAs assessed preoperative differences for each of four between-subject factors (Intervention group, type of surgery, gender, and hospital) for hormonal, inflammatory and haematological variables (Tables 6.27 to 6.28). Where the main effects of intervention group was significant, differences were examined by *post hoc* *t*-tests.

Postoperative differences for the same between subject factors were also assessed. Repeated measures ANOVAs were used for variables measured more than once postoperatively. In postoperative analysis, for each of the between-subject factors, ANOVAs assessed *main effects, change over time* and *interaction with time* postoperatively for all physiological variables (Tables 6.29-6.32). The main effect of time was included in each analysis and its effects are identical in each, subject to minor differences arising from interpolation of missing data. Therefore this part of the analysis is described for type of surgery but is disregarded for analyses of sex and hospital. In the section which highlights the postoperative effects of intervention groups on the physiological response, because the effect of different interventions is central to this investigation, main effects as well as main effect of time and interaction with time are commented upon. Significant interactions of between subject factors (type of surgery, sex, hospital and intervention group) with time were examined by *post hoc* *t*-tests.

As with the psychological response, preoperative analysis was performed to check the baseline status of patients for postoperative comparison, and also to check that patients for each of 4 between-subject factors (treatment group, type of surgery, gender, and hospital) were similar on all variables that would also be assessed postoperatively. After preoperative analysis, a postoperative analysis for each of the between subject factors on outcome variables was performed to assess changes that might have occurred due to the independent variable being manipulated. As with the physiological response, initially, all results were checked for significance at $p < 0.05$. Due to the large number of variables in this investigation the probability of accepting false positives would be increased. Therefore patterns of significance in results, as opposed to isolated variables were examined. In order to reduce the extent of such Type 1 error it was also considered appropriate for the final assessment of results to select only those findings with $p < 0.01$ or less, as being significant.

6.4.2 Preoperative comparisons

Table 6. 27 Preoperative comparisons of hormonal, inflammatory and haematological measures

Blood sample	DF*	Type of surgery	Gender	Hospital	Intervention group
Glucose	1,154	0.62	0.12	0.21	0.41
Adrenaline	1,154	0.05	1.48	0.73	1.72
Noradrenaline	1,154	4.72*	0.22	5.72*	0.50
Cortisol	1,156	0.84	0.25	0.10	2.80
CRP	1,155	6.63*	4.27*	9.95**	0.24
Interleukin-6 (IL-6)	1,156	14.97***	0.44	5.44*	0.85
Lymphocyte count	1,148	0.13	0.24	1.02	0.17
White blood cell count	1,149	0.01	0.38	1.23	0.31

F-ratio in table *:p<.05; **:p<.01**; ***:p<.001. *DF: degrees of freedom for type of surgery, gender, hospital, and intervention group

Patients having total knee replacement (TKA) surgery had higher CRP levels than those having total hip replacement (THA) surgery. THA patients had higher baseline noradrenaline levels than TKA patients. IL-6 concentrations were higher in TKA than THA patients at baseline (Table 6.27, Figure 6.12a, c & f.). Women had higher concentrations of CRP compared to men (respective means: 0.95, 0.83). Patients at the RLUH had higher concentrations of noradrenaline, CRP and IL-6 than those at Broadgreen (respective means: 0.76, 0.67; CRP, 0.69,0.63). Refer to Appendix 6 for complete preoperative, and postoperative mean scores on all physiological variables for each of the between subject factors. There were no preoperative differences on any biochemical measures between intervention groups.

6.4.3 Postoperative comparisons

6.4.3.1 Effects of type of surgery and changes over time

Table 6. 28 Postoperative comparisons between THA and TKA surgery, on hormonal, inflammatory and haematological measures.

Blood sample	Type of Surgery (J)	DF[a]	Time (T)	JxT	DF[b]
Glucose	0.01	1,156	487.46***	5.88***	6,855
Adrenaline	7.10**	1,155	42.09***	3.28**	6,847
Noradrenaline	1.27	1,155	43.81***	7.72***	6,847
Cortisol	0.15	1,156	179.6***	1.12	12,1678
CRP	4.82*	1,156	1.00***	3.42***	12,1675
Interleukin-6 (IL-6)	2.22	1,156	216.95***	10.05***	10,1675
Lymphocyte count	0.04	1,146	n/a	n/a	n/a
White blood cell count	5.79*	1,147	n/a	n/a	n/a

F-ratio in table *:p>.01; **:p<.01**; ***:p<.001. DF[a] -Degrees of freedom for analysis of type of surgery - main effects. DF[b] - Degrees of freedom for analysis of interaction of surgical group with time.

Plasma glucose. TKA surgery showed a more prolonged glucose response than THA surgery. Both surgical groups showed a gradual increase in glucose; THA patients had peak concentrations of glucose at 4 hours after incision, and TKA patients at 12 hours, with concentrations lower in THA compared to TKA patients at 1 hour/pre-tourniquet release (t= 2.85, p<.001), and higher in THA patients at 12 hours (t=2.26, p<.05) (Table 6.28, Figure 6.12a). Figure 6.12a shows that values for both surgical groups did not fall to baseline within the first twenty-four hours.

Plasma catecholamines. There was both a main effect and surgical interaction with time for adrenaline (Table 6.28). TKA adrenaline response was consistently raised in comparison to THA adrenaline response. TKA patients' response was raised from 2-12 hours in comparison to THA patients' response (min and max. scores respectively: t= 2.71, p<.01 (12hr); 3.47, p<.001 (2hr) (Table 6.28, figure 6.12 a, b).

Type of surgery interacted with time for the noradrenaline response to surgery. THA and TKA surgery showed a gradual increase in noradrenaline. Noradrenaline showed a similar pattern to adrenaline over time; both surgical groups showed an increase followed by a decrease in noradrenaline. Noradrenaline concentration for THA peaked at 4 hours but continued to increase for TKA patients up to 24 hours after incision; a greater noradrenaline response from 8-24 hours was found in TKA patients compared to THA patients (respective min. and max. t scores: $t= 2.20$, $p<.05$, $t=3.62$, $p<.001$). There was no difference between surgical groups regarding the timing of the noradrenaline peak (Table 6.28, Figure 6.12c).

Serum cortisol. Surgical group showed no main effect or interaction with time for cortisol. Cortisol showed a gradual reduction with time after it peaked at 8 hours after surgical incision (Table 6.28, figure 6.12d). Figure 6.12d shows that plasma concentration remained elevated at 7 days for both surgical groups by comparison with baseline (respectively for THA and TKA: $t=7.90$, $p<.001$; 8.0, $p<.001$).

Plasma C reactive protein (CRP). THA showed consistently lower levels of CRP than TKA (Table 6.28, figure 6.12e). Interaction of surgical group with time showed TKA patients had higher levels of adrenaline from baseline to 8 hours post-incision, compared to THA patients (respective min. and max. scores: $t= 2.40$, $p<.05$ (8hr); $t= 3.47$, $p<.001$ (1hr)) (Figure 6.12e).

Serum Interleukin-6. There was an interaction of surgical group with time for IL-6 concentrations. TKA patients had a lower IL-6 response than THA patients at 2 and 8 hours post-incision (2 hours: $t=3.78$, $p<.001$; 8 hours: $t=2.99$, $p<.01$). TKA patients showed a much greater concentration of IL-6 at the peak time of 24 hours, compared to THA patients ($t=2.57$, $p<.001$) (Table 6.28, Figure 6.12f).

White cell and lymphocyte count. TKA showed higher concentrations of lymphocytes at admission and day1 after surgery (Table 6.28). An interaction of surgical group with time for white cell counts. TKA patients had a higher white cell count than THA patients 24 hours after surgery ($t=2.40$, $p<.05$) (figure 6.13a). TKA patients had a higher lymphocyte count at 24 hours after incision compared to THA patients but the difference was not significant (figure 6.13b).

Figure 6.12 Comparisons between THA and TKA on the hormonal and inflammatory response to elective surgery

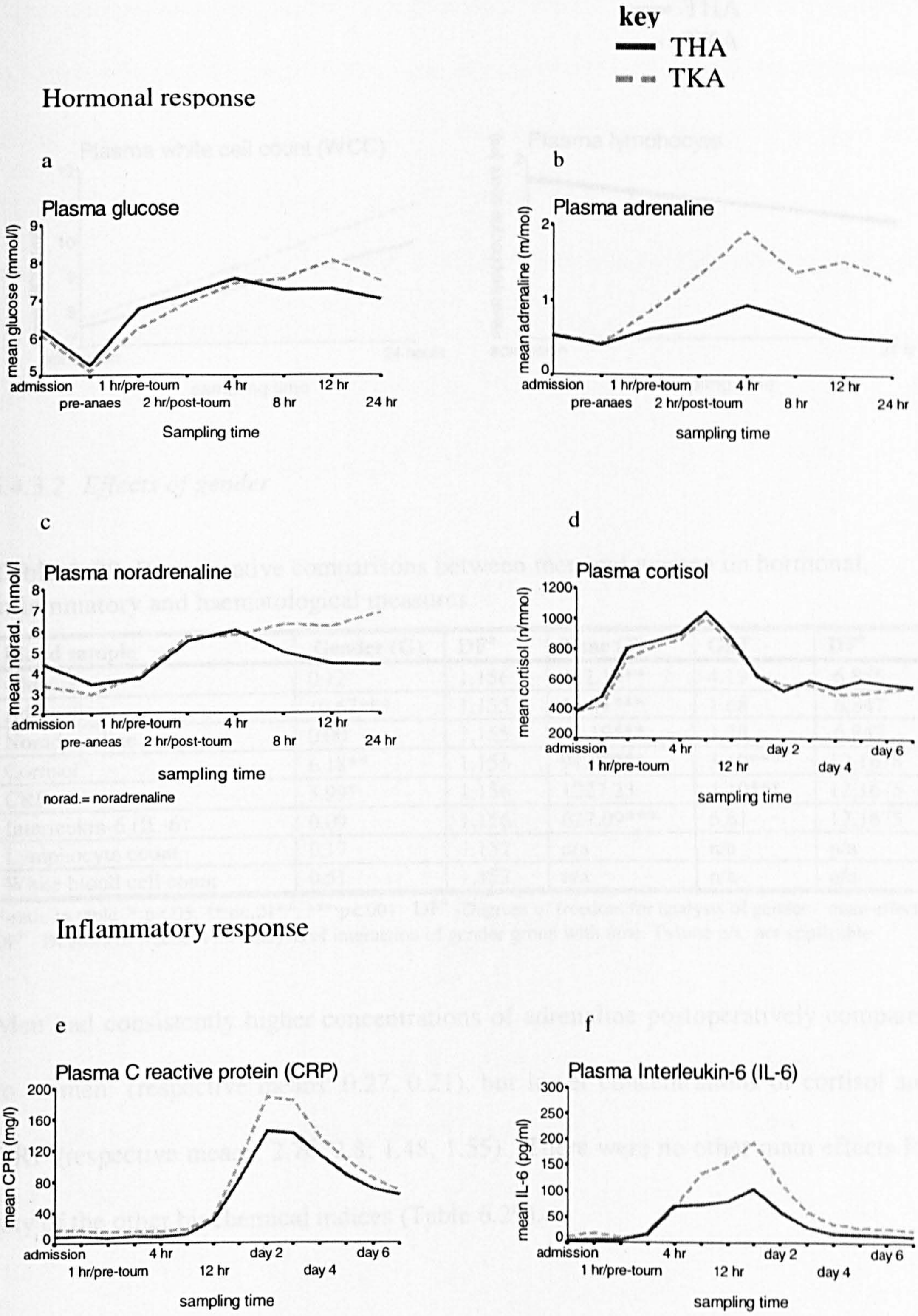
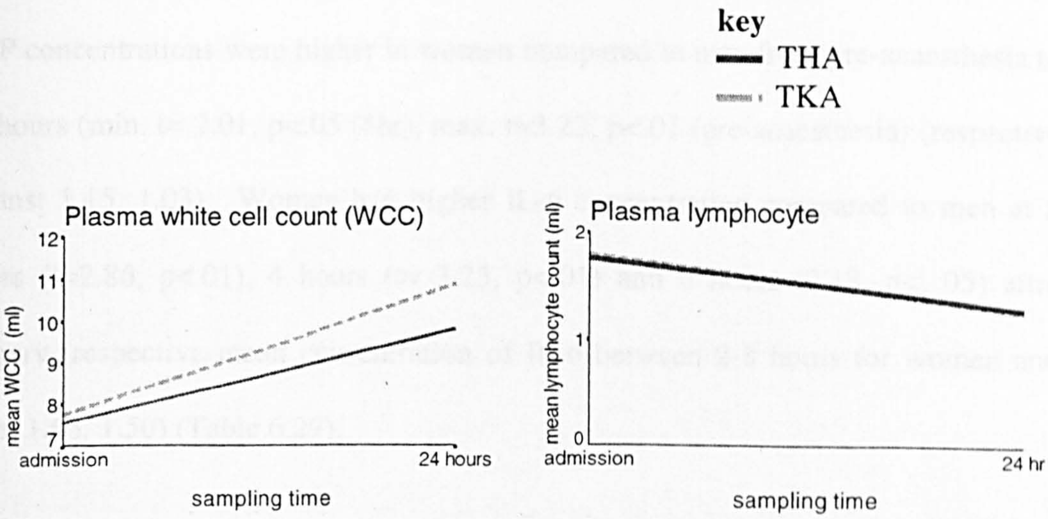


Figure 6.13 Haematological differences between surgical groups



6.4.3.2 Effects of gender

Table 6. 29 Postoperative comparisons between men and women on hormonal, inflammatory and haematological measures.

Blood sample	Gender (G)	DF^a	Time (T)	GxT	DF^b
Glucose	0.12	1,156	482.19**	4.19	6,855
Adrenaline	10.67***	1,155	41.41***	1.68	6,847
Noradrenaline	0.00	1,155	43.19***	1.78	6,847
Cortisol	6.18**	1,156	91.89***	3.40***	12,1678
CRP	3.99*	1,156	1227.23	4.19***	12,1675
Interleukin-6 (IL-6)	0.09	1,156	627.09***	6.61	12,1675
Lymphocyte count	0.17	1,152	n/a	n/a	n/a
White blood cell count	0.51	1,152	n/a	n/a	n/a

F-ratio in table *:p<.05; **:p<.01**; ***:p<.001. DF^a -Degrees of freedom for analysis of gender - main effects. DF^b - Degrees of freedom for analysis of interaction of gender group with time. T=time n/a: not applicable

Men had consistently higher concentrations of adrenaline postoperatively compared to women (respective means: 0.27, 0.21), but lower concentrations of cortisol and CRP (respective means: 2.76, 2.8; 1.48, 1.55). There were no other main effects for any of the other biochemical indices (Table 6.29).

Cortisol concentrations were higher in women compared to men, from 2 to 24 hours after surgical incision (min. t= 2.70, p<.01(2 hr), max. t= 3.90, p<.001(4hr) (respective cortisol means for men and women between 2-12 hours: 2.83, 2.91).

CRP concentrations were higher in women compared to men from pre-anaesthesia to 24 hours (min. t= 2.01, p<.05 (4hr), max. t=3.22, p<.01 (pre-anaesthesia) (respective means: 1.15, 1.03). Women had higher IL-6 concentration compared to men at 2 hours (t=2.86, p<.01), 4 hours (t= 3.23, p<.01) and 8 hours (2.18, p<. 05) after surgery (respective mean concentration of IL-6 between 2-8 hours for women and men: 1.63, 1.50) (Table 6.29).

6.4.3.3 Differences between hospitals

Table 6. 30 Postoperative comparisons between the RLUH and Broadgreen hospital on hormonal, inflammatory and haematological measures.

Blood sample	Hospital (G)	DF[a]	Time (T)	HxT	DF[b]
Glucose	0.19	1,156	467.45***	1.58	6,855
Adrenaline	2.37	1,155	42.65***	3.87***	6,847
Noradrenaline	4.62*	1,155	43.13***		6,847
Cortisol	0.22	1,156	89.64***	1.91*	12,1678
CRP	6.34*	1,156	1216.07***	1.97*	12,1675
Interleukin-6 (IL-6)	6.64*	1,156	606.99***	1.63	12 ,1675
Lymphocyte count	1.18	1,151	n/a	n/a	n/a
White blood cell count	1.33	1,152	n/a	n/a	n/a

F-ratio in table *:p<.05; **:p<.01**; ***:p<.001. DF[a] -Degrees of freedom for analysis of hospital - main effects. DF[b] - Degrees of freedom for analysis of interaction of hospital group with time. T=time n/a: not applicable

Patients at the RLUH had overall higher concentrations of noradrenaline, CRP, and IL-6 than patients at Broadgreen hospital (respective means: 0.74, 0.86; 1.56, 1.48; 1.47, 1.39).

An interaction of surgical group with time was found for adrenaline, cortisol and CRP. Patients at Broadgreen hospital had higher concentration of adrenaline 2 hours after surgical incision (t=3.22, p<.01) (respective means: 0.30, 0.25). Patients at Broadgreen hospital had greater concentration of cortisol than those at the RLUH on days 3 and 4 after surgery (respective means: 2.76, 2.70; 2.28, 2.74). Patients at the RLUH had had higher concentrations of CRP compared to those at Broadgreen on the day of surgery at pre-anaesthetic (t=3.27 ,p<.01), 1 hour (t= 3.27, p<.01), 4 hours to 24 hours (min t= 2.02 (12hr), p<.05, max. t= 2.65 (4hr), p<.01, and on day 5 (t= 3.38, p<.001)). Means for CRP concentration at the RLUH and Broadgreen were respectively for the following times: pre-anaesthesia - 0.96, 0.81; 1 hour - 0.92, 0.76; 4-24 hours - 1.34, 1.24; day 5- 1.98, 1.92 (Table 6.30).

6.4.3.4 Differences between intervention groups

Table 6. 31 Postoperative differences between intervention groups on hormonal, inflammatory, and haematological measures

Blood sample	**Intervention group (G)**	**DF[a]**	**Time (T)**	**GxT**	**DF[b]**
Glucose	0.99	2,155	136.96***	1.05	8,849
Adrenaline	0.78	2,154	41.36***	1.35	8,841
Noradrenaline	1.75	2,154	45.52***	0.99	8,841
Cortisol	0.36	2,155	90.52***	1.19	20,1663
CRP	0.12	2,155	1216.97***	1.97***	20,1663
Interleukin-6 (IL-6)	0.36	2,155	203.93***	0.126	20,1663
Lymphocyte count	2.34	2,145	n/a	n/a	n/a
White blood cell count	2.30	2,146	n/a	n/a	n/a

F-ratio in table *:p<.05; **:p<.01**; ***:p<.001. DF[a] -Degrees of freedom for analysis of intervention - main effects. DF[b] - Degrees of freedom for analysis of interaction of intervention group with time. T=time n/a: not applicable

For intervention groups, there were no main effects, and only one interaction with time for biochemical variables. The difference between intervention groups interacted with time for CRP levels. The passive group had lower CRP concentrations on day 6 and 7 postoperatively compared to the control (respective post hoc t-tests for day 6 and 7: $t = 1.91$, $p < .05$; $t = 1.72$, $p < .05$) and active groups (respective post hoc t-tests for day 6 and 7: $t = 1.86$, $p < .05$; $t = 2.21$, $p > .05$) (Table 6.31). Refer to graphs in figure 6.32 a-f for an account of hormonal and inflammatory responses between intervention groups.

Figure 6.15 Comparisons between control, relaxation and imagery groups on the hormonal and inflammatory response to elective surgery

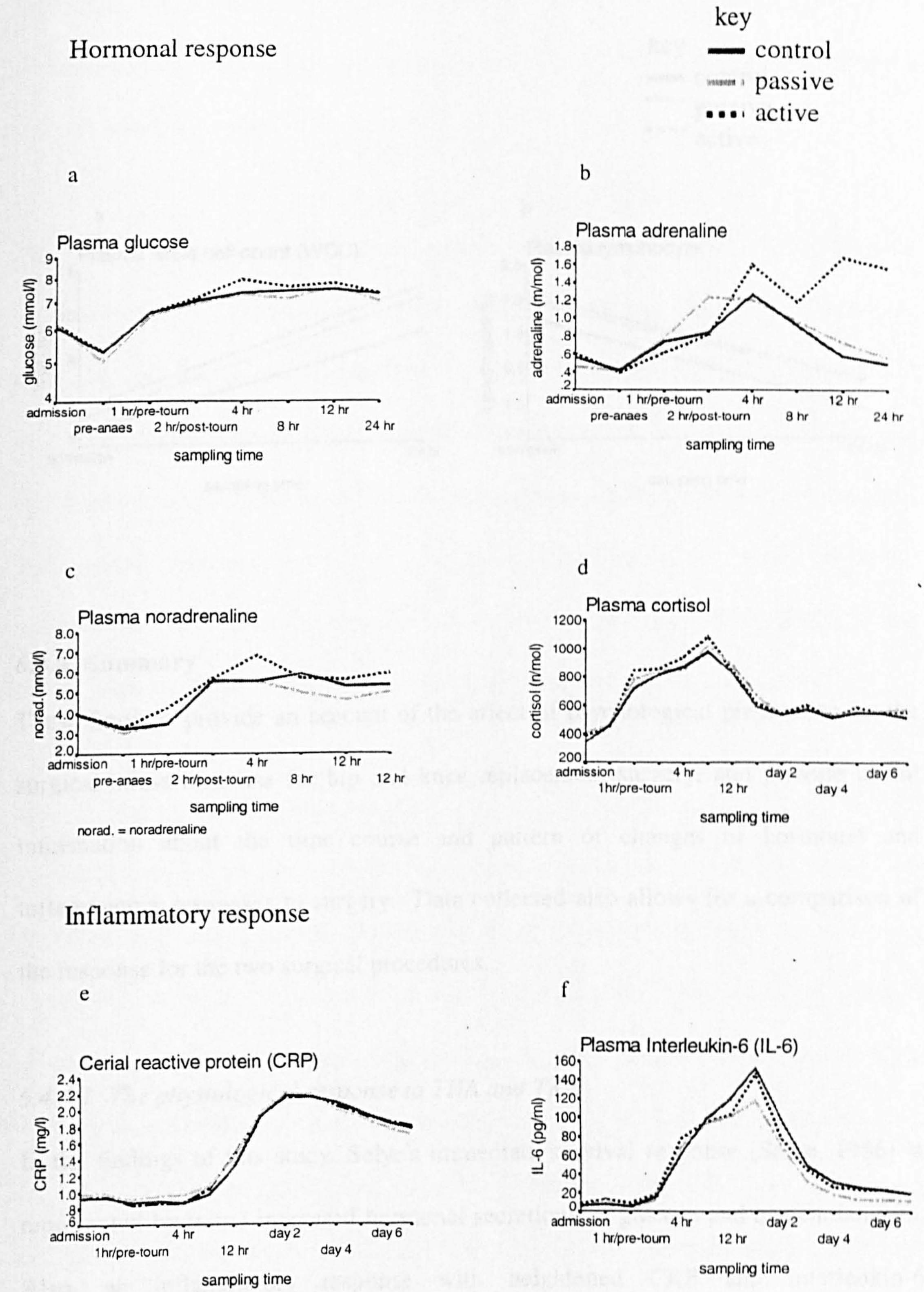
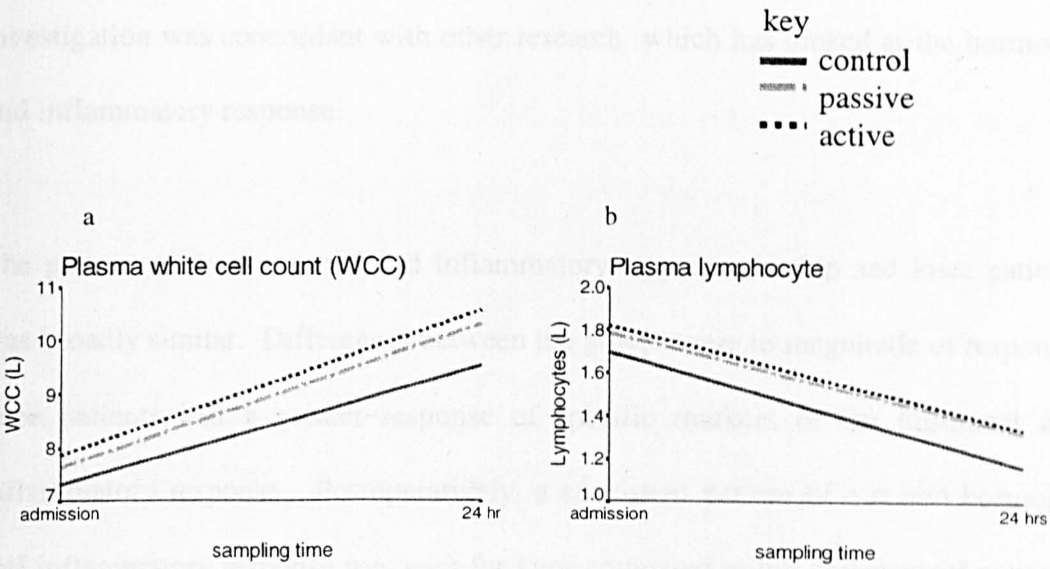


Figure 6.16 Haematological differences between the intervention groups



6.4.4 Summary

These findings provide an account of the effect of psychological preparation on the surgical stress response for hip and knee replacement surgery, and provide useful information about the time course and pattern of changes of hormonal and inflammatory responses to surgery. Data collected also allows for a comparison of the response for the two surgical procedures.

6.4.4.1 The physiological response to THA and TKA

In the findings of this study, Selye's immediate survival response (Selye, 1956) is represented by initial increased hormonal secretions of glucose and catecholamines. Also, an inflammatory response with heightened CRP and interleukin-6 concentrations was found. Although surgical trauma initiated the response, peak values did not occur until the postoperative period. Apart from persistent hypercortisolaemia, the physiological stress response from the elective surgery under investigation was concordant with other research which has looked at the hormonal and inflammatory response.

The pattern of the hormonal and inflammatory response for hip and knee patients was broadly similar. Differences between the groups were in magnitude of response; knee patients had a greater response of specific markers of the hormonal and inflammatory response. Postoperatively, a consistent pattern of a raised hormonal and inflammatory response was seen for knee compared to hip replacement patients. The raised inflammatory response, manifesting as consistently increased postoperative CRP and heightened levels of interleukin-6 for TKA patients on the day of surgery, suggests that TKA is associated with a greater tissue trauma.

6.4.4.2 Homogeneity of the sample

Although only isolated preoperative hormonal differences were apparent between hip and knee arthroplasty groups, differences in the inflammatory response were more consistent in that they occurred repeatedly on two or more consecutive measurements, for the different surgical and hospital groups. In particular, TKA showed heightened CRP and IL-6 in comparison to THA, as did patients at the RLUH compared to Broadgreen hospital. Postoperatively, although there were differences between THA and TKA patients, these were of magnitude rather than pattern of physiological response, and therefore the different surgical groups were thought to represent comparable models of surgery from a physiological perspective. However, due to differences in the degree of the physiological response between the surgical groups there was a possibility that surgical groups might not respond simialrly to the interventions. Therefore, additional analyses were done to see if intervention interacted with surgical group. There was no interaction and therefore results are not reported here.

With reference to other between-subject factors, men versus women, and the RLUH versus Broadgreen hospital only differed in their details of the physiological response, with all groups, in general, showing a similar pattern of response. Consequently, it can be presumed that different gender, hospitals and types of surgery did not compromise the homogeneity of the sample. Therefore they were combined for analysis in an attempt to assess the affect of psychological preparation on the physiological response to surgery.

6.4.4.3 The effect of psychological preparation

The lack of differences on physiological markers of stress and trauma for both the treatment and control groups indicates that the surgical stress response was not affected by the interventions. The finding that the passive intervention was associated with a reduced inflammatory response, indicated by lower CRP levels in comparison to the control and active groups, is likely to represent a Type 1 error. This is mainly because of the large number of biochemical variables in this investigation. Also, the likelihood of a type 1 error is reinforced by the majority of findings which showed intervention to have no influence on the hormonal and inflammatory response.

In absolute summary, the findings of this investigation provide no support for the view that physiological response acts as a direct mediator of effects of different forms of coping.

Chapter 7

Relationships between physiological, functional and psychological recovery

Chapter 7

Relationships between physiological, functional and psychological recovery

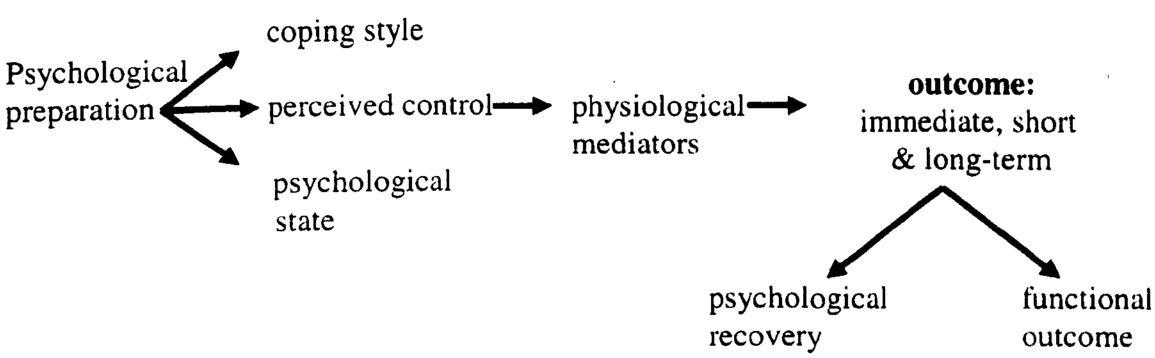
7.1 Introduction

This section examines the relationships between psychological, physiological and functional recovery, many of which have not been reported before.

Based on the ideas of Janis (1958) and research which has looked at the relationship of different coping styles on surgical recovery, it can be presumed that more 'problem-focused' coping will be associated with a better recovery compared to coping which uses denial strategies. In particular, Janis theorised that increased preoperative anxiety may have a negative impact on recovery if it is not utilised in a 'constructive' way. Unfortunately, as outlined in Chapter 1, research to date has found that anxiety is an inconsistent predicitor of recovery, and that other indices may be more reliable indices of recovery. Consequently, in this investigation attributes of preoperative psychological state which have been seen in recent research to have an impact on recovery were analysed. In particular, the influence of fatigue, depression, positive affect, and pain on outcome were checked.

In the context of the main hypothesis of this investigation, outlined in chapter 1, with reference to figure 7.1 it is hypothesised that the hormonal response might mediate the effects of psychological preparation on recovery. Existing research has found that different coping styles, perceived control and psychological state influence outcome from surgery. The influence of all of these on outcome, and the influence of the physiological stress response as a mediator of outcome is investigated in this chapter. Firstly, an analysis of the influence of preoperative psychological state on the hormonal and inflammatory response during the first postoperative week is undertaken. Secondly, the influence of the hormonal and inflammatory response on postoperative functional and psychological recovery is analysed. Finally, the influence of preoperative emotional state and coping with postoperative psychological state, immediate functional progress and long-term functional recovery is assessed.

Figure 7. 1 Hypothesised mediation of psychological interventions on surgical recovery.



7.2 Analysis strategy

As discussed in chapter 2, the pathology for rheumatoid arthritis and osteoarthritis is quite different. Also, as a difference in details of the physiological stress response was seen between the two surgical groups, it was decided that statistical analysis should be restricted to patients with osteoarthritis of the hip because any effects due to pathology and joint may have inflated correlations, and ultimately caused spurious correlations. In total, 102 patients were included in the analyses.

A series of product moment correlations assessed the relationship of predictor variables with outcome variables. Firstly, the relationship of preoperative psychological state (predictor variables) with the hormonal and inflammatory response was assessed. Psychological state was assessed by mood, fatigue and pain, as well as coping strategies (Table 7.1 - 7.4). Coping strategies, although measured retrospectively on day 7 for the postoperative week, were classed as predictor variables, and their relationship with the hormonal and inflammatory response was assessed (Table 7.13). In order to limit calculations, biochemical variables were represented by the measurement time(s) that showed the peak mean hormonal and inflammatory marker concentrations, together with the times before and after this. This strategy also applied for other correlations using biochemical measures.

Secondly, a set of Pearson product moment correlations assessed the relationship of predictor hormonal and inflammatory variables with psychological recovery. The relationship of the hormonal and inflammatory response with psychological variables (mood, pain and fatigue) was analysed (Table 7.5 and Table 7.6).

Thirdly, the relationship of hormonal and inflammatory response variables with immediate and later functional recovery was analysed. This involved an analysis of the relationship of the hormonal and inflammatory response with time to reach immediate functional milestones, pain experienced and motivation (Table 7.7 and Table 7.8). The relationship of the hormonal and inflammatory response with short and long term functional recovery was analysed (Table 7.9 and Table 7.10) by correlating the former with WOMAC - pain, function and stiffness outcome.

Fourthly, the relationship of preoperative psychological state with postoperative psychological state was analysed. This analysis is considered important because of theory which has suggested that negative preoperative state is likely to be associated with poorer adjustment after surgery.

Fifthly, the relationship of preoperative psychological and functional state with postoperative functional state was assessed. In particular, preoperative predictor variables of emotional state, fatigue and physical function were correlated with immediate functional milestone progress (Table 7.11), and long-term functional recovery, as measured by the WOMAC pain, function and stiffness sub-scales (Table 7.12). Thirdly, patients' coping strategies were correlated with postoperative psychological state after one week in hospital.

Initially, all results were tested for significance at $p < 0.05$. Due to the large number of variables in this investigation the probability of accepting false positives (Type 1 error) in the data would be increased. Therefore, patterns of significance in results, as opposed to isolated variables were examined. In order to reduce the extent of Type 1 error it was also necessary for the final assessment of results to select only those findings with $p < 0.01$ or less, as being significant.

7.3 Relationship of preoperative psychological state with the hormonal and inflammatory response

Table 7. 1 Relationship of preoperative mood, fatigue and pain with the hormonal response

	adrenaline			noradrenaline			cortisol		
preoperative predictor variables	**2 Hr.**	**4 Hr.**	**8 Hr.**	**2 Hr.**	**4 Hr.**	**8 Hr.**	**4 Hr.**	**8 Hr.**	**12 Hr.**
tension (POMS)	-.09	.06	.11	.05	-.01	.07	-.00	.04	-.06
depression (POMS)	-.03	.10	.11	-.09	-.06	.14	.00	-.16*	.05
positive affect	.04	.02	.10	-.12	-.00	-.06	-.13	-.01	-.04
mental fatigue	-.07	-.05	-.26	.18	-.03	-.00	-.12	-.12	-.19
physical fatigue	-.12	-.04	-.18	-.05	.04	.05	-.08	-.12	-.24
pain intensity	.08	-.03	-.09	-0.2	.07	.22*	.10	-.03	-.09
pain distress	.10	.08	-.18	.10	-.03	.01	-.08	-.04	-.03

rs in tables: *:p<.05; **:p>.01**; ***:p<.001 Hr. = hours

Distress from pain showed an isolated correlation with noradrenaline concentration (Table 7.1). Depression showed an isolated correlation with cortisol concentration. All other psychological variables showed no relationship with the hormonal response (Table 7.1).

Table 7. 2 Relationship of preoperative mood, fatigue and pain with the inflammatory response.

	cerial reactive protein (CRP)			Interleukin- 6 (IL-6)		
preoperative predictor variables	**day 1**	**day 2**	**day 3**	**12 hour**	**day 1**	**day 2**
tension (POMS)	.19*	.18*	.12	.02	.11	.04
depression (POMS)	.11	.14	.05	-.05	.00	.04
positive affect	-.23*	-.09	-.02	-.06	.01	.13
mental fatigue	.26	.15	.14	.09	.01	.26
physical fatigue	.15	-.21	-.16	.10	-.05	.19
pain intensity	.12	.06	.06	.07	.07	.01
pain distress	-.01	.00	.12	.-.00	.14	.16

rs in tables: *:p<.05; **p>.01**; ***:p<.001

For the first two days after surgery, patients who were happier had a reduced concentration of CRP; this however was at a significance of p <.05 and is therefore not considered to be reliable (Table 7.2). Similarly, at a significance of p <05, increased tension was associated with an increased CRP response over the Ist two postoperative days. All other psychological variables showed no relationship with the inflammatory response (Table 7.2)

Table 7. 3 Relationship of coping with the hormonal response

	adrenaline			noradrenaline			cortisol		
predictor variables	**2 Hr.**	**4 Hr.**	**8 Hr.**	**2 Hr.**	**4 Hr.**	**8 Hr.**	**4 Hr.**	**8 Hr.**	**12 Hr.**
problem focused	-.04	.00	-.07	.03	.02	.01	-.21	-.17	-.18
wishful thinking	-.21	.16	.16	.28*	.14	.22*	-.07	-.12	-.19
detachment	-.5	-.15	-.13	.19	.27*	.30**	-.0	.08	-.12
support seeking	-.08	-.05	-.10	-.13	-.09	-.09	-.21*	-.20	-.16
positive thinking	-.11	-.04	-.15	.02	-.12	.06	-.12	-.14	-.07

rs in tables: *:p<.05: **p>.01**: ***:p<.001 Hr. = hours

As shown in Table 7.3, patients who used a detached coping style had heightened noradrenaline levels at 4 and 8 hours. Other coping styles showed isolated correlations with the hormonal response (Table 7.3).

Table 7. 4 Relationship of coping with the inflammatory response

	cerial reactive protein (CRP)			Interleukin- 6 (IL-6)		
Predictor variables	**day 1**	**day 2**	**day 3**	**12 hour**	**day 1**	**day 2**
Problem focused	-.06	.02	..07	.10	.09	.20
wishful thinking	.27	.21*	.20	.30**	.18	.18
detachment	.07	..03	-.03	.19	.08	.13
support seeking	-.05	.04	.13	.14	.24*	.22*
positive thinking	-.00	-.06	.04	.09	.09	.11

rs in tables: *:p<.05; **p>.01**; ***:p<.001

In general, coping showed no consistent relationship with the inflammatory response; only isolated significant correlations were found (Table 7.4).

7.4 Relationship of the hormonal and inflammatory response with psychological recovery

Table 7. 5 Relationship of the hormonal response with mood, pain and fatigue.

		tension		positive affect		pain intensity		fatigue	
Predictor variables	**Time**	**1 mth**	**6 mth**	**1 mth**	**6 mth**	**1 mth**	**6 mth**	**1 mth**	**6 mth**
adrenaline	2 hours	.20*	.10	-.19	-.17	-.19	-.17	-.05	-.27
	4 hours	.25*	.05	-.10	.01	-.10	-.01	-.08	.06
	8 hours	.35**	.16	-.08	-.06	-.08	-.06	-.20	-.14
noradrenaline	2 hours	.08	.11	-.18	-.25	-.18	-.25	.14	.09
	4 hours	.09	.10	-.04	-.19	-.04	-.19	.15	.24*
	8 hours	.21*	.07	-.11	-.15	-.11	-.15	.08	.20
cortisol	4 hours	.38	-.00	-.19	-.17	-.19	-.17	-.15	-.15
	8 hours	.01	.06	-.02	.00	-.02	.00	-.23*	-.12
	12 hours	.09	-.11	-.08	-.06	-.08	-.06	-.08	-.05

rs in tables: *:p<.05: **p>.01**; ***:p<.001

Adrenaline was consistently associated with increased tension at one-month follow-up. In contrast, the other mood variable of positive affect showed no association with the hormonal response (Table 7.5). Pain showed no relationship to the hormonal response, and only two isolated correlations of fatigue with this response were found.

Table 7. 6 Relationship of mood, pain and fatigue with the inflammatory response

		tension		positive affect		pain intensity		fatigue	
Predictor variables	**Time**	**1 mth**	**6 mth**	**1 mth**	**6 mth**	**1 mth**	**6 mth**	**1 mth**	**6 mth**
CRP	day 1	.24*	.18	-.35**	-.21*	-.01	-.10	-.01	.21
	day 2	.21*	.16	-.32**	-.06	.07	-.03	-.03	.26
	day 3	.17	.08	-.26*	-.01	.11	-.07	-.08	.18
IL-6	12 hr	.11	-.03	-.12	-.00	-.12	-.00	.01	.34
	day 1	.10	-.04	-.15	.00	-.15	.00	-.03	.21
	day 2	.02	-.12	-.10	.05	-.10	.05	.05	.26

rs in tables: *:p<.05; **p>.01**; ***:p<.001

Patients with increased tension at one month had raised CRP concentration on day 1 and 2 after surgery. Consistently increased positive affect 1 month after surgery was also associated with raised CRP concentration between days 1-4 after surgery (Table 7.6). There was no relationship of pain or fatigue with the inflammatory response (Table 7.6). Only, isolated associations of immediate mood, pain and fatigue outcome with the hormonal response were found; they are not documented here.

7.5 Relationship of the hormonal and inflammatory response with short and long-term functional recovery

Table 7. 7 Correlations of hormonal responses with time to achieve functional milestones and with subjective ratings by physiotherapists at the end of physiotherapy.

hormonal response	**time**	**toilet**	**stairs**	**walk 10 metres**	**walk 25 metres**	**pain compliant**	**unwillingness to mobilise**
adrenaline	2 hours	-.04	-.12	-.23*	-.11	.00	-.04
	4 hours	.19	-.03	-.14	-.05	.09	.03
	8 hours	.09	-.00	-.20	-.03	.07	.07
noradrenaline	2 hours	-.04	.03	.10	-.03	-.04	.03
	4 hours	.19	.29*	.18	.17	-.08	.16
	8 hours	.09	.31**	.24*	.25*	-.08	.19
	12 hours	.17	.31**	.17*	.22*	-.01	.22*
cortisol	4 hours	-.23*	-.23*	-.09	-.07	-.19	.03
	8 hours	-.14	-.03	-.03	-.08	.04	.03
	12 hours	-.06	.13	-.07	-.01	.04	.05

rs in tables: *:p<.05; **p>.01**; ***:p<.001

Unlike noradrenaline, which was increased in patients that took longer to reach later functional milestones i.e. climb stairs and walk 10 metres, adrenaline showed no relationship with immediate functional recovery. Although cortisol was higher in those patients who took less time to go to the toilet independently and walk up and down stairs, this was an isolated and weak effect (Table 7.7)

Table 7.8 Correlations of inflammatory response with time to achieve functional milestones and with subjective ratings by physiotherapists at the end of physiotherapy.

Inflammatory response	time	toilet	stairs	walk 10 metres	walk 25 metres	pain compliant	unwillingness to mobilise
CRP	1 day	.03	.10	.09	.25*	.27*	.22*
	2 day	.02	.01	.13	.23*	.32**	.16
	3 day	.10	.10	.25*	.27*	.34**	.12
IL-6	12 hr	.06	.12	.15	.32**	.17	.21
	1 day	.16	.01	.23*	.31**	.27*	.15
	2 day	.04.	.07	.26*	.25*	.17	.10

rs in tables: *:p<.05; **p>.01**; ***:p<.001

Patients with greater IL-6 or CRP response were slower to reach later functional milestones, i.e. walking 10 and 25 metres. In those who took longer to walk 10 metres, IL-6 was raised on days 1 and 2 postoperatively, and CRP was raised on day 3. Although not shown in the tables, the raised CRP on day 3 was not an isolated significant correlation as CRP was also raised on days 4 and 5 postoperatively: Those with increased CRP complained more of pain during the first five postoperative days; correlations for the first three days are shown in Table 7.8.

Table 7. 9 Correlations of the hormonal response with functional outcome

		pain		functional impairment		stiffness	
hormonal response	**time**	**1 month**	**6 month**	**1 month**	**6 month**	**1 month**	**6 month**
adrenaline	2 hours	.05	.00	.13	.13	-.01	.10
	4 hours	.01	.05	.03	.10	-.00	.20
	8 hours	-.02	.03	.09	.15	.02	.14
noradrenaline	2 hours	.02	-.05	.10	.08	.01	.01
	4 hours	-.05	.05	.01	.03	-.04	-.07
	8 hours	.00	.04	.13	.24*	-.07	-.11
cortisol	4 hours	.04	-.06	.10	-.05	.00	.05
	8 hours	.01	-.01	-.05	.02	.05	.05
	12 hours	.11	-.08	.07	-.07	.05	.04

rs in tables: *:p<.05; **p>.01**; ***:p<.001

Only isolated significant correlations of functional outcome with hormonal response to surgery were found, and therefore were not considered to be of any real significance (Table 7.9).

Table 7.10 Correlations of the inflammatory response with functional outcome

		pain		functional impairment		stiffness	
Hormonal response	**time**	**1 month**	**6 month**	**1 month**	**6 month**	**1 month**	**6 month**
CRP	day 1	.05	.02	.11	.10	-.06	-.03
	day 2	-.00	.07	.06	.14	.06	-.06
	day 3	.05	.13	.05	.12	.01	-.08
IL-6	12 hr	-.05	-.01	-.02	.03	-.15	-.13
	day 1	-.06	.04	-.04	.07	.01	-.13
	day 2	-.04	-.01	-.07	-.00	-.08	-.23*

rs in tables: *:p<.05; **p>.01**; ***:p<.001

Again, functional outcome was unrelated to the inflammatory response except for isolated correlations (Table 7.10).

7.6 Relationship of preoperative psychological state with psychological recovery.

Table 7. 11 Correlations of preoperative emotional state with postoperative tension during patients' stay in hospital.

	Tension (POMS)	
	day 3	**day 7**
preoperative predictor measures		
tension (POMS)	.45**	.51**
confusion	.43**	.46**
depression	.32**	.30**
fatigue (physical)	.16	.41**
fatigue (mental)	.25**	.40**
friendliness	-.10	-.13
positive affect	-.27**	-.34**

rs in tables: *:p<.05; **p>.01**; ***:p<.001

Preoperatively, increased tension, confusion, depression, physical and mental fatigue were all associated with increased tension during the first postoperative week (Table 7.11). Also, increased preoperative happiness, measured by level of positive affect, was associated with reduced tension postoperatively.

Table 7. 12 Correlations of preoperative emotional state with tension.

	Tension (POMS)	
	1 month	**6 month**
preoperative predictor measures		
tension (POMS)	.44**	.40**
confusion	.50**	.43**
depression	.26**	.40**
fatigue (physical)	.40**	.37**
fatigue (mental)	.38**	.29**
friendliness	-.12	-.13
positive affect	-.35**	-.47**

rs in tables: *:p<.05; **p>.01**; ***:p<.001

Preoperatively, increased tension, confusion, depression, physical and mental fatigue were all associated with increased tension at 1 and 6 month follow-up. Increased preoperative happiness was associated with reduced tension. The only preoperative emotion which did not predict future emotion was friendliness (Table 7.12).

7.7 Relationship of preoperative psychological and functional state with functional recovery

Table 7. 13 Correlations of preoperative subjective emotional and functional state with time to achieve functional milestones unassisted and with subjective ratings by physiotherapists at the end of physiotherapy.

preoperative predictor measures	**toilet**	**stairs**	**walk 10 metres**	**walk 25 metres**	**pain compliant**	**unwillingness to mobilise**
pain	.12	.10	.03	.05	.05	-.04
funct. impair.	.11	.15	.11	.15	.19	.08
stiffness	.19	.03	-.05	.04	.09	-.09
fatigue (POMS)	.15	.15	.11	.00	.09	-.01
vigour	-.06	-.08	.15	-.11	-.28**	-.20*
depression	-.02	.01	.05	-.11	-.03	-.00
tension	.07	-.03	.06	.02	-.19	-.01
positive mood	-.18	-.14	-.11	-.13	-.24*	-.15

rs in tables: *:p<.05; **P>.01**; ***:p<.001 funct. impair. = functional impairment

Those who were happier, complained of less pain and were less unwilling to undertake physiotherapy. Also, individuals who felt more vigorous preoperatively had less postoperative pain. All other indices of emotional and functional state failed to show any relationship with immediate functional recovery. (Table 7.11)

Table 7. 14 Correlations of preoperative functional and psychological state with postoperative functional state.

	pain		functional impairment		stiffness	
preoperative predictor measures	**1 month**	**6 month**	**1 month**	**6 month**	**1 month**	**6 month**
pain	.12	.19	.15	.24*	.00	.28**
functional impairment	.14	.29**	.33***	.43***	.17	.38***
stiffness	.16	.16	.18	.25*	.22*	.42***
fatigue (POMS)	.18	.41***	.15	.33***	.18	.40***
vigour	.00	-.23*	-.15	-.23*	-.02	-.21*
depression	.00	-.14	.10	.20	.12	-.23*
tension	.13	.22*	.16	.23*	.14	.32**
positive mood	-.13	-.28**	-.19	-.32**	-.08	-.24*

rs in tables: *:p<.05; **P>.01**; ***:p<.001

As shown in Table 7.30 apart from isolated correlations, baseline WOMAC was unrelated to one-month functional recovery but was more predictive of long-term functional recovery. In general, better long-term outcome was predicted by, preoperatively, more positive mood and less fatigue (Table 7.12). Those with increased positive affect at admission had less pain and stiffness at 6-month follow-up, and those with less fatigue had reduced pain, functional impairment and stiffness.

Table 7. 15 Relationship of coping (measured retrospectively) with psychological state at the end of the first postoperative week.

predictor variables	**pain (VAS)**	**fatigue (POMS)**	**vigour**	**depression**	**tension**	**positive mood**
problem-focused	-.07	-.17	.29**	-.06	-.20	.03
wishful thinking	.17	.05	.06	-.01	.06	.00
detachment	.07	.17	-.03	-.01	.16	.20
support	-.05	-.30**	.30**	-.03	-.18	.35**
positive thinking	-.01	-.10	.23*	.08	-.20	.28**

rs in tables: *:p<.05; **P>.01**; ***:p<.001

In general, predictor variables showed few associations with postoperative psychological and functional recovery (Table 7.13). Patients with increased positive affect and vigour, one week after surgery, used positive thinking and support-seeking coping techniques. Increased vigour was also associated with more problem-focused coping. No other correlations were found between psychological and coping variables (Table 7.14).

7.8 Summary

7.8.1 Predicting recovery

The range of assessments and the interrelationships between them, reported here, provide an innovative assessment of previously unexplored relationships between the surgical stress response and functional and psychological recovery. The psychological and inflammatory responses both predicted outcome from major elective surgery. Preoperative measures of emotional state predicted emotional state during hospital stay, as well as at long-term follow-up. However, in general psychological variables were irrelevant to short-term functional recovery, unlike the inflammatory variables. The inflammatory response also predicted short-term psychological state.

Specific coping and psychological state variables were found to predict the hormonal and inflammatory responses. However, the majority of these were significant at $p < .05$, and were therefore considered to be possibly spurious findings because of the large amount of variables being dealt with in this investigation. Only, detached coping which predicted a raised hormonal response was significant at $p < .01$.

7.8.2 The effect of a raised physiological response

In general an increased hormonal response was not associated with more adverse surgical recovery. In contrast, those patients with increased inflammatory responses had reduced functional improvement in hospital, and were less happy, suggesting this response to be detrimental for immediate to short term functional recovery, as well as psychological adjustment. Also, an increased inflammatory response was associated with less willingness to engage in immediate functional milestones. However, although the physiological response had short-term clinical significance it did not affect long-term functional recovery. The relationship of psychological variables with recovery was seen 6 months after surgery, by which time recovery was unrelated to the inflammatory response. Apart from isolated correlations of hormonal or inflammatory response with anxiety or coping, the relationship of biochemical measures with short and long term psychological measures was largely non-existent.

7.8.3 The effect of psychological processes on recovery

More negative preoperative psychological state (confusion, depression, physical and mental fatigue, positive affect) was associated with worse psychological adjustment during the week after surgery, as well as at 1 and 6 month follow-up, as indicated by increased tension levels. Preoperative psychological state had less influence on postoperative functional outcome during the first week after surgery, with only increased pain levels and reduced vigour being associated with poorer functional status. Preoperative psychological state however was clearly associated with long-term functional outcome, with worse tension, fatigue (physical and mental), vigour and positive affect being linked to increased functional impairment, pain and stiffness. Coping had no major effect on postoperative state.

To conclude, the ability of the physiological response to act as a mediator of coping and psychological state was found to be limited in this thesis. Also, although research on preoperative psychological variables has focused on the immediate postoperative hospital period, it seems that these variables have more long-term implications.

PART 4

Chapter 8

Discussion

Chapter 8

Discussion

8.1 Aims of this investigation

This study assessed the effect of coping on subjective and objective recovery from major elective orthopaedic surgery. A diverse selection of recovery indices were used to monitor recovery from surgery including physiological, psychosocial, and functional aspects. The effect of active and passive coping on the surgical stress and inflammatory response was monitored with the primary aim of establishing if an intervention which encouraged patients to be more active produced a smaller stress response (adrenocorticol response) and facilitated recovery in comparison to an intervention that encouraged passivity. Recent research found that interventions which are construed to represent passive copings are associated with a heightened stress response (Manyande et al., 1992) and those construed to represent active coping are associated with a reduced stress response (Manyande et al., 1995). This investigation directly compares the active and coping strategies and their effects on recovery of patients. Collectively, the different parts of this thesis allowed three hypotheses to be tested. The first hypothesis was that patients encouraged to cope actively would have a facilitated recovery compared to those encouraged to cope passively. The second hypothesis was that passive coping would be associated with an elevated stress response, and active coping would be associated with a reduced response. Lastly, the third hypothesis was that an elevated neuroendocrine and inflammatory response would be associated with delayed or poorer recovery.

The longitudinal design of the study permitted the protracted recovery from hip and knee arthroplasty to be followed. Subjective wellbeing, an important indicator of quality of life, was inferred from patients' subjective reactions of mood and life satisfaction, as well as generic health-related quality of life measures. These were considered definitive subjective outcome measures. Physiological markers of the hormonal and inflammatory response were used to provide a more objective account of surgical processes. A functional assessment tool, developed specifically for this investigation, was considered a definitive index of immediate and intermediate functional progress. The development of such a tool was extremely important for increasing existing knowledge about the relationships between different dimensions of recovery. A qualitative analysis of patients' responses to active and passive attempts to cope with surgery was important for understanding how psychological preparation was received by patients. This type of qualitative analysis, along with a quantitative measurement of patients' immediate functional progress, has not been provided before. Measurement of the relationship of the hormonal and inflammatory stress response with psychosocial and functional measures of recovery also represents unique research in the field of stress.

8.2 The comparability of total hip and knee arthroplasty as models of recovery

It was important to find out whether total hip and knee arthroplasty surgery represented comparable models in psychological, physiological and functional dimensions of recovery, in order to make a decision on whether to combine them in a broader analysis assessing the effect of psychological preparation on surgical recovery. This section documents dimensions of recovery from surgery for total hip and knee replacement and any differences found between the groups.

8.2.1 Physiological recovery

Overall, the surgical stress response pattern was similar to that described by others (Barton, 1994; Hall, 1992). The onset of surgery caused an immediate, although short-lived 'fight or flight' or alarm response, initially described by Cannon (1929) and later Seyle (1956), which involved an increase in hormonal and inflammatory response markers. A number of expected findings were seen. Most hormonal responses reached their peak on the day of surgery, and inflammatory response markers peaked slightly later on day 1 and 2. There was an increased glucose response, presumably in response to glucagon release, which followed the catecholamine response to surgery. Cytokines, in the inflammatory stage continued to increase after the close of surgery (Baumann & Gauldie, 1994).

In contrast to expected findings, the prolonged hypercortisolaemia, for both THA and TKA, measured until one week after surgery was unexpected as cortisol does not remain elevated one week after surgery (Hall, 1989). Although the function of such an elevated response is not known, it is possible that this sustained response is important in influencing an increased inflammatory response, reflected by increased IL-6 and CRP concentrations throughout the postoperative period. As found by Nikansen, Korkala, & Pammo (1996) who assessed serum CRP levels after total hip and knee arthroplasty, there was a gradual increase in CRP and decline thereafter. However, in this thesis, maximal CRP levels were found on day 1 postoperatively, whereas in Nikansen and colleagues study this occurred on day 2 or 3 (Nikansen, Korkala, & Pammo, 1996).

As expected, the immune system was found to participate in the physiological regulation of the body after trauma (Berczi, 1998). Both lymphocyte and white cell counts reduced immediately after surgery. It can be supposed that this response occurred as a result of the short exposure to catecholamines (Kavelaars et al., 1994). As expected and found by others who have assessed lymphocyte and white cell counts (Kolstad & Levander, 1995), both markers of the immune response were affected by surgery. Analyses was terminated at 24 hours so it is uncertain when these counts returned to normal.

To date, there has been a lack of research assessing the comparability of the physiological response to surgery for THA and TKA. In this investigation, with reference to the comparability of the hormonal response (stress response) between surgical groups, TKA patients had a more consistently raised adrenaline response compared to THA patients on the day of surgery. All other hormonal markers for the two surgical groups were similar. The heightened inflammatory response for knee compared to hip arthroplasty in this investigation, represented by elevated CRP and IL-6 concentrations, suggests greater surgical trauma for this group (Hall, 1989; Cruickshank et al., 1990, 1992). The increased trauma for TKA patients may have been the reason for the increased adrenaline response in TKA patients. As catecholamines in general were not related to markers of tissue trauma, there is a possibility that psychological threat may have had some influence on the inflammatory response. However, an examination of the hormonal and psychological response showed no strong associations between either, hence minimising the impact of psychological threat on the physiological response. In contrast with other research which has found increased cortisol concentration to be linked to increased severity of surgery (Plumpton et al., 1969; Hall, 1989), cortisol concentration was similar for both surgical groups despite differences in surgical trauma. Consistent with recent research findings on the length of time for CRP concentration to return to baseline measures (Kolstad & Levander, 1995). CRP was still raised at the close of measurement one week after surgery.

8.2.2 Psychological adjustment and quality of life

With reference to follow-up data, the occurrence of transfer bias, whereby some aspect of recovery is misinterpreted due to a large percentage of missing follow-ups (Ryd & Dahlberg, 1994), was minimised in this study, as the follow-up rate success was very high. Of those patients recruited, 94% were seen at 1 month follow-up, and 91% were seen at 6 month follow-up. Consistent with many studies that have assessed quality of life after hip and knee arthroplasty from the patient's perspective, as discussed in chapter 2, both treatments resulted in improved physical, psychosocial, and functional wellbeing by six-month follow-up (Liang et al., 1986; Liang et al., 1990; Borstlap et al., 1994., Lichtenstein, Semaan & Maramr, 1993., Shields, Enloe, & Leo, 1999; Ritter et al., 1995). However, despite improvements six months after surgery, the findings of this thesis suggest that patients who have hip and knee arthroplasty should expect a decrease in physical function in the short-term.

Patients overall reported improved subjective health in relation to baseline measures. Interestingly, patients expressed increased, although stable, satisfaction with life before they had actually recovered to maximum functional levels. Despite the fact that patients had poorer physical status, particularly function, at one month compared to admission, they had increased satisfaction with their life one month after surgery, and they remained stable until six months postoperatively. The discordance between patients' subjective response and physical state, suggests that the former is not simply a reflection of the latter, but may reflect an evaluative process in which the occurrence of expected lack of energy and subjective malaise postoperatively is discounted. The complexity of wellbeing is highlighted by findings that mood continued to improve until six months after surgery, while satisfaction with life had reached a maximum early on in recovery. This suggests that the affective dimension of wellbeing (that which refers to pleasantness of experience) and the cognitive dimension of recovery (that which refers to rational appraisal, perception, reasoning and satisfaction (Campbell et al., 1976) are independent during recovery from surgery. Given this finding, the reliance on mood or satisfaction alone would not be the most reliable indicator of quality of life status. Differences between satisfaction and physical health dimensions of recovery are supported by research which examined recovery after colonoscopy (Salmon et al., 1994). So, research looking at 'recovery' should look at multidimensional aspects, for a complete account of the effects of the treatment.

Although energy and fatigue levels deteriorated shortly after surgery, indicated by vigour and fatigue levels on the Profile of Mood States (POMS), they showed improvement by the end of the first postoperative week, and further improvements at short-term follow-up. This is similar to other research that has assessed fatigue after hip and knee arthroplasty surgery (Aarons et al., 1996). Postoperatively, patients were more vigorous compared to preoperatively. Although no positive shift in their energy levels was apparent until one month after surgery, energy levels at this time began to exceed preoperative levels. Hence from this it is inferred that postoperative fatigue is not a major feature of convalescence from hip and knee arthroplasty, nor is it a universal experience.

A closer analysis of data from both surgical groups showed that although pain, mental health, physical and social function improved progressively in both THA and TKA patients up to six months, the extent of improvement differed for the two surgical groups on these dimensions. Patients with knee arthroplasties did not show improvement to the same extent as those with hip arthroplasties. This reduced rate of recovery for knee arthroplasty compared to hip arthroplasty is consistent with other research which has measured recovery up to and beyond six months (Rissananen, Aro & Slatis, 1995; McGuigan, 1995; Orbell et al., 1998, Shields, Enloe & Leo, 1999). This finding contrasts with research which has found no evidence that hip and knee arthroplasty differ at one year (Norman-Taylor et al., 1996), and 6 months, 1 year or 2 years after surgery (Ritter et al., 1995). However it is important to note that inability to detect differences between the groups in Norman-Taylor's investigation may have been a sensitivity problem, due to the sole use of clinical assessments that were concerned with gross level of disability. Whereas in Ritter et al's study, it is feasible that demographic and pathology bias together with a failure to statistically compare surgical groups may have influenced outcome reports. Consequently, the findings of this investigation emphasise the need for caution in interpreting other research which monitored psychological and functional dimensions of quality of life from hip and knee arthroplasty and found them to be equal between the groups. The surgical groups in our study were comparable on demographic characteristics. Unfortunately, the surgical groups in this investigation were not comparable in pathology, so this needs to be addressed in future research.

In the early postoperative period, similar to other research (Petrie, Chamberlain, & Azaraiah, 1984; Giuffre, 1991), both surgical groups had dramatically reduced pain. However, as found by others (Guiffre, 1991; Aarons et al., 1996), TKA patients experienced more intense pain than THA patients. These differences were not apparent preoperatively and hence are not likely to be associated with previous psychological and functional health. It is interesting that other research by Aarons et al. (1996) which measured recovery up to only 50 days, and used far less stringent inclusion criteria than this investigation found similar patterns of recovery for THA and TKA.

8.2.3 Functional recovery

The tool developed specifically for this investigation followed process rather than outcome by charting objective and subjective functional progress in hospital. This was essential in order to investigate specific relationships between immediate functional progress and other dimensions of recovery from surgery. It was clear from the findings that TKA patients progressed faster than THA patients on basic functional milestones. This finding is interesting because it is contrary to the long-term outcome results for these two surgical groups, which as discussed earlier found

THA to have a better quality of life at six-month follow-up compared to TKA patients. These findings suggest that progress differences early on are inconsequential for more long-term outcome. Also, the finding that earlier progress was associated with physiotherapy practice suggests that progress is related to external hospital factors and therefore potentially amenable to change. The tool which was developed can be easily incorporated into existing routine hospital practice, and the outcome data from it could be used not only to gauge patient progress but also to evaluate and amend existing practice.

In summary, the pattern of physiological, functional, and psychological recovery was similar for both surgical groups with differences pertaining mostly to magnitude of change. On the basis of these findings the different surgical groups were combined in analysis in order to assess the effect of psychological preparation for recovery from surgery. However, because of the differences it was necessary to be open to the possibility that psychological interventions might affect each surgical group. These concerns were resolved by subsequent additional analyses which checked to see if the intervention interacted with surgical group and these analyses found no significant interactions.

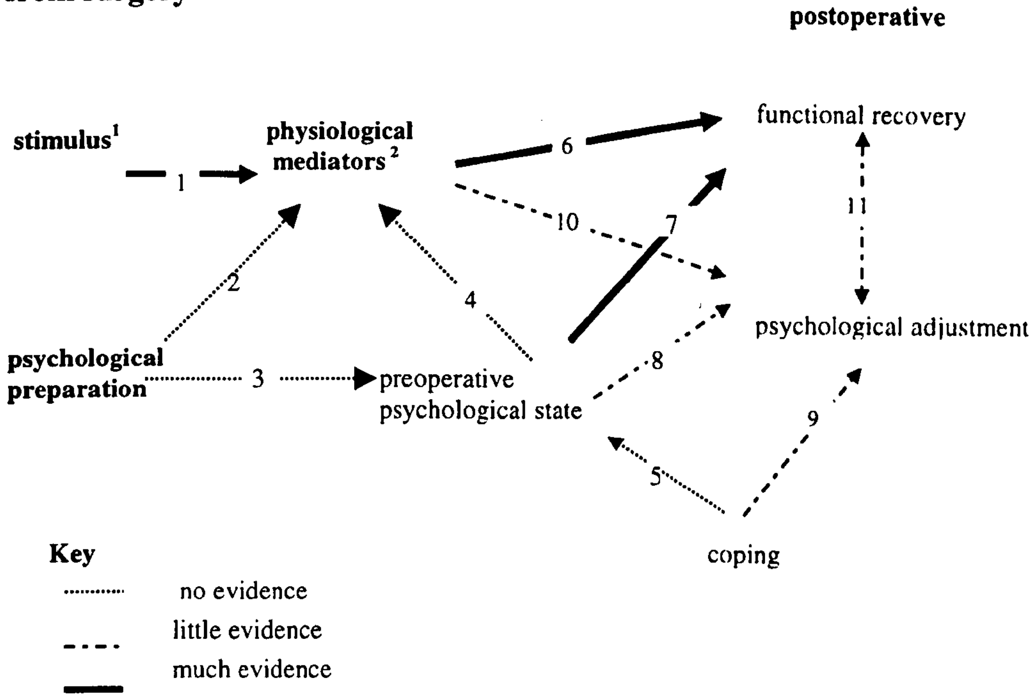
8.3 The relationship between physiological, psychological and functional recovery

This study reported innovative observations about dimensions of recovery that have rarely or never been assessed simultaneously before. The known multidimensional nature of recovery (Johnston, 1984; Wolfer & Davis, 1970) was confirmed by the lack of association between the majority of variables representing specific dimensions of recovery. Overall, the limited relationships of psychological state and coping style with physiological variables confirms the previously acknowledged independence between these dimensions of recovery (Salmon, 1992). In terms of the key hypotheses of this thesis, a diagrammatic summary showing possible pathways by which psychological preparation and coping might affect different dimensions of recovery from surgery is shown in figure 8.1.

8.3.1 The influence of the stress response on psychological and functional recovery

Unlike previous research findings (Salmon et al., 1988), the hormonal response showed no association with preoperative psychological state; suggesting an independence between these two dimensions of recovery (figure 8.1 - arrow 5). In contrast, an increased stress response was associated with immediate functional progress, while the inflammatory response was associated with immediate functional progress (figure 8.1 - arrow 6) as well as early psychological adjustment to surgery (figure 8.1- arrow 10). Taken together these findings suggests that surgical trauma is more important than the 'fight-or-flight' response in influencing psychological adjustment to surgery.

Figure 8.1 Possible pathways for psychological and physiological recovery from surgery



The evidence for relationships along pathways 1-11 is documented below.

1. surgery produced a similar hormonal and inflammatory response pattern for THA and TKA surgery. However, the magnitude of response was different between the surgical groups; TKA in general had a heightened hormonal and inflammatory response compared to THA
2. 'active' and 'passive' coping did not have an effect on the physiological response to surgery
3. 'active' and 'passive' coping did not influence preoperative psychological state.
4. preoperative psychological state did not influence the physiological response to surgery
5. interventions designed to affect preoperative anxiety through 'work of worry' or relaxation strategies had no effect on preoperative state.
6. an increased response was associated with delayed rehabilitation immediately postoperatively. An increased physiological response did not influence recovery at 1 and 6 month follow-up.

- noradrenaline increased in patients who took longer to reach basic later functional milestones
- inflammatory response increased in patients who took longer to reach basic later functional milestones
- increased CRP associated with increased observer-rated pain complaint during mobilisation

7. increased preoperative anxiety was associated with impaired function, and increased pain and stiffness during physical activity 6 months postoperatively

- increased positive affect was associated with increased motivation for rehabilitation *
- increased positive affect was associated with decreased functional impairment at 6 months
- increased fatigue predicted worse function, pain and stiffness at 6 month follow-up
- reduced positive mood predicted increased functional impairment and pain

8. heightened negative preoperative emotional state predicted increased postoperative anxiety, tension, depression, fatigue, and reduced positive affect, 1 week after surgery.
9. coping was not associated with postoperative psychological adjustment

The evidence for relationships along pathways 10-11 is weak and inconsistent, and consists of the following:

10. increased inflammatory response (CRP) associated with increased tension and positive affect at 1 month follow-up.
11. increased motivation (measured postoperatively) was associated with increased progress on basic functional milestone progress immediately after surgery

*** All correlations apart from this one (significant at p <.05), are significant at p <.01**

In contrast to previous research (Pick et al., 1994), there were no associations of pre- or postoperative fatigue with the hormonal response, implying that fatigue does not have this physical basis.

8.3.2 The influence of surgical trauma on psychological and functional recovery

Despite claims that the inflammatory response has the potential to preserve health and promote recovery (Broom, 1992; Kinney, 1995) this study found that a heightened inflammatory response, marked by increased CRP and IL-6 concentrations, was associated with slower immediate functional progress and increased pain during functional activity (figure 8.1 - arrow 6). This suggests that an elevated inflammatory response may result in or be associated with, as predicted in chapter 1, delayed recovery. However it is not possible to say whether an increased inflammatory response was responsible for poor functional performance or vice versa. These findings provide scientific evidence to support previous speculation that increased surgical trauma, characterised by a heightened inflammatory response, is detrimental because of its potential ability to delay recovery (Kehlet, 1984; Lowry, 1993). These findings verify the third hypothesis of this study which predicted that an elevated inflammatory response would be associated with delayed recovery. It also provides support for the scientific and anaesthetic practice geared towards reduction and suppression of the inflammatory response. However, the elevated response did not have a detrimental effect on long-term functional recovery, suggesting that the influence is short-lived.

Apart from affecting functional and bodily state indices of recovery, the inflammatory response also predicted psychological adjustment to surgery. Patients with increased CRP on the day of surgery were less happy at one-month follow-up. However, in general the evidence for a relationship of the inflammatory response with psychological state was very weak throughout this thesis (figure 8.1 - arrow 10).

Despite correlational findings from Chapter 7 which showed that TKA produced a greater inflammatory response compared to THA, and the analysis of postoperative comparisons for total knee and hip arthroplasty in Chapter 6 (which showed that the former was associated with more physical fatigue postoperatively), no direct correlation was found between the inflammatory response and postoperative fatigue. Therefore, the claim that greater trauma is related to increased postoperative fatigue (Christensen & Kehlet, 1993) is not supported. Overall these findings suggest that fatigue is not related to physiological processes that occur as a result of total hip and knee arthroplasty.

Clinically, the fact that the inflammatory response is still elevated one week after surgery may have implications for recovery. Although the median discharge time for patients at the two teaching hospitals in this study was 18 days, the economic pressure to decrease the duration of hospital stay for surgical patients (Weingarten et al., 1998; Wang et al., 1998) may not be beneficial for those who are still recovering physiologically. The impact of a raised inflammatory response on psychological and functional recovery for patients whilst they are at home has not been addressed.

8.3.3 The influence of preoperative emotional state on postoperative emotional state and functional outcome

There are inconsistent findings about the influence of preoperative anxiety on recovery (Salmon, 1994). The effect of preoperative anxiety on postoperative outcome has been the focus of attention in previous research. However, in this investigation, although greater preoperative anxiety was associated with worse postoperative outcome, other indices of preoperative state, for instance, depression, fatigue, positive affect, were equally effective at predicting outcome (figure 8.1 - arrow 8). Negative preoperative emotional state was associated with negative psychological adjustment to surgery. Overall, these finding suggest that anxiety is useful to some extent in predicting recovery, but that there are many other psychological indices which could also be used to predict recovery. Also, in the wider context of this thesis it can be suggested that concentrating solely on anxiety may be not be an adequate assessment by which to monitor the effects resulting from psychological interventions (see also Salmon, 1994).

An assessment of the relationship between fatigue and functional outcome in Chapter 7 showed fatigue was associated with functional activity. Increased preoperative fatigue predicted greater functional impairment, pain and stiffness during physical activity at six-month follow-up (figure 8.1 - arrow 7). These findings suggest that fatigue may affect the extent of that improvement from well-known symptoms associated with arthritis. Similarly, reduced fatigue has been found to be a predictor of increased freedom from cardiac symptoms six-months after surgery (Jenkins et al., 1994).

Support for a psychological basis to fatigue is based on the association of fatigue with mood. Patients who were more physically and mentally fatigued preoperatively were less happy in the week after surgery, as well as at 1 and 6 month follow-up. A relationship between happiness and fatigue has been found in other research with surgical patients (Aarons et al., 1996).

8.3.4 The relationship between postoperative psychological state and functional recovery

As shown in Chapters 4 and 7, one measure of patients' attitude during recovery - motivation to undertake physiotherapy - was associated with psychological and functional recovery. Reduced motivation amongst patients was clearly related to a slower rate of immediate functional recovery and worse psychological, functional, and physical state, six months after surgery (figure 8.1 - arrow 11). These findings are consistent with the suggestion that a motivational response to surgery underlines fatigue and other aspects of recovery (Salmon & Hall, 1998). Although studies which have looked at the effect of motivation on functional ability are rare, one study found increased motivation to be associated with reduced pain and depressive related symptoms (Goldberg & Maciewicz, 1994).

Chapter 7 showed that positive mood was also important in predicting immediate and more long-term functional recovery from surgery (figure 8.1 - arrow 7). In particular, increased positive affect preoperatively was associated with decreased functional impairment six-months after surgery. The perceived psychological state of patients may have important implications for recovery because of its influence on social relationships. It is possible that a lack of positive affect may be perceived as depression by others. Research has found that staff react negatively to those who present as depressed (Stack & Coyne, 1983), and that perceived negative interaction by patients is associated with a reduced sense of wellbeing (Vinkur & Van Ryan, 1993).

In Chapter 4, where fatigue (measured 6 months after surgery) was assessed in relation to psychological and functional dimensions of recovery, it showed an association with motivation during rehabilitation. This provides further support for speculation that fatigue has a psychological rather than physical basis.

Overall, these findings suggest that there is potential value for interventions which attempt to increase feelings of happiness and motivation for patients who are to undergo physical rehabilitation programmes.

8.3.5 Psychological versus physiological recovery as predictors of recovery

Research to date has examined the impact of preoperative psychological state on mostly short-term recovery, whereas the findings of this thesis clearly document that psychological variables are more appropriate predictors of long-term recovery (figure 8.1 - arrows 6). In contrast, hormonal and inflammatory response markers, as described above, were found to be a better predictor of immediate recovery (figure 8.1- arrow 7). For instance, consistent with findings which have found increased pain to affect other areas of recovery (Johnson, 1988), this study found that increased postoperative pain predicted worse quality of life and wellbeing at six month follow-up. This finding is supported by more recent research which found psychological variables, although different in nature from those assessed in this thesis, to be more influential for long-term compared to short-term recovery (de Groot et al., 1997; Croog, Baum & Nalbandian, 1997).

Given the multidimensional recovery from hip and knee arthroplasty, as suggested by Ritter and Albohm (1997), outcome research should aim to monitor clinical, functional and overall quality of life status as this helps to provide a greater understanding of the complexity of the recovery process from surgery. An ultimate aim would be to devise a standardised universal system of 'outcome data' collection providing information to practitioners and patients regarding outcome (Galante, 1985; Ritter & Albohn, 1997).

From a clinical perspective, findings from all process and outcome measures can be used by clinicians to provide patients with information about expected recovery, which has been found to be unrealistic amongst arthroplasty patients (Liang, Cullen & Poss, 1982; Clift & Rowley, 1992). Also, the overall findings of this investigation, suggest that it would be inappropriate to make judgements about quality of life based on the outcome of single quality of life measurements. Indeed, single items cannot capture the complexity of the concept of quality of life, which is multidimensional (Newell & McDowell, 1987).

8.4 Is recovery from surgery affected by psychological processes?

This section discusses how the psychological processes of perceived control, worry and anxiety affect recovery from surgery.

The interventions used for this thesis encouraged patients either to be more 'active ' and 'involved' or more 'passive' in their recovery. In the active intervention patients were provided with guided imagery techniques, which have been used with the aim of getting patients more 'involved' with their recovery (Rapkin, Strubing & Holroyd, 1991; Disbrow et al., 1993). Patients in this group were encouraged to address worries or concerns in order to promote more problem-focused coping. They were encouraged to make short-term future plans. It was hoped that these factors would enhance patient perceptions of control. In contrast, more palliative or emotion-focused coping was encouraged in the passive group; patients in this group were told to relax and not worry about anything.

Firstly, it is important to highlight that the respective number of times patients in the relaxation and active intervention group listened to tapes were: 2.8 and 3.1. These patients had been asked, by the researcher, to listen to the tapes at least three times preoperatively, and also after surgery. Patients were asked how many times they had listened to the tape preoperatively during the researchers first postoperative visit. The response of patients suggests nearly complete compliance. This can be taken as evidence that patients valued the interventions. As highlighted in Chapter 6, there was no significant difference in the amount of times that patients listened to the tapes between the relaxation and active intervention groups.

Despite a prediction that preoperative mental state, particularly active coping compared to passive coping, can facilitate surgical recovery, there were no differences on bodily state, psychosocial, functional and quality of life measures between patients in a treatment group designed to encourage active coping, and one designed to encourage passive coping. There were also no differences between treatment and control groups. This finding is contrary to the extremely limited research which has specifically assessed the impact of interventions encouraging patients to be 'active' or 'passive' in their coping (Thomas, 1995), or previously published research with surgical patients which found a beneficial effect of more problem-focused type coping over emotion-focused coping strategies in surgical patients (Peterson & Toler, 1986; Khalid & Sial., 1998; Mahler & Kulik, 1997; Ridgeway & Mathews, 1984; Ho et al., 1988; Koulepek, 1986; Manyande & Salmon, 1992). Also, in contrast to other studies which have found surgical patients with increased perceptions of control to have a more favourable outcome compared to those with reduced perceptions of control (Kugler et al., 1994; Street & Voigt, 1997), this study found that less control was not associated with worse outcome. Hence, the efficacy of psychological interventions which encourage patients to be more active and involved, in order to promote facilitated recovery from surgery, is not supported in this investigation.

According to the 'work of worry' theory proposed by Janis (1958), the generation of worry in the preoperative period is a means by which to reduce anxiety postoperatively and postoperative discomfort. Janis claimed that the 'work of worry' (1958) would be associated with how informed patients were about their pending surgery. In particular, the more informed the more likely the 'work of worry' process is to come into effect, with a better recovery from surgery ensuing. In disagreement with Janis' theory (Janis, 1958) the active intervention in this investigation, which was believed to instigate the 'work of worry', did not facilitate patients' psychological, functional or physical recovery from surgery. In fact, no differences were found pre or postoperatively between an intervention designed to encourage active coping and one designed to encourage passive coping. Patients in the passive, active and control groups showed similar levels of tension before and after surgery, and showed similar levels of postoperative discomfort in the early recovery period. Generally the findings of this thesis do not support the idea that active coping is a superior coping process to that of relaxation, nor other research findings showing that active coping is associated with a more positive emotional response (Folkman & Lazarus, 1988). Hence, the first hypothesis of this thesis, that those patients stimulated by active coping would have a facilitated surgical recovery, is firmly rejected.

In this investigation increased preoperative anxiety/tension was associated with increased anxiety/tension a week later, and negative emotional states predicted increased anxiety/tension both immediately after surgery and at short and long-term follow-up (figure 8.1 - arrow 8). Anxiety was associated with functional recovery (figure 8.1 - arrow 7). This study found preoperative anxiety/tension to have little influence on functional recovery after total hip and knee replacement one month postoperatively. Anxiety was however a more consistent predictor of increased stiffness during functional activity at six months. These findings suggest that anxiety is a predictor of long-term psychological and functional recovery. Such findings are consistent with other research which has found preoperative anxiety and negative emotional states to have a negative influence on recovery from surgery (de Groot et al., 1997; Abbott & Abbott, 1995; Croog, Baume, Nalbandian, 1987; Jamison, Parris, & Maxson, 1987; Graver et al., 1995; Anderson, 1987., Auerbach et al., 1983; Boeke et al., 1991., Sime, 1976; Dean & Surtees, 1989).

Out of all recovery variables, only one isolated variable, pain, was affected by psychological interventions. The finding that patients who received either the passive or active intervention had lower pain levels postoperatively than those in the control group, could suggest that both interventions are effective for reducing pain. This difference however, was not consistent across all pain measures, and therefore is likely to be a Type 1 error.

According to the theory that information may help to enhance predictability and may be more important than control (Ludwick-Rosenthal & Neufield, 1993), a difference between the intervention groups and the control group would be expected. However, because there were no outcome differences between either the treatment groups and control group, the findings suggest that predictability has no effect on recovery.

The lack of differences between the passive and active intervention, and between the treatment and control groups both immediately after surgery and at 1 and 6 month follow-up suggest that the treatments were ineffective with regards to outcome. Such a finding may be explained by limitations of the theory on which this study was designed, limitations of the interventions themselves, or unforeseen interaction of the intervention messages with personal (internal) or environmental (external) variables.

8.4.1 Patients' responses to interventions

It is possible that patients' responses may have 'distorted' the nature of the intervention. This distortion may have occurred through their methods to implement the intervention or their response to the intervention. In chapter 5 the actual coping processes that patients used were checked in detail, and the way in which patients responded to the active intervention message shows how they in effect subverted the message.

With reference to the interventions themselves, it cannot be presumed that patients unquestioningly accept interventions. Indeed it is the patient's prerogative to implement interventions as much or as little as they desire (Caunt, 1992). The qualitative analysis in this study showed that patients subvert the meaning of the interventions. This particularly applied to patients who received the active intervention; it suggests that the intervention did not work in the way that it was intended to. Consequently, patients' responses were remarkably similar in the active and passive intervention despite the contrasting message. For example, patients in the passive group accepted authority on the basis of faith, staff expertise and staff territoriality, while those in the active group implied that their involvement also meant acceptance of staff expertise and territoriality. Direct denial of the active intervention was shown by emotional disengagement, which was willingly accepted by most patients in the passive group (Peerbhoy et al., 1998).

Several patients in this investigation chose to disengage emotionally from asking questions about their treatment, but at the same time considered it important to 'find out' information. Results from the ways of coping checklist suggest that there were no differences between the treatment and control groups on the types of coping strategies used. The manipulation check used in this investigation asked patients to rate how relaxed they had felt during their hospital stay, how much control they felt they had over their recovery, how much their feelings had been understood by staff, and finally how helpful they had found the researcher. It was found that patients in the treatment and control groups perceived equal control over their recovery, which suggests that the interventions were ineffective at changing coping strategy. This finding also supports the argument that it cannot be presumed that the provision of an opportunity for patients to be more involved in health actually enhance their sense of control about recovery (Mahler & Kulik, 1997).

Associating adequate coping with 'taking control' is a value judgement rather than a clinical reality. Indeed as discussed in Chapter 5 of this thesis, problem-focused activity does not solely mean making plans and seeking information but is also associated with acceptance of what is happening in the hospital environment, and conforming to the expectations of nurses and other hospital staff. Street & Voigt (1997) showed that behavioural indices of involvement like asking questions, expression of concern, and active communication by patients do not correspond to an increased perception of control. Hence, from a clinical perspective it might be more useful to ascertain what in particular comprises behavioural indices of involvement, and in general to rely on patients' subjective judgements of their involvement rather than value-based judgements of this concept.

Although the literature generally supports the theory that perceived control is beneficial in a stressful situation (Lazarus, 1958, Vogele, 1985), because the interventions used in this investigation failed to influence feelings of control, this theory remains untested. Interventions that afforded greater opportunity for personal control in hospital produced equal psychological and physiological stress responses to those interventions which were intended to reduce individuals' ability to take control. There may be several reasons for the failing of the theory in a surgical context. Firstly, a large proportion of research examining control issues has used animals or humans in experimental laboratory situations, and therefore it is perhaps unreasonable to presume that a similar model for perceived control could be attributed to humans who are afforded control in a clinical setting. So far, there is little evidence that laboratory stress models are useful for understanding social stressors (Linden, Rutledge & Con, 1998). Secondly, research that has found increased perceived control to be effective for specific mental illness problems, which are often chronic in nature, should perhaps not be compared to a non-mentally ill population going through a transient stressful period.

8.4.2 Supportive effects of interventions

In this investigation, it is possible that patients in the treatment interventions as well as those in the control group, construed their interaction with a researcher as supportive (Salmon, 1994). It has been suggested that social support might be gained from the process of being interviewed and taking part in research (Oakley, 1992). The influence of the process of being involved in an interview may have been more influential for recovery than increased perceptions of support from hospital staff, friends or relatives which have all been found to be beneficial for recovery (Egbert et al., 1964; Linn Linn & Klimar, 1988; Levy et al; 1990; Kulik & Mahler, 1989;

Fontana et al., 1989; Gil et al., 1990; King et al., 1993; Stams, Koopmans & Mathieson, 1991; Jenkins, Stanton & Jono, 1994). Research has previously shown that an interview with a hospital staff member, be it an anaesthetist (Williams et al., 1975; Leigh, Walker & Janaganathan; 1977) or a nurse (Lessees et al., 1987), has improved recovery from surgery. As with other health services it is possible that reassurance and emotional support may have been those aspects most wanted by patients (Valori et al., 1996), and that dissatisfaction with a service can result when this, along with other aspects, is not provided (Fitzpatrick & Hopkins, 1993). In this investigation it is possible that increased perceived emotional support as a result of contact with a researcher was more influential than informational support provided in the passive and active intervention groups. If this is so, emotional support of this type might be more effective for surgical outcome compared to informational forms of support.

The manipulation check used in this investigation to verify how patients felt about visits from the researcher, showed that 46% found her to be 'quite helpful', and 21% found her 'very helpful', as opposed to 'very unhelpful' (5.1%), 'quite unhelpful' (4.3%) or 'neither unhelpful or helpful' (23.2%). Also, as highlighted in Chapter 6, patients' perceptions of the researcher's visits were equal between treatment and control groups. The explanation of increased perceived support as a result of interaction with a 'key figure' may help to explain similar non-significant differences between intervention groups on recovery measures that have been found in many other studies (Matthews & Ridgeway, 1982). Unfortunately, this investigation did not measure the supportive effects of the researcher and therefore it is impossible to know whether outcome may have been affected by this. Consequently, in terms of study design the supportive influence of the researcher should have been measured, and the researcher contact for intervention and control groups adjusted. For instance, although all patients in this investigation were visited both pre and postoperatively by a researcher, a more appropriate design for reducing any support bias may have been to test the control group postoperatively only, as others have done (Hart, 1980), or to use two control groups; one tested pre and postoperatively, and the other tested postoperatively.

It was clear from the qualitative study, outlined in Chapter 4, that patients valued respect and dignity (Peerbhoy et al., 1998). It is possible that the increased attention given to patients in each group by the researcher increased patients' perceptions of respect and dignity, which in turn influenced patients' perceptions of support and self-esteem. In effect, an increased value of dignity and respect over control may have been responsible for the lack of differences between treatment groups and the control group. Indeed, in an assessment by Boman and colleagues (1997) of those factors which patients placed most priority on in hospital care, it was found amongst breast surgery patients that increased control was not important to patients. More specifically, a greater need for trust was expressed than information, practical assistance, personal treatment and emotional support by breast surgery patients.

The provision of support to patients is a practical intervention to administer. It could be easily incorporated into hospital routine and would take up a relatively short period of time. Indeed a ten minute visit by an anaesthetist was associated with reduced anxiety in comparison to groups that received just information or routine hospital treatment (Leigh, Walker & Janagathan, 1977). It has been suggested that nurses could provide support to patients (Nichols, 1993). Indeed, it has been found that emotional support provided by 'nurse-contact' during the perioperative period is associated with a more favourable recovery than informational support provided by an anaesthetist; the nurse-contact group felt more relaxed, less discomfort during preparation and awakening from anaesthesia, and had less pre and postoperative anxiety (Elsass, 1987).

8.4.3 Timing of intervention

A further reason for the lack of differences between the active, passive, and control group may have been related to the amount of time patients had preoperatively to embrace the different interventions. This point is perhaps more relevant for patients in the active intervention group which encouraged more non-traditional behaviour, and therefore may have not been expected. One or two days prior to surgery might not have been long enough for an intervention construed to instigate the 'work of worry' (Janis, 1958) to be as effective as one initiated earlier. Also, it is suggested that during admission to hospital, a period in which patients experience emotional adjustment to the prospect of surgery, patients may find it more emotionally beneficial to use avoidance as opposed to more involved strategies of coping (de Groot et al., 1997). If this is so, patients' ability to embrace an 'active' coping intervention might be compromised. Given both of these factors, it may be more appropriate to instigate a preparation which encourages the 'work of worry' before the patient enters hospital, as it may be more effective at this time.

8.4.4 Problems with existing theory about the effects of active coping

Existing theories of coping have largely been concerned with the functions of coping. In particular the regulation of emotions and distress, and the management of problems causing distress have been centred upon, with problem-focused coping over emotion-focused being considered the 'superior' coping strategy. This conclusion has arisen largely from the presumption that problem-focused coping is helpful for reducing the demands of a situation, and that this form of coping confers increased control. Early research concluded that increased control, whether it be perceived or actual, as opposed to reduced control was important for reducing stress. Later research showed that this relationship was not so simple, with individual appraisals, generalised beliefs, and self-efficacy beliefs about control being important in understanding control as a commodity (Lazarus & Folkman, 1984). Also, problem-focused coping in comparison to emotion-focused coping is associated with increased control due to its association with increased knowledge and information about events, and ultimately with reference to the surgical setting, a more positive outcome (Janis, 1958). Subsequently, provision of information has been considered extremely important for generating positive outcome.

The research findings on which early coping theory was based do not extrapolate well to the surgical setting. Indeed, early research was not originally based on surgical patients' responses but controlled laboratory experiments and therefore may be inappropriate for this group, for whom control is perceived as a more subtle concept. Results from this thesis and from other recent research in clinical settings suggest that although control is thought to be positive because of its association with reduced psychological distress, it is not always desired by patients and consequently may generate stress (Thompson, 1981; Wallston et al, 1994; Law, Logan & Baron, 1994), and may be antagonistic to a preferred, or habitual, style of coping (Waterworth & Luker, 1990; Kahn, Steeves & Benoliel, 1994).

Also, even theory that was based on findings from surgical patients is questionable. For example, Janis' theory about the beneficial effects of the 'work of worry' was based on 23 patients having major surgery. From these patients, Janis confirmed that the amount of fear patients had before surgery related to how informed they were; those with moderate fear were more informed than those who were very apprehensive or had little fear. Janis went on to assess how this fear affected patients' stress response, showing that high and low fear was associated with low stress tolerance and moderate fear with high stress tolerance in the postoperative period in patients who had recently had surgery. However, in Janis' investigation, patients' accounts of how worried they were preoperatively (supposedly an indicator of how informed one is) were retrospective, and therefore should be treated cautiously.

Referring back to Chapter 5's findings, it can also be suggested that being 'in control'' or 'involved' does not necessarily mean using information to prepare for recovery in an 'active' way. On the contrary it is about yielding to what is conveyed in that information, and in turn, yielding to the authority of hospital staff. As such the relationship of 'being in control' with problem-focused coping is questionable. Given these more subtle ways by which people can feel 'in control' and empowered, it should not be presumed that emotion-focused as opposed to problem-focused coping is necessarily related to reduced tolerance to stress, or that yielding to external forms of control should be seen as a more negative way of coping (Chapman, 1992). This finding suggests that the being actively in control is not the only way to prepare for surgery, and that it may be more valuable to view preparation for surgery in broader terms rather than in terms of it being related only to problem-focused coping or the 'work of worry'. The theory on which this thesis' research is based may not have been suitable for the clinical group used, and as such it may be that it would be better applied to either minor surgery, or surgery that is perceived to be more life threatening.

In summary the findings of this thesis ask for a re-evaluation of the concept of control, and the means by which it can be obtained.

8.4.5 Problems with the interventions

The interventions in this investigation were planned carefully, basing components of the intervention on previous research conducted by Manyande and colleagues (1992 1995), and on comments from patients, upon informal questioning, about things that concerned them with regards to being in hospital and having surgery. Despite this the interventions may have been too weak to have an effect on outcome. These weaknesses may have been due to external factors affecting the interventions or the interventions themselves.

It is possible that if the hospital environment did not encourage 'involved' behaviour, patients may have perceived attempts to put the active intervention into practice as too difficult (White & Jansen, 1986), and opted to accept routine practice. The current running of pre-admission clinics at both hospitals, which provide sensory and procedural information to patients about their surgery, may have affected the impact of messages encouraged in the interventions. To provide one example, patients in the passive group would have, in general, been seen by a specialist pain nurse, prior to the operation, who informed them that a patient controlled analgesia (PCA) machine would allow them to control their pain relief. This message is clearly contradictory to the passive intervention used for the purposes of this thesis. In addition to this, one patient informed the researcher that he had also attended a pain management clinic for his arthritis prior to hospital admission, where he had been given a TENS machine which allowed him to be active in his pain relief. The patient said that he used the machine frequently postoperatively. Also in opposition to the relaxation message, all patients in this investigation were seen postoperatively by a physiotherapist who explained rehabilitation in detail, and emphasised to patients how much their rehabilitation progress relied on them. It has been found recently that patients find pre-admission clinic reassuring, helpful, and useful for relieving anxieties (Nelson, 1996). Hence, it is possible that such confounding variables may have affected responses to the interventions used in this investigation.

Interventions which try to foster increased perceived control may also fail because patients feel that the opportunity for increased control is inappropriate in the hospital environment. Indeed, Skinner (1995) suggests that choice in the surgical environment may be perceived by patients as an illusion. Indeed, for some patients it has been suggested that the perception of limited control may be more beneficial for recovery (Breemhaar & van den Borne, 1991).

Personality variables may also affect outcome. In this investigation it was feasible that specific individual differences relating to perceived control may have affected responses to psychological preparation. Subsequently, it was checked preoperatively that individual differences on attitudes towards the amount of behavioural and informational control desired by patients in terms of their health care (measured by the Health Opinion Survey – HOS - Krantz, Baum & Wideman, 1980), and how much control they perceived to have over their general health and wellbeing (measured by the locus of control - Lau & Ware, 1981) were similar between treatment groups. It was also important to establish whether treatment interacted with the former individual differences because of the aim of psychological interventions, used in this investigation, to influence patient perceived control over procedural and informational aspects of their care. Findings showed no interaction of treatment group with these individual differences.

It is possible that other personal characteristics of patients outweighed any effects of the interventions; however, it was not the aim of this investigation to assess the influence of all possible individual differences on recovery. Indeed, it is established within the literature that coping strategies (Jordan, Lumley, Leisen, 1998; Hopman et al. 1998; Scharloo et al. 1998), perceived control over one's illness (Chaney et al. 1996), self-efficacy (Taal et al., 1993; Beckham et al; 1996; Barlow, Williams & Wright, 1996) and optimism beliefs (Brenner, Melamed & Panush, 1994; Long & Sangster, 1993) are strongly related to physical and psychological symptoms in those with arthritis; hence, it may be that these factors influenced outcome after surgery. For example, referring to literature which has assessed outcome from joint arthroplasty, increased expectations have been associated with greater perceived improvements and importance of these compared to those with low expectations (Flood et al., 1993). Also, where patients have expected problems preoperatively this has been associated with increased dissatisfaction after surgery (Kiyak, Vitatcano & Crinean, 1988). It would be useful to assess the mediating influence of patient expectation, optimism and other personality variables on short and long-term outcome across physical, psychological, and functional dimensions of recovery.

It might be argued that if the interventions were strong enough that they should be able to counteract any external influences. It is possible that the interventions used in this investigation may have been too weak to do this. With reference to the design of the interventions, firstly, the preparatory information provided for those in the 'active' group may have been too 'mild' to initiate the 'work of worry' process which on a theoretical level is an integral part of preparing for surgery (Janis, 1958). It might be that sensory and procedural details of recovery may be more effective if provided on a video using real patients rather than in auditory form on tape. In this investigation some patients in the active group found it difficult to imagine events and expressed a preference for more concrete examples, suggesting that they were not able to use the guided imagery in an effective way. It might be that a visual presentation of procedures and sensations would be easier for some patients to relate to. Although a comparison of tape versus video has not been undertaken, recent research with total hip replacement patients found that preoperative video-viewing compared to normal hospital routine was associated with reduced physiological and psychological distress (Doering et al., 2000). A similar argument can be put forward for the 'passive intervention'; here the components of the overall intervention may have been too weak in order for it to be effective. Secondly, although relaxation is generally considered to be an important prelude for guided imagery techniques, the use of a design which included relaxation techniques as a vehicle for both active and passive intervention groups may have reduced any outcome differences between the intervention groups. It might be important in future research to differentiate interventions completely with respect to their form and their content.

The active intervention in this investigation mainly required patients to mentally prepare for surgical and rehabilitation events. Recently, however, it has been found that increased anxiety amongst surgical patients is associated with 'common' worries, that is factors associated with illness, family and medication, rather than information about surgery conditions and procedure (Johnston, 1987). Subsequently, it can be suggested that the 'real' worries of patients were not targeted and that, in turn, patients were not encouraged to prepare adequately for their surgery.

8.4.6 Patient and environmental factors which may have affected recovery

Other variables, not directly affected by perceptions of control or postsurgical outcome, may have resulted in promoting a psychological situation that affected recovery. These variables can be categorised into those relating to characteristics of the patient sample, and aspects of the hospital environment. In terms of characteristics of the patient sample, it is well documented that age, degree and type of social support after discharge, and patients' need or desire for information and autonomy can all affect recovery. In particular, worse psychosocial adjustment has been seen in older patients (Jacobsen, 1984; Edwards, 1991), and those who have limited support networks during their hospital stay and after discharge (King et al.

1993; Stams, Koopmans & Mathieson, 1991; Reifman, 1995). It has also been consistently found that certain personality types benefit more from increased information (Miller & Mangan, 1983; Watkins, 1980, Law et al. 1994; Davis et al., 1994; Pickett & Clum, 1982; Partridge & Johnston, 1989; Shaw et al., 1985) depending on their individual need for information and autonomy. Also, although most research that has assessed the effect of worry on surgical recovery has concentrated largely on surgical and anaesthetic fears, it is plausible that worries not directly associated with surgery may have influenced recovery. Research has shown that worry about illness and the family occurs more frequently for some patients compared to worry about surgery and is linked to increased anxiety postoperatively (Johnston, 1987). Unlike Johnston's study, although the extent of both surgical and other worries were not recorded in this investigation, it was apparent during interviews that surgical worry was not the sole concern of patients. Patients often expressed concern about the welfare of their partner or their pets, about cleanliness on the ward, or about leaving and returning to an empty house. Another influence on recovery may have been previous experience of surgery, as this may affect coping. In this investigation a quarter of patients had direct experience of joint replacement; some less than six months beforehand. It might be interesting for future research to assess the impact that prior surgical experience has on coping and recovery.

In terms of the hospital environment, it has also been found that individuals who interact with depressed patients, as opposed to non-depressed ones, respond negatively towards those patients, becoming more tense, irritable and angry themselves (Coyne, 1976). This response may affect future interactions between staff and patients and be associated with adverse psychological and emotional states.

It has also been found that impact of a preadmission booklet and other information has equal effects to postoperative education to assist rehabilitation after surgery (Mikulaninec, 1987). In addition, more subtle hospital features such as admission policy and even the view from a patient's window might affect recovery. Indeed, research has found that increased waiting time in health care settings is linked to more aggression towards staff (Akerstroem, 1997), and that a more naturalistic view from a hospital window of a row of deciduous trees, compared to a brick wall, to have a positive effect on recovery (Ulrich, 1983).

With reference to the findings of this study, it can be inferred from the profound difference in patients' mood state before and after surgery, and between the different hospitals, that variables other than perception about control and recovery were influencing patients' psychological state. Whether these variables were individual characteristics of patients or/and environmental aspects was not explored. It is possible that the application of preadmission care and information which was received by the majority of patients in this investigation, staff-patient interaction and environmental differences between the two hospitals affected recovery. Again, although this investigation did not systematically record how long patients had to wait in a day room before receiving a bed, it was evident that one of the hospitals was generally faster to allocate patients to beds. With reference to this study, a link between recovery and any veiled hostility, perhaps resulting in negative emotion associated with staff-patient interaction or admission procedures, and the potential influence of the more rural environment of one of the hospitals in comparison to the other, is purely speculative. It may be important in the future to assess the influence of such variables, which although not directly related to perceptions of control might affect the psychological situation and thereby surgical outcome.

8.5 Are the effects of psychological interventions mediated by their effects on the stress response?

One way in which psychological interventions have been claimed to influence recovery from surgery is through their influence on the surgical stress response. It was predicted in this study that patients in the active group would have a decreased surgical stress response compared to patients in the relaxation or control group. The former prediction came from recent findings which showed the glucocorticoid response to be raised in response to interventions construed to represent passive (Manyande et al., 1992) as opposed to active coping (Manyande et al., 1995).

Lack of differences in the stress response between intervention groups in this study suggests that the physiological stress response is independent from passive and active coping. Other psychological mechanisms, not measured in this investigation, may have influenced the physiological response.

Although it has been suggested that attempts to reduce postoperative anxiety may represent the 'medicalisation' of a natural emotional response, thereby increasing the stress response, and compromising future recovery (Salmon, 1993), this study found no support for this. Indeed all intervention groups showed an increased hormonal response, which in general had little effect on recovery. As such, interventions which include relaxation or reassurance components, previously connected with a raised response (Manyande et al., 1992), should not be seen as more harmful than those which encourage active coping.

As illustrated in figure 7.1, Chapter 7, it was hypothesised that psychological preparation may work by influencing coping style, perceived control or emotional state, and that outcome would be physiologically mediated by these effects. However results from chapter 7 looking at the relationship of these psychological processes on the stress responses show clearly that coping, perceived control, and psychological state have no effect on the stress response.

In conclusion because psychological interventions used in this study did not have any effect on the surgical stress response, it is impossible to test the second hypothesis that they might be potential mediators of that response. Indeed, as the stress response was clearly not related to recovery, it can be presumed that if an intervention which changed the stress response was produced, then this would not be expected to affect recovery. Correspondingly, if an intervention which changed recovery was produced it would not be expected to work by changing the stress response.

8.6 Summary

Two subsidiary studies in this study proved crucial for an investigation and interpretation of the core hypotheses in this thesis. The qualitative study indicates a need to re-evaluate the concept of control for surgical patients, which operates at a more subtle level than anticipated. Also, a way of measuring the process of functional progress was developed and tested and found to have excellent clinical validity and application. Overall, this study showed a lack of relationships between the numerous psychological, physiological, and functional indices of recovery measured in this investigation, thus reinforcing current findings on the multidimensional nature of the recovery process. The findings of this thesis made it necessary to firmly reject two out of three hypotheses of this investigation. Firstly, active coping did not facilitate recovery. There are several plausible explanations for the equal recovery of patients in all intervention groups in this study, some involve internal factors and others involve external factors. Referring to the second hypothesis that the biochemical response might mediate the effects of psychological interventions, the fact that the interventions used in this investigation failed to influence patients' perceptions of control, made this impossible to test. There was some support for the third hypothesis, that a raised stress and inflammatory response would compromise recovery, as it was found that heightened inflammatory responses was associated with impaired immediate functional progress.

This investigation has shown that there are psychological and physiological reasons for delayed recovery from surgery. One novel finding arising from this investigation is the different amount of influence that the physiological and psychological responses had on short and long-term recovery. The physiological response was associated with short-term functional recovery, whilst the psychological response was associated with more long-term functional recovery. Clinically, the importance of a positive emotional state before surgery was confirmed by the finding that, out of all psychological variables only two, heightened motivation and positive affect were associated with more positive psychological adjustment and functional recovery. Positive affect was the only psychological variable to have a strong association with immediate functional progress and more long-term functional recovery. So although much focus has been given to the provision of various cognitive coping interventions hich encourage passivity or active involvement amongst patients, a specific focus on increasing motivation and positive affect within such interventions may result in more psychological and functional recovery from surgery.

The results of this thesis clearly show that attempts to manipulate coping had no influence on the physiological response to surgery. However, the fact that psychological state, which may be affected by coping, was found to influence recovery, suggests that coping may have an influence on recovery. Lastly, in terms of the surgical models used in this investigation, it was found that although total hip and knee arthroplasty represented comparable models of recovery in terms of psychological, physical, and psychological recovery, the overall long-term health-related quality of life after TKA was poorer than that of THA.

8.6.1 Future research and recommendations

The findings of this investigation suggest that the role of personal control in recovery from surgery is minimal, and that other factors such as motivation and positive mood have more influence on recovery than more commonly measured variables relating to preoperative psychological distress. Consequently, it may be beneficial for future clinical interventions to place an emphasis on the promotion of positive mood and increased motivation, and to assess the influence of these factors on a wide range of outcome measures. It is also necessary to further work on how patients' experience interventions, and to explore concepts of dignity and respect instead of control.

Clinically, physiotherapists may provide a key role in the recovery of patients. It is well known that brief interaction in health care settings can lead to dissatisfaction. However, physiotherapists have an advantage over several members of hospital staff, devoting significant amounts of time to patients before and after surgery. With the establishment of good rapport, there is a potential opportunity to influence a patient's behaviour, promote adaptive coping strategies, and influence health attitudes. As seen from the findings of this investigation, reduced motivation has adverse short term and long term psychological and physical effects. From this it can be argued that those physiotherapists with greater motivational skills, may encourage faster and better recovery. Consequently, it might be suggested that physiotherapists as a group be encouraged to assist early detection and modification of psychological aspects that have been found to affect recovery. This is a particularly relevant issue given that patients are not always motivated to attempt extra exercise; the main barriers to exercise are pain and disability (Lewis & Lynch, 1993), a lack of positive feedback, and a feeling of helplessness (Slujis, 1991). Overall it is important that physiotherapists are sensitive to the potential influence of psychological factors on physical signs and symptoms which arise during rehabilitation, and can incorporate a patient's viewpoint into consideration when working with them. As suggested by Moffet and Richardson (1997), increased patient rehabilitation compliance might be gained by asking patients to discuss their perceptions of problems or barriers, and to assist them, by encouraging control over their pain and ability to cope, in overcoming a state of helplessness. An examination of physiotherapists' ability to understand patients' emotional and psychological state during recovery could be undertaken in a study which assessed both patient and physiotherapists' attitudes towards rehabilitation, and the influence that they have on each another.

This prospective study might have been improved in its design. It would have been better to use only postoperative assessment for control groups, as a way of ruling out possible influences of increased social support, which in theory may be obtained from contact with a researcher. Also, considering the positive effects associated with increased social support networks after surgery, it may have been useful to monitor the type and amount of support that patients' received after discharge from hospital to see if this had any impact on recovery.

Findings from this investigation indicate the importance of continuing with a multi-disciplinary assessment of recovery from surgery. This investigation used only total hip replacement patients, a large homogenous sample, to assess interrelationships between psychological, functional, and physiological measures of recovery. A sensible follow-on study would be to assess the relationship between psychological, physiological and functional recovery for the total knee arthroplasty patient group before proceeding to other surgical groups, taking into account pathology and other factors which may affect outcome. Specific attention should be drawn to relationships of the physiological response (inflammatory in particular), with functional recovery, as well as the influence of motivation and mood on functional and psychological recovery, given that this thesis has shown a relationship between these variables for total hip replacement patients. The use of immediate functional recovery indices, like the tool developed specifically for this thesis, may prove invaluable in disclosing further information about short-term, as well as long-term interrelationships with other dimensions.

Physiological processes had important clinical implications, implying that their measurement would be important in future research. However, although increased physical trauma was associated with more delayed immediate functional progress in this study, because of the short-term monitoring of the physiological response it is not known how long after surgery this association exists for. Hence, future research may wish to assess more long-term relationships of the inflammatory response with functional recovery.

The influence of perceived social support as a medium for improving recovery from surgery should be investigated further. More specifically, it would be useful to monitor those aspects of care which patients find non-supportive, or negative interactions which are likely to have the most detrimental effects (Rook, 1990). Here focus is placed on the 'dynamics' of social support, rather than concentrating on type of social support and the beneficial effects to be gained from it (Druley & Townsend, 1998). Also, measuring perceived support gained from psychological interventions would increase the understanding of the potential of different interventions to provide support to patients. So far, although it is well established that support has a positive psychological impact for surgical patients (DiMatteo & Hays, 1981; Elizur & Hirsch, 1997; Ahmadi, 1985; Guilbert & Roter, 1997), as well as less physiological arousal (Cohen & McKay, 1984), there is little information on how supportive patients perceive interventions to be. Hence, to broaden the literature on the supportive influence of interventions, it would be useful to ascertain which interventions are supportive, and to assess if these mediate patients' psychological and physiological responses to surgery, and/or helps to change patients' appraisals of the situation by reducing their subjective stress of surgery or recovery (Cohen et al., 1985, Gottlieb, 1985). These ideas relate respectively to theory about support having a direct effect on outcome (Lazarus, 1964), or support acting as a buffer in stressful experiences, thus reducing the negative impact of them (Cohen & Willis, 1985). As it is suggested that one of the most important times patients need increased support may be following hospital discharge (Rene et al., 1992., Young, 1990), it might be worth assessing the effects of interventions which are used at this time.

To conclude, findings from this thesis highlight the need for further investigation into psychological processes which might influence recovery from surgery. They also strengthen existing evidence that recovery from surgery is a diverse process involving physiological, psychological and functional aspects which often show no relationship; thus reinforcing the multidimensional nature of recovery. As physiological processes and psychological aspects of surgical stress are important in influencing psychological adjustment and functional outcome from surgery, it is appropriate to assess both of these in providing an account of surgical recovery. It is only by such methods that an increased understanding and knowledge about the complex process and extent of recovery will be determined.

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APPENDICES

Appendix A Consent form

PATIENT INFORMATION SHEET

Study of psychological needs of patents undergoing hip and knee replacement.

We want to improve the psychological care that patients receive while they are waiting for surgery. Before we can do this we need to know more about how patients feel before and after surgery. Therefore each week, one or two patients are being asked to take part in a study to give us this information.

So that we can tell how you feel before and after surgery, we will ask you to fill in some questionnaires before and after surgery. A nurse will also visit you in your home at 1 and 6 months after you leave hospital to ask some more questions about how you are getting on at home. So that we can tell how quickly your body is getting over the operation we shall ask you to provide some blood samples (about 2 teaspoonfuls each) through a vein in your arm. The first will be on the day you are admitted, then just before surgery starts and just after it ends. There will be 4 more samples during the day of surgery, then one on each of the next 7 days.

Some patients may be asked to spend 30 minutes or so before surgery listening to a tape recording that some patients have found useful in the past.

All the information you give us will be strictly confidential. To make sure of this, your name, will not be kept on any of the questionnaires. We will use a code number instead.

You are under no obligation to take part in the study. Also if you decide to take part you can change your mind at any time. Whether or not you do take part will not affect the way you are cared for. You would be helping to give us the information that we need if we are to improve the way patients are cared for in the future.

Please ask me now or later if you have any questions or concerns at all.

Departments of Clinical Psychology and Anaesthetics
University of Liverpool

Appendix B Physiotherapy Questionnaire

Patient name -
Date of operation: -
Surgeon:

1. On what date after surgery did this patient first start to mobilise (i.e. walk)

Date _____

2. In your opinion did mobilisation appear to cause:

a = The first time it was carried out
b = The last time it was carried out

0 - no pain
1 - little pain
2 - moderate pain
3 - severe pain   **a=** _______   **b =** ______

3. Day of achievement of milestones
Assistance applies if the person is physically helped by one or more individuals.

	With assistance	**Without assistance**
	(Date achieved)	(Date achieved)
a)-on/off chair	....	....
b)-on/off bed	....	....
c)-on/off toilet	....	....
d)-up stairs	....	....
e)-down stairs	....	....

4. Day of achievement of walking distances (date)

5 ....

10 ....

25 ....

5. How willing was this patient to undertake the physiotherapy

a - the first time it was carried out
b - the last time they did physiotherapy in hospital

0 - very willing - no complaints
1 - willing but with minor complaint
2 - willing but with much complaint
3 - patient would only continue with much persuasion
4 - patient would not continue with physiotherapy until a later time or day

a= _____ b = _____

6. At conclusion of inpatient physiotherapy, how confident is this patient with mobilisation?

0 - very confident
1 - quite confident
2 - not confident at all = ___________

7. On discharge what problems will the patient have with outdoor walking

1. a lot
2. slight
3. none

Appendix C Modified Health Locus Of Control Scale

Here are some statements about your health. <u>For each one</u>, please circle a number to show to what extent you agree or disagree with it

		Strongly Disagree					Strongly Agree	
1.	Staying well has little or nothing to do with chance.	1	2	3	4	5	6	7
3.	Doctors can rarely do very much for people who are poorly.	1	2	3	4	5	6	7
3.	Doctors relieve or cure only a few of the medical problems their patients have.	1	2	3	4	5	6	7
4.	There is little one can do to prevent illness.	1	2	3	4	5	6	7
5.	No matter what anyone does, there are many diseases that can just wipe you out.	1	2	3	4	5	6	7
6.	Whether or not people get well is often a matter of chance.	1	2	3	4	5	6	7
7.	People who never get poorly are just plain lucky.	1	2	3	4	5	6	7
8.	The serious of many diseases is overstated.	1	2	3	4	5	6	7
9.	When it comes to health, there is no such thing as 'bad luck'.	1	2	3	4	5	6	7
10.	In the long run, people who take very good care of themselves stay healthy and get well quickly.	1	2	3	4	5	6	7
11.	Recovery from illness requires good medical care more than anything else.	1	2	3	4	5	6	7
12.	Recovery from illness has nothing to do with luck.	1	2	3	4	5	6	7
13.	Most people are helped a great deal when they go to a doctor.	1	2	3	4	5	6	7
14.	There are a lot of medical problems that can be very serious or even fatal (can kill you).	1	2	3	4	5	6	7
15.	Healthwise there isn't much you can do for yourself when you get poorly.	1	2	3	4	5	6	7
16.	Doctors can do very little to prevent illness.	1	2	3	4	5	6	7
17	"Taking care of yourself" has little or no relation to whether you get poorly.	1	2	3	4	5	6	7
18.	Some kinds of illness are so bad that nothing can be done about them.	1	2	3	4	5	6	7
19.	Many times doctors do not help their patients get well.	1	2	3	4	5	6	7
20.	Good health is largely a matter of fortune.	1	2	3	4	5	6	7

Appendix D Physiotherapy exercises

Physiotherapy routine treatments differ between institutions i.e. some physiotherapists prefer to get patients out on the same side of bed they had their operation on, whereas others prefer to use the opposite side, so these routines and exercises should only be used as a treatment guideline. The specific exercises outlined below are those given to patients initially via a patient information booklet used at Broadgreen Hospital. If patients did not receive these preoperatively they were given to patients as soon as possible after surgery.

C1 Rehabilitation for THA patients.

Bed rest. Immediately postoperative physiotherapy exercises to be performed regularly whilst on bed rest include: 1) gentle toe, foot and ankle flexing and extending exercises of both legs 2) static contractions and relaxation of quad muscles in both legs periodically throughout the day 3) static gluteal (buttock) contraction and relaxation exercises on both legs and 4) gentle knee flexion and extension of the unaffected leg is encouraged 5) specific breathing exercises. Patients are advised on chest care and encouraged to perform deep breathing exercises, coughing and expectoration if appropriate 6) patients walk at 48 hours (after check X-ray and removal of drips and drains) with the assistance of a physiotherapist, an assistant and a walking frame.

Initial walking and transfers. Instructions given to patients by physiotherapists for *getting out of bed* are as follows:

1. They should get out of bed on the side of the unoperated leg.

2. Lean back as far as they possibly can, taking their weight through their arms to give full support to the operated leg, before positioning themselves in the bed.

Patient's return to bed after this and resume their designated bed rest period, with periodic walking in between, until the time arrives for them to transfer from a bed to a chair. Surgeons have a fixed preference for times at which they prefer their patients to transfer from a bed to a chair (Table 3.2). Patients are advised of the following positions when *sitting out in a chair*:

1. Do not cross legs. They are given an abduction wedge immediately postoperative that should prevent them from doing this.

2. Do not bend the operated leg more than the normal sitting position i.e. not more than 90°.

When a patient *rises from a chair* they are told:

1. To keep their operated leg straight out in front of them.

2. To push up with their arms using the arms of the chair and take the weight of the operated leg mainly through their unoperated leg (Again the patient may be able to refer to visual aids to help them with these exercises).

When sitting down in a chair the patient is told to:

1. Keep their unoperated leg out in front of them

2. Lower themselves by bending their unoperated leg and taking the weight evenly through their arms by holding the arms of the chair.

<u>Walking and exercise practise</u>. Once patients have sat out of bed and are confident using the walking frame, they will progress to elbow crutches and sticks at the discretion of the physiotherapist. To help assist the patient to get back to normal walking there are three types of walking aid available: walking frame, sticks or elbow crutches. In many instances it is at the discretion of a physiotherapist to decide which one is most suitable for his/her patient. Some consultants however, prefer progression to crutches rather than sticks in order to protect the joint in the early stages of recovery. The following sequence represents the correct procedure for walking with any aids are conveyed to patients: Walking aid first ⇒ operated leg ⇒ unoperated leg ⇒ walking aid...

Patients are informed never to twist round, and that each leg must be picked up carefully and you step round carefully, and that the operated leg should be stepped away from to reduce the risk of twisting.

<u>Stair climbing.</u> At discharge the majority of patients are expected to be able to climb stairs. Practise of this exercise may depend on the patient's home circumstances. The following instructions are provided for stair climbing:

Upstairs:-

1. Stand at the bottom of the stairs and hold onto the banister rail with one hand.

2. Carry both crutches in one hand. To carry your aid make a T-shape with them in one hand (a physiotherapist will show the patient how to do this)

3. Put the unoperated leg first (the 'good' leg)

4. Put the operated leg second.

5. Bring the walking aid up onto the step last

Downstairs:-

1. Stand at the top of the stairs and hold onto the banister rail with one hand.

2. Carry both crutches in one hand. To carry your aid make a T-shape with them in one hand (a physiotherapist will show the patient how to do this)

3. Walking aid goes first

4. Operated leg.

5. Unoperated leg.

Patients are given instructions for getting in and out of a car, although they are generally advised not to do this for six weeks following their operation if they have had a THA.

C2 Rehabilitation for TKA patients.

Bed rest and first postoperative week. All patient's legs in this study were placed in a splint, to maintain knee extension immediately after their operation. Patients may have received their splint in theatre or on return to the ward. Although TKA patients generally walk and perform other transfer functions, on average earlier than THA patients, they are expected and encouraged to do a lot of exercises in bed, as well as walking intermittently 48 hours postoperatively. TKA patients are expected to do the following maintenance and circulation exercises postoperatively whilst on bed rest or resting in bed between intermittent walking: static quads, static gluts (buttock contraction) and unoperated leg knee flex exercises. It is emphasised to patients that bed rest exercises should be performed frequently during the first two post operative days in order to gain strength in their muscles in preparation for later exercises, as well as them being beneficial for their circulation and chest care.

Some patients that had attended a pre-admission clinic will have been given an information booklet that will contain sheets documenting immediate postoperative exercises to be carried out by the patient; if not physiotherapists often provide patients with sheets that document the exercises. All TKA patients walk, as much as pain allows, with a back-splint and walking frame 48 hours postoperatively. Knee wounds are inspected approximately 5-7 days after surgery and if there are no problems the patient commences knee flexion. When the patient has achieved a good straight leg raise (SLR) the splint is removed, upon which gentle knee flexion can commence. The aim is to increase knee flexion with each physiotherapy session. To develop knee control after TKA straight leg raises (SLR) are performed whilst the patient is on bed rest. Here patients are told to: 'pull your toes up towards you⇒ tighten your thigh⇒ lift the leg and hold it in this position keeping your toes up, hold and lower ⇒ relax. Patients are told to make sure they engage in deep breathing exercises, coughing and expectoration if appropriate.

Advanced exercises. Approximately one week after surgery patients perform inner range quadriceps exercises (block under the knee). Patients are told to: pull you toes up towards you ⇒ keep the knee in contact with the roll⇒ push as hard as possible down into the roll⇒ straighten the leg ⇒ Relax. This exercise effects the inner range quads and improves knee control in extension.

An exercise is performed at approximately one week after surgery to assist in knee flexion (bending) with a cloth under the foot exercise. This exercise will be performed after consultant has checked wounds. Here the patient is told to extend their leg as far as possible and slide their foot back on the cloth and hold it still, for as long as possible (until it feels painful and stiff). One hospital in this study encouraged patients to do this every 2 hours for 10 minutes, whilst the other instructed patients to perform it 3-4 times a day.

TKA patients follow the same procedural rules as THA patients when they walk with aids, when they sit and raise themselves in a chair, and when they go up/down stairs. TKA often require outpatient one or two times per week after discharge. Unlike THA there are no restrictions for getting in/out of a car after a TKA.

Appendix E Short term functional progress in THA/TKA

Table 1 Mean number of days to achieve basic functional milestones

Function		0-2	3	4	5	6	7	8	9	10	11	12+	M
Bed	Assisted	97	44	32	16	12	3	1	2	5	0	4	13
	%	45	19	15	7	6	1	1	1	2	0	2	
	Unassisted	10	13	18	22	31	35	19	16	11	10	26	18
	%	5	6	9	10	15	17	9	8	5	5	13	
Chair	Assisted	73	25	28	15	20	36	8	3	6	1	2	12
	%	**34**	**12**	**13**	**7**	**9**	**17**	**4**	**1**	**3**	**1**	**2**	
	Unassisted	19	20	20	20	34	35	25	15	8	4	16	14
	%	**9**	**9**	**9**	**9**	**16**	**17**	**12**	**7**	**4**	**2**	**7**	
Toilet	Assisted	53	22	25	29	20	33	7	4	4	4	7	21
	%	**26**	**11**	**12**	**14**	**10**	**16**	**3**	**2**	**2**	**2**	**5**	
	Unassisted	14	18	16	24	29	30	20	16	9	6	22	25
	%	**7**	**9**	**8**	**12**	**15**	**15**	**10**	**8**	**4**	**3**	**11**	
Stairs	Assisted	0	0	0	0	2	9	11	17	12	14	126	38
	%	**0**	**0**	**0**	**0**	**1**	**5**	**6**	**9**	**6**	**7**	**66**	
	Unassisted	0	0	0	0	1	11	9	14	9	14	162	40
	%	**0**	**0**	**0**	**0**	**1**	**5**	**5**	**7**	**5**	**7**	**69**	
Walking	5 ms	87	44	31	26	12	6	2	2	3	1	3	12
	%	**40**	**21**	**14**	**12**	**6**	**3**	**1**	**1**	**1**	**1**	**1**	
	10 ms	40	35	31	45	21	11	10	4	6	3	10	13
	%	**19**	**16**	**14**	**21**	**10**	**5**	**5**	**2**	**3**	**1**	**5**	
	15 ms	9	21	23	31	24	27	19	8	5	5	38	18
	%	**5**	**10**	**10**	**15**	**11**	**13**	**9**	**4**	**2**	**2**	**18**	
	Discharge	0-7	8-14	15-16	17-18	19-20	21-22	23-24	25-26	27-28	29-35	35+	
		0	21	64	34	24	34	10	4	9	12	6	11
	%	**0**	**9.5**	**29.1**	**15.5**	**10.9**	**15.9**	**5**	**1.8**	**4.1**	**5.5**	**2.7**	

M= missing

Table 2 Number of patients within the different surgeon groups who transferred 'early' or 'late' in the week

Day of transfer from a chair to a table	Transfer time	
	'early'	'late'
day 2	37	18
day 4	3	13
day 7	45	45

Table 3 Day of first assisted transfer to chair in hip patients operated by surgeons with differing requirements for when this should occur.

Surgery	Surgeon transfer time	Day on which achieved											
		1	2	3	4	5	6	7	8	9	10	11	Miss.
Hip	day 2	0	38	4	5	1	1	0	0	1	0	0	5
	day 4	0	0	2	11	1	0	1	1	0	0	0	0
	day 5	0	0	1	0	0	0	1	0	0	0	0	0
	day 7	0	5	4	4	7	17	34	7	1	5	3	3
Knee		2	28	14	8	6	2	0	0	1	1	0	4

Appendix F Preoperative interaction with patients

E1 *Passive intervention*

This outlines the nature of the 1:1 intervention for patients in the Relaxation group.

pre-surgery

' Good morning/afternoon Mr/s X. I'm sorry you've been on the waiting list so long; you'll realise that there's no other way of organising things. It's unfortunate that we can't do anything about it. Thank you for being patient. Even now that you are here, waiting isn't over! You're probably waiting for a bed now! There are lot's of things that have to be done. Have you had any X-rays done yet Mr. X ? (*list other things they will be having done: bloods, premeditation, surgery etc.*).

Unfortunately we can't give you definite times when they will happen. We can't be sure what time you'll go down for your X-rays for example, they have to arrange yours with everyone else's; you have to fit in with the way that the x-ray department works which could mean being whisked away quickly in the middle of someone visiting etc.

It's important to realise that the hospital has well-worked out routines and ways of doing things. It makes it easier for you and everyone if you do your best just to go along with these. I'm here to tell you a bit about how you can fit in with how things are done here.

Which hospital staff have you met?. They are each here to look after the different needs that you will have over the next two weeks. They're all well trained, or being trained to look after patients like you. So I hope you can trust them to decide the best care for you, they know much more than you or I, and it really is best to let them make as many of the decisions as possible. Leave them to look after all your physical needs. This will leave you with plenty of time just to rest and relax while you wait for your surgery. Over the past year/months you have been having to cope with many things yourself. Now, you don't have to think about anything, it will all be done for you. For instance, nurses have worked out the best ways of dealing with the pain that you'll have. Leave it to them to give you pain-killers when they come round. After your operation you'll even have a machine, which will control the pain for you. Nurses will check your blood pressure and temperature at set times.

There's no need for you to concern yourself with this, it's just routine, for the doctors to see. You don't have to worry about anything.

Has anyone been to tell you about the patient controlled analgesia machine you'll be having? *(If patient has, ask the patient to explain what they were told. If it challenges the relaxation message, reframe the nature of the PCA machine for the patient. If no explanation of the PCA has been given, inform the patient about what it does).* At the end of your operation a PCA machine, something that I am sure someone has already spoken to you about, will be attached to your arm just after you wake up. You will have the PCA machine by your side for approximately two days. This machine is there to control your pain for you. By just pressing the button your pain is relieved, for you, within a few minutes. It puts some morphine into your blood, which will deal with your pain. Press the button as many times as you need to and let the machine control your pain for you. You must relax and rest during recovery time and let the doctors and nurses take care of you. Rest in preparation for the exercises that the physiotherapists will tell you to carry out. If you wake up during the night I'd like you to do the exercises then. In the meantime just relax and rest. You don't have to worry about anything, it's all being taken care of for you. Again, as I said before, You don't have to worry about anything.

After the operation, physiotherapists will guide you through a series of exercises. They will tell you exactly what to do. It's very important to follow all the instructions as closely as possible. Even if you find yourself thinking that things should be done differently, try to remind yourself that they are the experts; they've looked after lots of people having your operation, just leave it to them. The more relaxed and patient you are the easier it will be for the staff to take care of you. Besides, there really is nothing much you can or should do apart from rest.

If you find yourself thinking of questions, just stop and tell yourself, 'it's all being taken care of for me, forget it. There's nothing I need to do, or nothing I can do. All I have to do is just slip into the routine that the hospital has worked out for people having hip operations'. Even when staff don't explain what they're doing, they always have good reasons for what they do. You'll see that the staff around you are all really busy; it's often hard for them to answer questions. But they will attend to you whenever they feel it's important. Just leave everything up to them over the next couple of weeks. How do you feel about what I have just said?

You'll have lots of free time over the next couple of weeks. Just use it to rest and relax. Of course I realise that many people find it difficult to relax in hospital. Most of the time, you might do what you normally would do at home - read a book, chat to people or visitors *(elicit what they'll do to occupy themselves).* All these things can help take your mind off surgery or anything else that bothers you at present. We're also giving patients simple relaxation exercises to calm them down, which I will run through in a moment. Before I do that I'd just like to explain why I want you to do these exercises.

It has been found that relaxation is a simple method for relieving feelings of stress and anxiety. You are about to have surgery. It is quite natural that you may feel concerned and worried about what is going to happen to you. It is not good for the body to be put under constant stress, as this can make you feel tired, and can make you prone to other illnesses. It has been found that Relaxation exercises will help your body by reducing feelings of stress, which will reduce tiredness and other illness. The exercises will help you to take your mind of any worrying thoughts that you have. This will help reduce the amount of stress in your body, leaving it as relaxed as possible. It is easier for the nurses to look after you when you are more relaxed. Relaxation feels good and it is good for your mind and your body. We know that if you do these exercises they will make you feel more relaxed. It is important that you do the exercises regularly, as they will have the most beneficial effect this way. I would like you to do these exercises at least three times a day.'

It's very important to practice this regularly. I'd like you to listen to this tape at least three times before and after you're operation. I'm leaving this tape, and recorder, for you to go over the exercises by your self. Remember, Relaxation will help take your mind off the operation and other worries. You may have for example, been thinking about what happens when you get home. Just let the relaxation help you get rid of these thoughts. Just let time take its course, be patient. In the morning you'll have a bath , be given pre-medication, and be asked to remove any false teeth, jewellery etc. I'll see you after the operation.

post-surgery (day 3)

'I hear everything has gone well. The PCA machine was controlling your pain for you; it's now been removed and the nurses will take over your pain control for you. They'll deal with your pain for you. They will give you pills and injections, if they think you need it. Physiotherapists by now will have planned the best timetable for you as far as exercises go. It is very important that you keep to these as closely as possible. Apart from this, there's very little else you need do to do. So when you're not doing exercises just relax and let time take its course in the recovery process.

And remember, if you find your mind racing ahead, just stop and tell yourself, it's all being taken care of for me, forget it, there is nothing I need to do.' Just leave it to everyone else to do the worrying for you'.

post surgery (day 7)

'If you have not already been given a date for your discharge you will be soon. The main thing you can do when you get home is relax and let time aid in the process of recovery. Remember to follow the useful advice that doctors, nurses, physiotherapists and other hospital staff have given you, and to let time take its course in the healing process.

Are you having a home help? This will have been arranged for you. You'll get a letter in the near future telling you when to come back to the hospital. A nurse will also make an appointment for six weeks time to see how you're getting on. Until then rest and exercise in moderation. Again, if you find yourself asking questions, just stop and tell yourself, 'It's all being taken care of for me, forget it. There is nothing I can do. There is little part I can play to help me recover, apart from rest, relax and exercise and let time take its course.

E2 Active Intervention

This provides a brief outlines of the nature of the 1:1 intervention for patients in the active group. It may be used as a potential guide for anyone planning to conduct a similar intervention. There is particular emphasis on the comments in bold type when speaking to patients.

pre-surgery (day -2)

'Good afternoon Mr/Ms. You have been on the waiting list a long time. You didn't have much choice about when your appointment was going to be. You had to wait for the letter or telephone call. Now that you are here things are different. How things go is much more up to you. Over the next couple of weeks you'll find that you have much more control and responsibility than you think.

In fact, we know that patients do best when they do get involved with their own treatment here. So, we want you to be involved as much as you feel able. I'd like to go through the sorts of ways that you might like to get involved. ***You can do a lot more than you think you can.!*** Is that O.K?

Which hospital staff have you met so far?. They will each give you advice or help, but they all rely on ***you*** to tell them what you need. They rely on you to make the important decisions (*use a clinical example).* Have you been in much pain recently Mr. X?. Well the nurses will be able to help you with this. They will offer you pain-killers, but they need you to choose whether or not you need any, you are in charge. Are you happy to do this? (*make sure patients understand/accept what you are saying to them).* The staff are all highly trained in looking after patients having your operation, but every person is different, so they recognise that ***you are the expert*** as far as your own needs go. Everybody is different.

Now Mr. X, has any one been to talk to you about the patient controlled analgesia machine which you are likely to be using? *(If patient say yes, ask them to talk about the idea behind the machine, if not, explain when they will get it and how it works).* After your surgery tomorrow a patient controlled analgesia, PCA machine, something you will have chosen to use after being spoken about it by a nurse, will be attached to your arm just after you wake up. You will have the PCA a machine by your side for two days or so. When you press the button some morphine will be injected into your arm, it lets ***you*** deal with the pain. You're the only one who really ***knows*** the amount of pain you are in. So it's up to you to press the button if you need to. ***You*** are completely in charge of your pain relief. You are the best person to judge when and how many times to press the button.

For a few days after your operation a physiotherapist will help in getting you up. Later on a physiotherapist will show you some exercises; but the real value of these is when you go over them yourself at your own pace, in the ways that you find best, and at the times that suit you. It's really helpful if you get involved as much as possible, after all, you are the expert as far as your own needs go. It's important that you try as hard as possible with these exercises. And when the physio comes back to visit, ***tell them*** what you think about the exercises. Staff like to know how people find what they tell them to do.

How do you feel about what I've just said?. It's very important that you understand what's going on around you, there are lots of staff here who will answer your questions to help you understand. ***You*** should ask them if you would like to know or feel uncertain about anything. ***Please do ask.*** Even small things for example, nurses will check your blood pressure and temperature regularly, if you would like to know what these show, just ask. Sometimes the staff might seem too busy. Don't be put off; they ***are*** busy, but they are keen to tell you what you need to need to know. Even if they seem harassed, it's their ***job*** to do this. It's ***your right*** to ask questions. How do you feel about asking questions?. Have you got any questions for ***me****?*

For a lot of the time you'll be left alone, with nothing happening. It's easy for you too feel that there's nothing to do except just wait for things to happen. In fact, it's really important ***to use this time well.*** You can plan and get ready for the things that will be happening over the next few weeks and months. First of all, you can help to get your body and mind ready for the ***big*** operation - I'll run through some exercises with you in a few minutes. But it's also a good time to prepare for life ***after*** the operation. ***If you'd like to,*** we'll talk about this tomorrow *(say if patient admitted 2 days before their operation).* Are you happy with what I've said, does it make sense?

What I'd like to do this afternoon is to give you some ideas about how you can help to get yourself ready for the ***big*** operation. *(Mention ways in which the patient can be more involved with their treatment and health care). It may be easier to ask patients questions for example,* Have you spoken to...?, I'm sure you've left specific instructions...., Would you like me to go and ask somebody to call...? *(It might be helpful to refer to previous surgery and to elicit worries. The response of the client should enable the interviewer to choose a hospital layer. This should be connected with any worries/concerns the patient has recently mentioned, this will help the conversation to flow more easily.*

You will/may find yourself worrying about all sorts of things, or you might just find yourself becoming confused or uncertain about something. It's natural to feel like this at such a stressful time; the staff realise, and you may/can often sort things out by asking them questions *(prompt questions).*

Of course, I realise there's only a certain amount staff can do by answering questions and that's why it's really up to you to prepare yourself mentally as well. There are ways that you can practice thinking that will help to prepare your mind. These may help you ***feel*** calmer; even if they don't they're still worth doing because they will be preparing you.

So you're worried about.....*(tie in with worries elicited - keep the conversation flowing)*. You may find yourself feeling negative about....., try to notice when you do. Shall we talk about ways in which you might be able to notice when you're thinking negatively about something?

(Use the following as a guide. Some examples may be more appropriate for certain patients. {Remember to prompt patient responses; to keep the conversation flowing).

(i) Try to stop...and ask yourself 'what is it that's upsetting me?' You may come up with a few things, but if you look at these carefully you may see that some are only short-term problems. Would that work for you?

(ii) Thinking negatively may reflect a habit you've got into of expecting things to be difficult or to get worse... you may be ignoring lots of positive evidence, and paying more attention to things that ***might*** go wrong. Would that work for you?

(iii) Try arguing with yourself; running over the two sides of the argument in your head, instead of just concentrating on the one, negative, side; even just telling yourself positive things can help. Would that work for you?

(iv) Trying to just put it out of your mind. Say to yourself.....I've dealt with it and can now think about other things. Would that work for you?

It's easy to give in to this way of thinking. But doing whatever you can, even if it's a little. Even if its difficult to reduce your negative thoughts it will help, even just ***trying*** can help. You'd be surprised. You might have been trying to do this over the last two years, and even if you don't believe it's been helpful it ***can*** help you get ready for what it's going to be like before and after surgery. As has already been mentioned, people recover much quicker when they are more prepared. I realise that in a situation like this, it ***is*** difficult to get control of your thoughts and feelings. But it ***is*** possible; it's well-worth trying. Is there anything you'd like to talk about?

I'd like to leave what we've just been talking about for a moment and show you some mental exercises that many patients find useful and that you might like to practice and to use yourself over the next few days, and even weeks if you find them particularly helpful. Do try to do these.

The first part is some simple relaxation exercises. You may have tried something like this before? These give you a simple way that you can use to control and calm down your body

- and your mind. In this way you can help to reduce your body's arousal - you may notice your heart rate go down for example. You can also use the exercises to help you deal with pain or stress. ***You know*** that the mind can influence the body in many ways *(Interventionist: sell the idea by expressing that you do the exercises and that they work for you*). In the second part you 'rehearse' actively coping with difficult situations that you will be in over the next days and weeks. You'll practice seeing yourself actively coping well with them, seeing them as a challenge. By doing this you can actually help yourself to cope better with the real thing. Have you come across this technique before?

Do you do any sports?. You know that some of the most famous sports people use this technique don't you? Yes, some of the most famous sports people spend some time each day doing special exercises that will help them with their training/competitions.

I'm leaving this tape with a recorder so that you can go over the exercises on your *own (give equipment to the patient and explain how it works).* You can help yourself ***now*** by rehearsing dealing with the challenges in your mind. Some of the challenges you'll face, will be the same as for other people having the operation - letting you legs take your weight for the first time, walking a few yards with equipment you might not have used before. After this, though, only ***you*** know what you are aiming for, what you'd like to achieve *(elicit aims).* It's no use just rehearsing all the things you want to do in a jumbled way, or aiming to run before you can walk! You need to start at the beginning. It's important to make sensible plans, step by step. The tape I have given you will help you to do this. Do you have any questions for me?. *(Recap on anything that did not come up in discussion: questions; negative thinking; relaxation/active coping).*

You have the rest of the day to do any exercises and to ask any remaining questions that you may have about surgery. Ask about as many things you feel you need to know. Get as involved as you can be. See ***yourself as in charge***, and in control. I'll see you after you've had you're operation Mr/Mrs. X.

day 3 postoperatively

I hear everything has gone very well. Have you seen the physiotherapist yet?. How did you find the exercises that you practised? *(discuss).* Do you have any questions for me? *(discuss anything that comes up with the patient).* Remember that it is important to keep thinking positively, and to do as much exercise as possible. Physiotherapy, mobility and exercises help circulation, keep going. What immediate targets have you set yourself for the next few days?

Even though the PCA machine has gone, you are still in charge of your pain relief, ***you can choose*** whether or not you need painkillers when the nurses offer them to you. And remember, if you find yourself asking questions in your head, about medication, physiotherapy, recovery, or anything else, keep them, and ask the appropriate member of staff. You have a large part to play in this busy hospital system, so let the staff know about your wishes and concerns. You've heard of the patient charter *(if not explain).* You have a right to know as much as possible about your care and to tell others what you think of it.

day 7 postoperatively

How has everything been?. How did you find the exercises that you practised? Do you have any questions for me? *(discuss).* What targets do you have for the following week and when you get home?. What would you like to be doing in a few weeks time?. The nurse is coming to visit you in six weeks time-what would you like to be doing then? Looking into the future even further, the nurse is coming to visit you in six months time, what would you like to have achieved by then?. Have you been given your discharge date?. No... ask when this may be.

Once you get home, it's even more up to you how quickly you make you new hip work for you. Go too fast, and you might make things difficult for you; on the other hand, it's easy to give into the feelings that you just want to rest. What you need to do is to plan what your targets are, and how you are going to achieve them - like we discussed a few days ago. Remember, that when you are sitting, resting, you can help yourself by working through things in your mind - rehearsing them in the way that you've been practising in hospital. If it works for world champions, it can work for you. At your follow-up visit, you'll have another chance to ask any questions you may need to; make a note of things as they occur to you over the next weeks. Carry on doing the exercises that you found useful with physiotherapists. You'll be able to work out the best way of fitting them into your routine.

How have you found your experience in hospital? Things not gone as you had wanted?. Feel free to tell the staff. If anything occurs to you when you get home perhaps you would like to write a note to the hospital. You could even write to the manager if you like. They need people like you to tell them what you think of it all. They rely on you to tell them if things go wrong, so that they can do something to improve things for patients in future. Of course they also want to know about what you found good and helpful during your hospital stay. A nurse will contact you in the future to make an appointment with you later for a nurse to visit you in your home to see how you are getting on. Keep to the plans that you've made.

Appendix G Recorded messages for patients

F1 passive intervention (mental relaxation)

(start of tape)

'Get into a comfortable position in bed or in a chair. For the next 20 minutes you are going to try some exercises that will help you to relax. If you don't succeed in relaxing some part of your body, do not worry, just carry on, and with practice it will become easier. Relaxing will allow your body to get better. If you find your mind wandering off don't worry just bring your mind back to what I'm saying. Just listen to my voice......

Firstly close your eyes. Listen to any sounds you can hear on the ward. There's no need to let them distract you, listen to them as they come and go. Don't put names to the noises or think about them in anyway. Just listen to them......

Now think about your breathing. Don't try to change it in anyway. Think of each breath in and out.....feel each breath floating in and out.....feel the warmth of the air as it comes out.....follow each breath as it goes in and out. Notice the feelings of tension go each time you breath out. As you relax breath slowly, quietly and calmly. Each time you breath out feel yourself fall deeper into relaxation, relax more deeply.

Now think of your hands. Think about all the feelings you can notice in your hands.....think about the position of your hands.....the fingers, and the palms...... Think about the temperature of the skin of your hands.....for example, the warmth and coolness of your hands. Notice any tight, tense or tingling feelings.....let go of these feelings.....let your hands go heavy and loose.....let them feel soft and limp. Feel your hands rest on the bed.....feel them calm, still and heavy. Let your hands sink into the bed. As you relax breath **slowly, quietly** and **calmly** *(x2)*

Now think about your arms.....the position of your arms...... Feel your upper arms resting on the pillow.....your forearms and elbows on the bed or chair.....notice any tension.....let go of any tension that you can feel. Your arms feel heavy and relaxed. Now think about your shoulders.....notice any tension.....let go of any tension that you can feel..... feel your shoulders become heavy and relaxed. Carry on breathing **slowly**, **quietly** and **calmly** *(x2)*

Now think about your head and face. Think about your scalp and how it feels right now. Think of your forehead.....Notice any slight frowning tension.....It begins to go.....let your forehead smooth out, and feel it becoming cool and relaxed.

Now think of your eyebrows, and your eyelids. Feel the eyelids become heavier. Be aware of the space between the eyebrows and the eyelids. Feel the space become longer and wider as you relax more and more.

Think of the upper lip, the lower lip.....Let both lips relax, feel them slightly parted. Your tongue, allow it to rest on the floor of your mouth. Your teeth - allow them to part slightly. Notice any tingling feelings in the teeth.....let go of them.

And now become aware of your chin, your left side of your jaw, and your right side of your jaw. Feel your teeth slightly parted and your jaw slightly open. Feel your jaw heavy and relaxed. And now become aware of the whole of your face - with all the muscles smooth and relaxed.....soft, relaxed and expressionless. Feel the cool air brushing over your face, feel your face calm, cool and composed. Carry on breathing **slowly, quietly** and **calmly** (x2).

Think of each breath in and out.....feel each breath floating in and out.....feel the warmth of the air as it comes out. Follow each breath as it goes in and out. Notice the feelings of tension go each time you breath out. As you relax breath **slowly**, **quietly** and **calmly**. Each time you breath out feel yourself fall deeper into relaxation, relax more deeply.

And now leave your face and take your attention to the back of your head, and then the back of your neck. Feel your head resting on the pillow.....feel your head sink into the pillow.....feel it heavy and relaxed. Carry on breathing **slowly, quietly** and **calmly** (x2).

Now think of the muscles of your stomach and chest.....notice any tension in your stomach and chest...... As you notice the tension, let it go.....feel the muscles soft and relaxed.

Now think about your feet and legs.....just as you did with your hands and arms...... First your feet. Think of all the feelings you can notice in your feet...... Think about the position of your feet.....the toes, sides of the feet, the heels...... Think about the temperature of the skin of your feet.....for example, the warmth and coolness on the skin on your feet. Notice any tight tense or tingling feelings.....let go of these feelings.....let your feet go heavy and loose.....feel your feet flop out to the sides.....feel them calm, heavy and relaxed. Feel the heaviness of your feet.

Now the legs.....think of any feelings you can notice in the legs. Notice any tension.....feel any tightness in the muscles of your legs...... Let go of any tight, tense or tingling feelings.....feel, your legs heavy and limp..... let your legs sink into the bed. Be aware of your legs, all the muscles soft and slack.....let your legs rest completely.....feel the heaviness in your legs.....feel your legs sink into the bed or chair. Enjoy the deep heavy satisfying feeling of relaxation. Carry on breathing slowly, quietly, and calmly (x2).

Notice the feelings of tension go as you breath out. Each time you breath out feel yourself fall deeper into relaxation. Relax more deeply all the time. Carry on breathing slowly, quietly and calmly (x2). Again be conscious of getting rid of tension as you breath out. Each time you breath out feel yourself fall deeper into relaxation. Relax more deeply all the time. Feel the deep heavy satisfying feeling of relaxation in both of your hands.....arms.....feet and legs.....stomach and chest. Feel yourself heavier and warmer.

Now think of your back.....the position of your back.....all the muscles in your back.....let your back go heavy and soft...... Feel your back become more and more relaxed.....feel the deep feeling of relaxation I your back. Now leave your back and think of your whole body......Notice any remaining tension.....and let go of it......Let yourself relax completely. Enjoy the calm peaceful feeling of relaxation. Carry on breathing slowly, quietly and calmly (x2). Let go of any remaining tension with each breath.

Now feel your whole body relax...... Let your whole body sink further into the bed. Feel your body resting...... Feel your breathing quiet and gentle...... Enjoy the calmness and quietness in your body. And now I'll count backwards from 4 to 1. When I reach 1 I'd like you to open your eyes and feel how relaxed you are.....4...3...2..1.

(end of tape)

F2 Active intervention (mental relaxation and imagery exercises)

The following is a brief version of the relaxation mental relaxation together with mental imagery. Different imagery is used for those having THA or TKA. Like patients in the relaxation group patients are given a rationale for doing the exercises. In order to make the patient feel they can be involved with the implementation of the intervention patients are told that 'the beauty of these exercises is that you can choose to do them whenever you want to. You can do them when you're feeling tense and anxious or purely just to pass the time away. The more you do the exercises the more relaxed you will feel. You could try the exercises after meals. Perhaps you could do the exercises before physiotherapy. Being as relaxed as possible will aid movement. Alternatively you could go through the exercises after physiotherapy'

F2a Total Hip Arthroplasty

pre-surgery (day -2) - part 1

Get into a comfortable position in bed or in a chair. You're going to try some exercises that will help you to relax. Relaxing will allow your body to get better.

Firstly close your eyes. Now think about your breathing. Don't try to change it in anyway. Think of each breath in and out.....feel each breath floating in and out.....feel the warmth of the air as it comes out.....follow each breath as it goes in and out. Notice the feelings of tension go each time you breath out. As you relax breath **slowly, quietly** and **calmly** (x2). Each time you breath out feel yourself fall deeper into relaxation, relax more deeply.

Now think of your hands. Think about all the feelings you can notice in your hands...... Think about the position of your hands.....the fingers, and the palms...... Think about the temperature of the skin of your hands.....for example, the warmth and coolness of your hands...... Notice any tight, tense or tingling feelings.....let go of these feelings.....let your hands go heavy and loose.....let them feel soft and limp. Feel your hands rest on the bed.....feel them calm, still and heavy. Let your hands sink into the bed. As you relax breath **slowly, quietly** and **calmly** (x2)

Now think about your arms.....the position of your arms......Feel your upper arms resting on the pillow.....your forearms and elbows on the bed or chair.....notice any tension.....let go of any tension that you can feel. Your arms feel heavy and relaxed. Now think about your shoulders.....notice any tension.....let go of any tension that you can feel.....feel your shoulders become heavy and relaxed ......*Carry on breathing **slowly, quietly** and **calmly** (x2).*

Now think about your face and head.....notice any tension in the forehead, eyes, or jaw.....let go of an tension you can feel...... Feel your head and face become more relaxed. And now leave your face and turn your attention to the back of your head, and then the back of your neck. Feel your head resting on the pillow.....feel your head sink into the pillow .....feel it and relaxed. Carry on breathing **slowly, quietly** and **calmly** (x2)

Now think about your feet and legs.....just as you did with your hands and arms...... First your feet. Think of all the feelings you can notice in your feet......Think about the position of your feet......the toes, sides of the feet, the heels...... Think about the temperature of the skin of your feet.....for example, the warmth and coolness on the skin on your feet. Notice any tight tense or tingling feelings.....let go of these feelings.....let your feet go heavy and loose.....feel your feet flop out to the sides. Feel them calm, heavy and relaxed. Feel the heaviness of your feet.

Now the legs.....think of any feelings you can notice in the legs. Notice any tension.....feel any tightness in the muscles of your legs. Let go of any tight, tense or tingling feelings.....feel, your legs heavy and limp. Let your legs sink into the bed......Be aware of your legs, all the muscles soft and slack.....let your legs rest completely.....feel the heaviness in your legs. *Carry on breathing **slowly** , **quietly**, and **calmly** (x2).* Again be conscious of getting rid of tension as you breath out. Each time you breath out feel yourself fall deeper into relaxation. Relax more deeply all the time.

Now leave your legs and think of your whole body...... Notice any remaining tension.....and let go of it.....let yourself relax completely. Enjoy the calm peaceful feeling of Relaxation. *Carry on **breathing slowly, quietly** and **calmly** (x2).* Let go of any remaining tension with each breath.

Remember that by going over a situation ***in your mind,*** you will, in fact, be much better prepared for it. While staying relaxed try to imagine each of the situations I describe as vividly as possible. Then picture yourself active well with it. Imagine it's the day of surgery. You have had ***nothing*** to eat or drink, you feel hungry and thirsty. You know that you ***cannot*** eat or drink. You tell yourself: 'I will ***only*** be hungry and thirsty for ***a very short*** period of time. I know that it is for ***the best*** that I'm hungry and thirsty...... As these things help my operation to run more smoothly.' Breath **slowly, quietly** and **calmly** (x2)

Now imagine the time for the operation is getting nearer......You are given premeditation and you are in bed waiting to go to theatre. Your mouth feels ***very dry*** and.....you feel very hungry. Again you ***tell yourself,*** 'this is only ***short-term***. Later on, after the operation, I'll be ***tucking into a good meal.'*** You can't help worrying how it's going to go but you ***tell yourself:*** 'I'll soon be feeling fine.....and it will be a success. *Breath **slowly, quietly** and **calmly** (x2)*

Now you arrive at the operating theatre. You are greeted by the surgeon and his team, the room is ***warm*** and ***you feel*** comfortable. You tell yourself, 'I am about to have the surgery that I want.....I feel pleased, and ready for what is going to happen.

Imagine you are now waking up from the anaesthetic. The operation has been done and you now have a ***new hip.*** Feel yourself drowsy and weary. You may even feel sick. Perhaps you are not sure where you are or what has happened......You don't feel up to doing or saying much at all. You feel you can't cope with activity. You know that you will ***only*** feel like this for the next few hours. You tell yourself 'it's ***only natural*** that I'm going to feel like this after surgery, and the staff around ***don't expect*** me to be bright and cheerful.' You know you will be feeling ***much more*** cheerful later. *Breath **slowly, quietly** and **calmly (x2)***

You may feel some pain.....but you tell yourself this is just a natural reaction to the surgery. You know that ***you can control*** this. You know that you must use or ask for pain killers when you need them.....you're the best judge of when you need them. You tell yourself: '***I'm in charge*** of my pain medication.' You feel in control. Your worried about certain things...... Maybe you have strange feelings in your head, stomach or other parts of your body. You ask nurses to help you feel better. You tell yourself, 'this is just a reaction to the surgery.....I wont feel like this for long.....I can ***easily*** cope.'

You arrive back on the ward.....you're feeling uncomfortable......You may be in pain or feel stiff.....maybe you feel sick.....but you know that you can ask the nurses to help you feel better. Imagine how restless you may feel not being able to move around.....having to sit or lie in bed. You feel awkward and embarrassed about having to rely on so many people for so many things. You know you must ask for help. You tell yourself, 'the staff are here to help me, and want to help me as much as possible.....If I need something I'll ***ask*** them to help me. I'm the best judge of what I need.' You know things ***won't happen*** unless you make them happen. It all seems so difficult at the moment but you ***tell yourself, I'm doing well*** and in a short while I'll be over this.'

Imagine yourself feeling uncomfortable as you lie in bed.....but you ***still f***eel in control...... You tell yourself 'I wont feel like this for long.....it's ***just*** short term, I can ***easily manage*** for the rest of the day.' The time passes quickly. You feel ***positive*** about what you're going through, knowing that it's the first stage of recovery......You tell yourself 'I will feel much better in a few hours time.' Breath **slowly, quietly** and **calmly** (x2)

It's the day ***after*** the operation. You really don't feel good at all. You may feel tired and sick. You may be wishing that you hadn't gone through with the operation.....but you tell yourself, 'this feeling will soon pass, I'll ***soon*** be over this.' Maybe you feel there's nothing you can do to help yourself, but this is the time you can rehearse, in your mind, what you will soon be doing. Remember the more you rehearse in your mind, the more quickly you will succeed in practice. So picture yourself trying to move your new leg, in bed, for the ***first time***. You lift it.....very carefully.....just a little.....to see what it feels like.....and let it drop. It was hard.....so you rest.....again.....lift.....rest.....lift.....rest..... lift..... rest. It feels very difficult, but you tell yourself this is the beginning of getting back to a normal life...... You try wiggling your toes and bending the leg slightly. You tell yourself it's good to move the leg.....if only very a tiny bit. It's a great effort the first few times and you feel tired.....but you tell yourself, 'it's good for my circulation, it's the ***first*** step towards getting better'. You feel your circulation improve ***each*** time you exercise, feel your muscles become ***warmer*** and warmer as they work ***harder*** and harder. Feel your muscles ***strengthening*** with each exercise. You tell yourself that you're hard work makes each exercise feel slightly easier than the one before, and helps you get ready for the next one. You're feeling ***positive*** about what you are going to achieve.....you imagine the leg muscles strengthening.....and see the exercises as a challenge. *Breath **slowly, quietly** and **calmly** (x2)*

A few days after the operation. Imagine for the first time, you're ready to get out of bed and take a few steps, with a little help......You feel worried about how the new hip will feel when you put weight on it for the first time.....but at the same time glad to do something...... Imagine yourself grasping the monkey pole above the bed.....lifting yourself up slowly.....It hurts.....you feel worried.....you bend your good leg and keep your bad leg as straight as possible. Imagine yourself moving around to the edge of the bed slowly and gently..........putting both hands on the frame.....you lean forward and use it to pull yourself up.....you feel your feet touch the floor...... You don't want to put weight on the bad leg.....your leg feels strange.....there are feelings you're not used to.....you're taking things nice and slowly......You breath **slowly, quietly** and **calmly**......You're ready to take steps. It's a ***huge effort*** to take just a ***few*** steps. Imagine yourself put your foot down without putting any weight on it. Imagine yourself pushing the frame forward so that you have some walking space...... You take one step slowly and gently with the bad leg.....and then the good leg moves just past the bad leg...... You take a few more steps.....move the frame.....the bad leg.....good leg.....rest......Again, the frame.....bad leg.....good leg.....frame.....bad leg.....good leg.' You're concentrating hard. It hurts and you feel tired but it feels so ***good*** to be ***out*** of your bed and to be ***walking.*** You tell yourself 'my muscles haven't been working since the arthritis, now they've got to be strengthened.....that's what I'm doing strengthening the muscles.....and improving my circulation.' Feel them growing warmer and stronger as you make them work. You feel pleased with all your ***hard*** work.

part two (listened to after surgery)
(Patient listens to relaxation exercises first)
'Remember that by going over a situation in your mind ***you will*** in fact be much ***better prepared*** for it. While staying relaxed go through the hurdles you face, just as you did before.....Imagine them as vividly as you can.....then picture yourself coping well with them......

You still feel some pain, and feel rough generally. But you're getting fed up with your bed......You're becoming impatient to see progress. But you tell yourself: ' I'm in control......I can help myself by mentally rehearsing the hurdles you face. Imagine you are about to get out of bed and take a few steps.....you feel worried.....about how the new hip will feel when you put weight on it for the first time.....but at the same time glad to do something...... Your grasp the monkey pole above the bed.....lift yourself up slowly.....it hurts.....you feel worried.....you bend your good leg and keep your bad leg as straight as possible...... You move around to the edge of the bed slowly and gently.....put both hands on any walking aids.....you lean forward and use it to pull yourself up.....you feel your feet touch the floor...... You don't want to put weight on the bad leg.....your leg feels strange.....there are feelings you're not used to.....you're taking things nice and slowly ...... Breath **slowly, quietly** and **calmly**(x2).

You're ready to take steps. It's a ***huge effort*** to take just a ***few*** steps. Your put your foot down without putting any weight on it.....you push your walking aids forward so that you have some walking space.....you take one step slowly and gently with the bad leg.....and then the good leg moves just past the bad leg......You take a few more steps.....walking aids forward.....bad leg.....good leg.....rest......Again, walking aids.....bad leg.....good leg.....walking aids.....bad leg.....good leg.' You're concentrating hard.....it hurts and you feel tired but it feels so ***good*** *t*o be ***out*** of bed and to be ***walking***. You tell yourself 'my muscles haven't been working since the arthritis, now they've got to be strengthened.....that's what I'm doing strengthening the muscles.....and improving my circulation.' Feel the muscles growing warmer and stronger as you make them work. You feel very pleased with all your ***hard*** work. *Breath **slowly, quietly** and **calmly** (x2).*

Imagine yourself walking up and down the ward. Ever so gradually it gets easier and easier.....Walking is quicker and easier. The muscles are building up as you're circulation is getting better, and you ***feel positive*** about your progress.....each step is an achievement......You feel positive about the exercises.....you tell yourself, 'they are improving the circulation and building up the muscle strength.' You tell yourself 'I'm making ***good, steady progress***.' *Breath **slowly, quietly** and **calmly** (x2)*

It's a week after the operation. You're feeling better with each day. You're appetite is coming back and you're sleeping well. It has been an unpleasant week but you tell yourself, 'I've ***coped well***.....and I'm ***through*** the worst'. You remember to ask questions about anything you're worried about. You tell yourself 'it's really important to ask questions.'

You feel frightened about trying out things by yourself without nurses and physio. You worry about things like walking upstairs and getting on and off the toilet. You may be worried about how you will ***manage*** stairs, you lift the *good l*eg up first and keep the *bad leg* down. Imagine yourself walking upstairs.....your leg aches.....there are strange feelings.....but you remind yourself it's bound to feel strange......You hold onto the banister and put the crutches or sticks in the other hand .....first you lift the good leg up.....rest.....then bring up the bad leg.....lift the good leg up.....rest.....then bring the bad leg up.....rest......Rehearsing this ***in your mind*** will help you in practice. The exercise becomes ***easier*** with practice and the strange feelings don't seem to bother you. You feel tired.....but pleased with all your hard work. Time is passing quickly.

A few days on and you feel really on top of things......You feel more confident about what you can do. Your walking improves with each day. You tell yourself 'everything, '***I've*** been doing over the last week or so has ***helped*** me. I may need help with some things but I feel positive about what I've achieved so far, in such a short time. Since the operation I've steadily built up strength and I'm still doing that.'

You're ***thinking*** about going home.....you feel worried about how you'll manage.....things seem so difficult and you've maybe felt like giving up, but you think about how much you can do.....and you tell yourself 'everything I've been doing over the past couple of weeks has helped me get ***ready*** for leaving the hospital. I feel ***pleased*** with all my hard work'......For the next few moments just think about being at home.....what it will feel like. Start with inside the house.....think about making a cup of tea.....or going to answer the door......Think about the effort, the frustration when things don't go as well as you want.....think about how you will feel......If you're sitting down you get up nice and slowly.....put your weight on your walking aid.....you take it very steadily.....you tell yourself there's no hurry. Your careful not to turn around quickly......Now think about things you will do outside later on.....like walking or shopping. Again think about the effort.....the frustration when things don't go as you want......

You're glad to be home.....it's a lot quieter than what you've been used to over the past couple of weeks.....maybe it even seems lonely. Imagine what it feels like to have no-one to remind you what you should and shouldn't be doing......You think about how the operation has changed things for you.....you feel positive about those changes.....you tell yourself, 'my future looks positive.....I can, and will, be able to do ***so*** many things now that I wouldn't have ***dreamed*** of doing before. You think about all the plans you've made. You tell yourself this is a ***new start*** for me.....you feel very satisfied and excited about the future. *Carry on breathing, **slowly, quietly** and **calmly** (x2) (end of tape)*

F2b Total Knee Arhtroplasty

<u>preoperatively, day -2</u>

(Firstly the same relaxation exercises as for THA are given)

Remember that by going over a situation ***in your mind,*** you will, in fact, be much better prepared for it. While remaining relaxed try to imagine each of the situations I describe as realistically as possible. Then picture yourself coping well with it.

Imagine it's the day of surgery. . You have had ***nothing*** to eat or drink, you feel hungry and thirsty. You know that you ***cannot*** eat or drink. You tell yourself, 'I will ***only*** be hungry and thirsty for ***a very short*** period of time. I know that it is for ***the best*** that I'm hungry and thirsty.....as these things help my operation to run more smoothly.' *Breath **slowly, quietly** and **calmly** (x2).*

Now imagine the time for the operation is getting nearer......You are given premeditation and you are in bed waiting to go to theatre. Your mouth feels ***very dry*** and..... you feel very hungry. Again you ***tell yourself***, 'this is only ***short-term.*** Later on, after the operation I'll be ***tucking into a good meal.'*** You can't help worrying how it's going to go but you ***tell yourself***, 'I'll soon be feeling fine.....and it will be a success. *Breath **slowly, quietly** and **calmly** (x2)*

Now you arrive at the operating theatre. You are greeted by the surgeon and his team, the room is ***warm*** and ***you feel*** comfortable. You tell yourself, 'I am about to have the surgery that ***I*** want.....I feel pleased, and ready for what is going to happen.

Imagine you are now waking up from the anaesthetic. The operation has been done and you now have ***a new knee*** feel yourself drowsy and weary. You may even feel sick. Perhaps you are not sure where you are or what has happened.....you don't feel up to doing or saying much at all. You feel you ***can't*** cope with activity. You know that you will ***only*** feel like this for the next few hours. You tell yourself 'It's ***only natural*** I'm going to feel like this after surgery, and the staff around ***don't expect*** me to be bright and cheerful.' You know you will be feeling ***much more*** cheerful later. Breath **slowly, quietly** and **calmly** (x2)

You may feel some pain.....but you tell yourself this is just a natural reaction to the surgery. You know that ***you can control*** this. You know that you must use or ask for pain killers when you need them.....you're the best judge of when you need them. You tell yourself, ***'I'm in charge*** of my pain medication.....You feel in control.' Your worried about certain things.....maybe you have strange feelings in your head, stomach or other parts of your body. You ask nurses to help you feel better. You tell yourself, 'this is just a reaction to the surgery .....I wont feel like this for long.....I can **easily** cope.'

You arrive back on the ward.....you're feeling uncomfortable.....you may be in pain or feel stiff.....maybe you feel sick.....but you know that you can ask the nurses to help you feel better . Imagine how restless you may feel not being able to move around.....having to sit or lie in bed. You feel awkward and embarrassed about having to rely on so many people for so many things. You know you must ask for help. You tell yourself, 'the staff are here to help me, and want to help me as much as possible.....If I need something, I ***will ask them*** to help me. ***I am*** the best judge of what I need.' You know things ***won't happen*** unless you make them happen. It all seems so difficult at the moment but you ***tell yourself I'm doing well*** and in a short while I'll be over this.'

Imagine yourself feeling uncomfortable as you lie in bed.....but you still feel ***in control*** .....You tell yourself, 'I wont feel like this for long.....It's ***just*** short term. I can ***easily manage*** for the rest of the day.' The time passes quickly. You feel positive about what you're going through, knowing that it's the ***first*** stage of recovery.....you tell yourself, 'I will feel much better in a few hours time.' Breath **slowly, quietly** and **calmly** (x2)

It's the day ***after*** the operation. You really don't feel good at all. You may be wishing that you hadn't gone through with the operation. You may feel tired and sick.. ..but you tell yourself this feeling will soon pass, I'll soon be over this'. Maybe you feel there's nothing you can do to help yourself but this is the time you can rehearse, in your mind, what you will soon be doing. Remember the more you rehearse in your mind, the more quickly you will succeed in practice. So picture yourself trying to move your leg, in bed, for the first time.

You pull your toes up towards you .....lift the splinter up.....very carefully.....just a little to see what it feels like.....hold it there for a few seconds.....bring it down slowly and relax..... . And again lift.....rest.....lift.....rest. As you do the exercise try not to let the leg role out to the sides, lift.....and keep going. Feel the muscles at the top of your legs working.....feel those muscles strengthening.....it feels very difficult, but you tell yourself, 'this is the beginning of getting back to a normal life...... You try wiggling your toes and moving the leg slightly. You tell yourself it's good to move the leg.....if only a tiny bit...... It's a great effort the first few times and you feel tired but you tell yourself, 'it's good for my circulation, it's the ***first*** step towards getting better'......You feel your circulation improve ***each*** time you exercise, feel your muscles become ***warmer*** and warmer as they work ***harder*** and harder. Feel your muscles ***strengthening*** with each exercise. You tell yourself that you're hard work makes each exercise feel slightly easier than the one before, and helps you get ready for the next one. You're feeling ***positive*** about what you are going to achieve.....you imagine the leg muscles strengthening.....and see the exercises as a challenge. *Breath* **slowly, quietly and calmly** (x2)

Imagine yourself doing some more exercises. Imagine a soft block placed under your knee......You pull your toes up and press down into the roll with your knee. Your leg raises slightly. Imagine yourself doing this.....press.....really press into that roll.....hold it there......Put the leg down slowly and relax. You remember that you must keep in contact with the roll and keep the leg straight. And again.....toes up.....straighten the leg.....push down on that roll.....hold it there......Put the leg down slowly and relax.

A few days after the operation...... Imagine for the first time, you're ready to get out of bed and take a few steps, with a little help...... You feel worried about how the new knee will feel when you put weight on it for the first time......But at the same time glad to do something......Imagine yourself grasping the monkey pole above the bed.....lifting yourself up slowly.....it hurts.....you feel worried.....you bend your good leg and keep your bad leg as straight as possible. Imagine yourself moving around to the edge of the bed slowly and gently.....imagine yourself for the first time put your foot down without putting any weight on it.....putting both hands on walking aids.....you lean forward and use them to pull yourself up.....you feel your feet touch the floor......Your leg feels strange. There are feelings you're not used to. You don't want to put weight on the bad leg.....you're taking things nice and slowly .....you breath **slowly, quietly** and **calmly**.....You're ready to take steps. It's a ***huge effort*** to take ***just*** a few steps...... You push the walking aids forward so you have some walking space. You take one step slowly and gently with the bad leg ..... step just past the bad leg with the good leg.....you may find it easier to slide the bad leg along the floor. You take a few more steps.....move the walking aids.....the bad leg .....good leg.....rest .....the walking aids.....bad leg.....good leg.....move the walking aids.....bad leg.....good leg. You're concentrating hard. It hurts and you feel tired after a few steps but it feels so ***good*** to be ***out*** of your bed and to be ***walking.*** You tell yourself, 'my muscles haven't been working since the arthritis, now they've got to be strengthened.....that's what I'm doing strengthening the muscles and improving my circulation. Feel the muscles growing warmer and stronger as I make them work. You feel very pleased with all your hard work.

End of part 1 of tape.

part 2 (listened to after surgery)

While staying relaxed go through the hurdles you face, just as you did before.....imagine them as vividly as you can.....then picture yourself coping with them.

You still feel some pain, and feel rough generally but you're getting fed up with your bed. You're becoming impatient to see progress but you tell yourself, ' I'm in control.....I can help myself by mentally rehearsing the hurdles I face. Imagine you are about to get out of bed and take a few steps.....You feel worried about how the new knee will feel when you put weight on it for the first time.....but at the same time glad to do something...... Your grasp the monkey pole above the bed.....lift yourself up slowly.....it hurts.....you feel worried.....you bend your good leg and keep your bad leg as straight as possible......Your move around to the edge of the bed slowly and gently..... you put your foot down without putting any weight on it.....put both hands walking aids.....you lean forward and use them to pull yourself up.....you feel your feet touch the floor. Your leg feels strange. There are feelings you're not used to. You don't want to put weight on the bad foot.....you're taking things nice and slowly .....you breath **slowly**, **quietly** and **calmly**..... you're ready to take steps. It's a ***huge effort*** to take ***just*** a few steps...... You push the frame forward so you have some walking space. You take one step slowly and gently with the bad leg ..... step just past the bad leg with the good leg.....you may find it easier to slide the bad leg along the floor. You take a few more steps.....move the frame.....the bad leg .....good leg.....rest .....the frame.....you take some more steps.....bad leg.....good leg.....move the frame.....bad leg.....good leg. You're concentrating hard. It hurts and you feel tired after a few steps but it feels so ***good*** to be ***out*** of your bed and to be ***walking.*** You tell yourself, 'my muscles haven't been working since the arthritis, now they've got to be strengthened.....that's what I'm doing strengthening the muscles and improving my circulation. I feel them growing warmer and stronger as I make them work.' You feel very pleased with all your hard work.

Imagine yourself walking up and down the ward. It gets easier and easier.....walking is quicker and easier. The muscles are building up and your circulation is getting better and you ***feel positive*** about your progress.....that each step is an achievement.....you feel positive about the exercises you tell yourself , 'they're improving the circulation and building up the muscle strength. You tell yourself you're making ***good, steady*** progress. Breath **slowly, quietly** and **calmly** (x2).

It's a week after the operation. You're feeling better with each day. You're appetite is coming back and you're sleeping well. It has been an unpleasant past week but you tell yourself, 'I've coped well.....and am through the worst.' You remember to ask questions about anything you're worried about. You tell yourself, 'it's really is important to ask questions.'

You feel frightened about trying out things by yourself without the nurses and physios.....you worry about things like walking upstairs and getting on and off the toilet. You may be worried about how you will manage stairs...... You lift the ***good leg***, keep the ***bad leg*** down, then you bring your walking aids up. Imagine what it feels like, your leg aches, there are strange feelings.....holding onto the banister......You put the crutch or stick in the other hand.....you lift the good leg up.....rest.....bring up the bad leg.....bring up walking aids.....good leg up.....rest.....bad leg up.....walking aids up rest......Rehearsing this in your mind will help you in practice. The exercise becomes ***easier*** with practice and the strange feelings don't seem to bother you. You feel tired, but you feel pleased with all your hard work. Time is passing quickly.

Now imagine yourself coming down stairs. You hold the banister rail with one hand.....walking aids in other hand.....bad leg up.....rest.....good leg up.....walking aid.....and again.....hold the banister rail with one hand.....walking aid in other hand.....put the bad leg up.....rest.....good leg up.....walking aid.

A few days on and you feel really on top of things----you feel more confident about what you can do. Your walking improves with each day. You tell yourself, 'everything I've been doing over the last week or so has helped me. I may need help with some things but I feel positive about what I've achieved so far, in such a short of time. Since the operation I've steadily built up strength and I'm still doing that.'

You are ***thinking*** about going home......You feel worried about how you'll manage .....things seem so difficult and you've maybe felt like giving up...... But you think about how much you can do.....and you tell yourself, 'everything I've been doing over the past couple of weeks has helped me get ready for leaving the hospital home. I feel ***pleased*** with all my hard work'. For a few moments think about at home and what it will feel like to do certain things inside and outside the home. Start with inside the home.....think about making a cup of tea or going to answer the door.....think about the effort, and frustration when things don't go as well as you want...... Think about how you will feel.....if you're sitting down you get up nice and slowly.....put your weight on your walking aids.....you take it very steadily.....you tell yourself there's no hurry. Your careful not to turn around quickly...... Now think about things you will do outside later on.....like walking or shopping. Again think about the effort, the frustration when things don't go as well as you want......

You're glad to be home. It's a lot quieter than what you've been used to over the past couple of weeks.....maybe it even seems lonely. Imagine what it feels like to have no-one to remind you what you should and shouldn't be doing......You think about how the operation has changed things for you......You feel positive about those changes. You tell yourself, 'my future looks positive.....I can and will be able to do ***so*** many things now that I wouldn't have ***dreamed*** of doing before. You think about all the plans you've made. You tell yourself this is a ***new start*** for me......You feel very satisfied and excited about the future. Carry on breathing, **slowly, quietly** and **calmly**) (x2). *(end of tape)*

Appendix H Comparisons between different intervention groups and different type of surgical methods

Table 4 A comparison across intervention groups and joints on biographical factors (number of patients in each group)

Type of surgery	Total hip arthroplasty (THA)			Total knee arthroplasty (TKA)		
Intervention group	**control**	**passive**	**active**	**control**	**passive**	**active**
Sex						
Female	24	20	26	11	10	9
Male	11	15	11	7	8	8
Hospital seen in						
hospital 1	19	19	20	8	9	9
hospital 2	16	16	17	10	9	8
Marital Status						
Married	17	15	18	9	11	15
Widowed	15	10	12	6	5	2
Single	1	5	5	2	0	0
Living with another	2	5	2	1	2	0
admission day						
-2 +	30	35	30	14	16	9
-1	5	0	7	4	2	8
Previous cancellation	2	3	1	4	1	0
Operating surgeon[a]						
1	11	11	11	6	8	6
2	5	6	4	0	0	0
3	6	5	11	3	3	4
4	0	3	1	4	1	1
5	9	7	4	2	3	2
7	0	0	1	1	0	0
10	1	0	1	1	2	3
other [b]	3	3	1	1	1	4
Anaesthetist [c]						
no. 1	3	2	5	4	4	1
no. 2	8	7	5	0	0	0
no. 3	5	6	10	3	3	5
no. 4	3	3	3	1	1	0
no. 5	0	1	1	3	1	0
no. 8	3	9	6	0	4	3
no. 9	5	2	1	2	3	1
no. 14	3	0	2	1	0	1
Other [d]	5	5	4	4	2	6
Pathology						
OA	33	33	36	15	9	12
RA	1	2	1	3	9	5
Medical History						
Hypertension	7	4	9	3	4	2
cardiac failure	1	1	1	0	0	0
myocardial infarction	5	7	3	1	5	1
Chronic obstructive airways disease (COAD)	2	3	1	0	0	0
other [e]	6	6	7	5	5	4
Previous joint replacement	9	10	7	5	4	5

[a] Surgeons who performed at least 6 (10%) of study operations (1-9,14) [b] Surgeons who performed less than 8 operations are classified as other . [c]Anaesthetists performing a total of at least 6 (10%) anaesthesias are recorded. [d]Anaesthetists performing less than eight anaesthesias. [e] Other major illnesses throughout life.

Table 5 Comparisons between different intervention groups and different type of surgical methods (number of patients in each group)

	THA			TKA		
Intervention group	**C**	**P**	**A**	**C**	**P**	**A**
prosthesis type						
Charnley	30	29	33	0	0	0
Monk	4	6	4	0	0	0
Install -Burnstein (IB-2)	0	0	0	10	8	7
Miller/Galante	0	0	0	5	8	6
Genesis	0	0	0	2	1	0
Kinemax	0	0	0	0	0	1
AMK	0	0	0	1	1	3
PCA(used)	30	31	33	16	17	16
Blood given: 0 unit	16	9	13	14	15	13
1 unit	4	9	9	2	2	2
2 unit +	14	16	14	2	1	2
Tourniquet (used)	n/a	n/a	n/a	18	18	17

C: control, P: passive, A: active. 89% (N = 143) of patients used a PCA machine and the average amount of morphine consumption was 48.96 ml. 8 types of prosthesis were used (Table 6.3). A total of 14 surgeons and 25 anaesthetists were involved in the surgery (check details).

Appendix I Mean scores on psychological questionnaires

Table 6 Mean scores on coping and health belief questionnaires

Questionnaire	Assessment time	Male (SD)	Female (SD)	RLUH (SD)	Broadgreen (SD)	THA SD)	TKA (SD	C (SD)	P (SD)	A (SD)
Ways of Coping										
Problem focused	day 7	17.2 (8.0)	13.7 (6.0)	14.5 (6.7)	15.6 (7.4)	14.6 (6.8)	16.0 (7.5)	15.0 (7.2)	14.8 (7.0)	15.4 (7.0)
	1 month	16.6 (7.6)	15.3 (6.9)	15.7 (7.0)	16.0 (7.3)	15.5 (6.8)	16.6 (7.9)	15.6 (7.2)	15.3 (7.6)	16.6 (6.6)
Wishful thinking	day 7	4.0 (3.7)	4.5 (3.7)	4.6 (4.0)	4.0 (3.4)	4.1 3.6)	4.8 (4.0)	3.9 (3.1)	4.4 (4.0)	4.6 (4.0)
	1 month	3.9 (4.0)	4.0 (3.7)	4.3 (4.1)	3.6 (3.3)	3.6 (3.6)	4.7 (4.1)	3.8 (3.6)	4.1 (4.0)	3.7 (3.9)
Detachment	day 7	6.0 (4.2)	6.0 (3.3)	5.9 (3.8)	6.1 (3.5)	5.9 (3.5)	6.1 4.0)	5.8 (3.2)	6.6 (3.8)	5.6 (4.0)
	1 month	5.4 (4.0)	6.3 (3.5)	6.1 (3.7)	5.8 (3.6)	6.2 (3.6)	5.6 (3.9)	5.9 (3.5)	5.9 (4.2)	6.1 (3.4)
Support	day 7	9.8 (5.4)	9.3 (4.6)	9.5 (4.8)	9.5 (5.0)	9.6 (4.6)	9.2 (5.5)	9.2 (5.4)	9.3 (5.1)	9.2 (4.2)
	1 month	9.0 (5.3)	9.2 (4.8)	9.3 (5.2)	8.9 (4.8)	8.9 (4.6)	9.4 (5.5)	8.7 (4.9)	8.6 (5.0)	10.1 (5.1)
Positive thinking	day 7	5.5 (2.9)	5.0 (2.9)	5.3 (2.9)	5.1 (3.0)	5.3 (3.0)	4.9 (3.0)	5.7 (2.8)	4.8 (3.0)	5.2 (2.9)
	1 month	5.3 (3.5)	5.2 (2.9)	5.4 (3.1)	5.0 (3.1)	5.4 (3.1)	4.9 (3.1)	5.5 (2.7)	4.7 (3.5)	5.4 (3.1)
Locus of Control										
Chance	admission	20.7 (5.8)	22.7 (6.4)	22.4 (6.4)	21.4 (6.0)	22.0 (6.4)	21.7 (5.9)	22.9 (6.8)	21.5 (6.6)	21.5 (5.1)
Provide	admission	30.6 (4.2)	30.1 (4.6)	30.1(4.8)	30.5(4.1)	30.4 (4.7)	30.2 (3.9)	30.4 (5.1)	29.5 (4.1)	31.1 (4.1)
Self	admission	21.0 (4.4)	19.0 (4.5)	19.9 (4.45)	19.6 (4.7)	19.8 (4.5)	19.5 (4.7)	19.7 (4.7)	19.8 (4.6)	19.9 (4.4)
Threat	admission	19.5 (4.6)	20.6 (3.9)	20.0 (4.3)	20.5 (4.0)	19.9 (4.3)	20.8 (4.0)	19.8 (4.0)	20.2 (3.7)	20.5 (4.9)
HOS										
Information	admission	3.0 (1.9)	2.4 (2.0)	2.7 (2.0)	2.5 (1.0)	2.3 2.0)	3.2 (2.0)	2.4 (2.0)	2.8 (1.9)	2.6 (2.0)
Behavioural	admission	2.6 (1.9)	2.8 (1.9)	2.6 (1.8)	2.9 (2.0)	2.7 (1.8)	2.9 (2.0)	3.2 (2.0)	2.7 (1.8)	2.2 (1.6)

RLUH/ Broagreen: hospital THA/TKA: Total hip/knee replacement C:control P:passive A: Active HOS = Health Opinion Survey

Table 7 Mean scores and standard deviation on quality of life (SF-36, MHI) questionnaires for gender, hospital, type of operation and intervention group

Questionnaire	Assessment time	Male (SD)	Female (SD)	RLUH (SD)	Broadgreen (SD)	THA (SD)	TKA (SD)	C (SD)	P (SD)	A (SD)
SF-36 -TOTAL*	admission	423.0	353.0	360.0	401.0	370.0	388.0	388.0	392.0	358.0
	1 month	466.6	419.8	435.7	438.1	457.0	394.0	430.0	433.3	450.6
	6 month	564.0	507.6	529.0	528.7	555.3	472.2	542.3	450.6	513.6
Physical function	admission	24.9 (22.7)	16.0 (17.0))	18.5 (20.0)	20.3 (19.5)	19.1 (19.8)	18.6 19.8)	19.7 (18.2)	20.4 (21.7)	18.0 (19.5)
	1 Month	27.2 (1.6)	15.7 (16.2)	18.6 (17.8)	21.6 (18.8)	19.4 (17.0)	21.3 21.0)	20.8 (20.1)	21.3 (16.7)	18.2 (18.2)
	6 Month	49.6 (26.4)	41.4 (28.2)	43.0 (27.5)	46.2 (28.2)	47.9 (28.4)	37.2 25.1)	47.8 (30.2)	44.4 (26.6)	40.7 (26.4)
Role limitation (physical)	admission	23.0 (30.0)	10.0 (23.6)	14.2 (24.6)	15.9 (30.3)	11.3 (22.3)	23.0 34.1)	17.8 (30.1)	13.5 (24.3)	13.8 (27.3)
	1 Month	8.6 (21.2)	5.9 (17.4)	9.8 (24.0)	3.3 (10.0)	7.9 (20.8)	4.1 (13.8)	7.7 (20.7)	4.8 (15.7)	7.7 (20.2)
	6 Month	50.0 (44.7)	45.1 (42.9)	46.3 (42.7)	48.4 (44.4)	54.3 (42.5)	31.9 (42.1)	49.8 (42.9)	46.1 (44.0)	46.0 (44.4)
Role limitation (mental)	Admission	51.0 (48.1)	43.7 (44.4)	40.9 (44.7)	53.2 (46.1)	43.3 (44.3)	54.4 (48.1)	48.1 (46.4)	49.4 (46.0)	42.9 (45.6)
	1 Month	58.8 (47.9)	56.8 (44.2)	53.2 (47.7)	62.4 (42.5)	63.0 (44.0)	46.3 (47.1)	57.1 (46.8)	55.8 (45.6)	60.3 (44.7)
	6 Month	83.7 (29.7)	71.1 (41.0)	80.6 (34.6)	71.0 (40.7)	80.6 (35.0)	65.5 (41.1)	75.8(40.0)	80.2(34.4)	71.6 (38.5)
Social function	admission	56.5 (32.1)	41.0 (30.3)	46.0 (31.4)	48.2 (32.4)	46.0 (32.6)	48.6 (30.2)	46.8 31.5)	54.1 33.0)	39.7 (29.7)
	1 Month	35.4 (35.3)	28.6 (30.0)	31.8 (33.0)	30.6 (31.6)	29.6 (32.0)	34.5 (32.7)	31.0 (31.5)	33.3 (35.2)	29.3 (30.1)
	6 Month	71.0 (36.6)	67.2 (33.4)	68.1 (35.3)	69.2 (34.0)	72.9 (33.1)	59.2 (36.0)	67.3 (35.6)	70.6 (33.8)	66.8 (34.9)
Mental health	admission	73.3 (18.3)	62.5 (19.7)	64.0 (19.7)	69.3 (19.8)	66.1 (20.0)	67.5 (19.7)	68.5 (19.8)	66.8 (19.3)	64.3 (20.5)
	1 Month	78.6 (19.5)	71.5 (19.7)	74.7 (19.2)	73.6 (20.6)	76.9 (18.8)	68.5 (20.8)	74.0 (22.1)	72.5 (21.1)	76.4 (15.5)
	6 Month	82.8 15.7)	75.4 (18.3)	79.3 (17.1)	77.0 (18.3)	79.6 (17.1)	75.3 (18.4)	79.3 (19.5)	77.4 (15.2)	77.4 (18.2)
Vitality	admission	51.2 (23.2)	41.4 (20.3)	43.4 (20.4)	47.0 (23.5)	44.0 (21.5)	47.3 (22.7)	47.5 (22.6)	43.6 (21.0)	44.2 (22.2)
	1 Month	55.3 (24.8)	42.6 (23.5)	49.0 (22.0)	46.1 (27.5)	63.3 (23.8)	40.8 (26.4)	45.2 (27.9)	47.0 (23.2)	51.0 (22.7)
	6 Month	64.0 (26.2)	54.4 (21.9)	57.8 (23.7)	58.2 (24.4)	66.8 22.0)	47.7 (27.3)	58.0 (26.6)	56.0 (23.1)	60.0 (21.9)
Pain	admission	31.5 (17.3)	27.9 (19.3)	27.5 16.4)	31.1 (20.7)	29.6 (19.4)	29.0 (17.1)	28.1 (20.7)	34.0 (18.3)	25.7 (15.8)
	1 Month	56.0 (28.5)	56.2 (26.1)	56.326.1)	56.0 (28.0)	63.3 (24.5)	40.8 (25.5)	50.4 (27.3)	57.7 (27.4)	61.0 (25.4)
	6 Month	63.0 (31.5)	59.4 (29.8)	61.7 (30.1)	60.3 (31.0)	66.8 (29.3)	47.7 (29.3)	61.5 (32.0)	63.4 (29.3)	57.2 (30.1)
Health perceptions	admission	70.0 (21.4)	72.0 (21.0)	67.3 (22.1)	74.8 (19.2)	74.0 (17.8)	65.0 (25.6)	71.9 (20.9)	67.8 (20.2)	72.7 (22.2)
	1 Month	80.1 (15.4)	75.3 (20.7)	74.3 (19.2)	80.1 (18.3)	80.0 (16.1)	71.0 (22.8)	76.6 (19.3)	75.1 (20.6)	80.0 (16.5)
	6 Month	78.5 (15.7)	73.2 (21.0)	73.2 (21.1)	77.3 (17.4)	77.0 (18.5)	71.3 (21.0)	78.9 (16.9)	73.4 (20.1)	72.8 (21.1)
Change in health	admission	42.5 (21.7)	38.7 (24.5)	39.9 (23.2)	40.5 (23.9)	39.0 (23.6)	43.0 (23.2)	40.6 (25.6)	43.9 (21.9)	36.1 (22.6)
	1 Month	66.8 (28.2)	68.0 (25.4)	69.0 (27.2)	66.0 (25.7)	70.4 (26.1)	61.7 (26.6)	68.3 (29.8)	66.0 (24.4)	68.1 (25.2)
	6 Month	23.8 (26.5)	23.7 (25.5)	25.0 (26.1)	23.0 (25.7)	20.7 (24.8)	31.7 (27.1)	23.9 (26.4)	25.1 (25.8)	21.9 (25.6)

*** not used in analysis RLUH/ Broagreen: hospital THA/TKA: Total hip/knee replacement C:control P:passive A: Active**

Table 8 Mean scores on Global measures of quality of life for gender, hospital, type of operation and intervention group

Questionnaire	Assessment time	Male (SD)	Female (SD)	RLUH (SD)	Broadgreen (SD)	THA (SD)	TKA (SD)	C (SD)	P (SD)	A (SD)
MHI *	admission	43.7 (11.5)	37.8 (11.8)	39.2 (12.1)	41.0 (11.8)	40.0 (11.8)	42.3 (12.2)	40.8 (21.5)	40.6 (12.3)	38.6 (11.2)
Positive affect	1 Month	46.8 (11.4)	41.2 (11.2)	42.6 (11.5)	44.2 (11.6)	43.9 (10.8)	42.1 (13.0)	43.2 (11.9)	41.4 (11.6)	44.7 (11.2)
	6 Month	49.6 (11.4)	42.8 (10.7)	45.3 (11.3)	45.3 (11.6)	45.4 (11.0)	45.5 (12.4)	47.4 (10.8)	43.4 (11.6)	44.2 (11.6)
Cantril's ladder	admission	6.6 (1.8)	5.9 (1.9)	5.9 (2.0)	6.4 (1.7)	6.2 (1.9)	6.1 (1.9)	6.1 (2.1)	6.1 (1.8)	6.3 (1.6)
	day 3	6.6 (1.7)	6.0 (2.0)	6.2 (2.0)	6.1 (2.0)	6.3 (2.0)	6.0 (1.8)	6.3 (2.0)	6.2 (2.0)	6.1 (1.8)
	day 7	6.7 (1.7)	6.4 (1.6)	6.4 (1.5)	6.7 (1.7)	6.6 (1.5)	6.3 (1.8)	6.2 (2.0)	6.7 (1.3)	6.7 (1.4)
	1 Month	7.1 (1.5)	6.7 (1.4)	6.7 (1.4)	7.0 (1.4)	7.0 (1.3)	6.6 (1.6)	7.0 (1.5)	6.6 (1.4)	6.8 (1.3)
	6 Month	7.0 (1.4)	6.7 (1.4)	6.8 (1.4)	6.8 (1.4)	7.0 (1.3)	6.5 (1.6)	7.0 (1.4)	6.5 (1.4)	7.0 (1.4)
Face Scale	admission	2.7 (1.2)	2.9 (1.3)	2.9 (1.3)	2.7 (1.2)	2.9 (1.3)	2.8 (1.2)	2.9 (1.4)	2.7 (1.0)	3.0 (1.4)
	day 3	2.6 (1.4)	2.9 (1.3)	2.8 (1.1)	2.7 (1.4)	2.7 (1.3)	2.8 (1.4)	2.9 (1.5)	2.7 (1.1)	2.7 (1.4)
	day 7	2.5 (1.2)	2.6 (1.9)	2.6 (1.1)	2.5 (1.4)	2.5 (1.1)	2.7 (1.4)	2.7 (1.4)	2.5 (1.0)	2.5 (1.2)
	1 Month	2.5 (1.2)	2.4 (1.1)	2.5 1.1)	2.4 (1.2)	2.4 (1.0)	2.5 (1.4)	2.4 (1.3)	2.6 (1.1)	2.4 (1.0)
	6 Month	2.3 (1.2)	2.2 (1.1)	2.3 (1.2)	2.2 (1.1)	2.2 (1.0)	2.3 (1.4)	2.1 (1.1)	2.5 (1.0)	2.2 (1.3)

RLUH/ Broagreen: hospital THA/TKA: Total hip/knee replacement C:control P:passive A: Active

Table 9 Mean scores on Physical function questionnaires

Questionnaire	Assessed	Male (SD)	female (SD)	RLUH (SD)	Broadgreen (SD)	THA (SD)	TKA (SD)	C (SD)	P (SD)	A (SD)
WOMAC										
Function	admission	40.0 (13.0)	46.1 (12.8)	45.6 (12.3)	41.8 (13.8)	45.5 (12.4)	40.4 (14.0)	43.5 (15.0)	41.4 (12.0)	46.4 (12.0)
	1 month	33.0 (14.6)	37.8 (11.7)	38.3 (13.5)	33.7 (12.4)	35.8 (11.6)	36.5 (15.8)	35.3 (15.1)	36.0 (11.9)	36.7 (12.1)
	6 month	20.8 (14.5)	24.6 (15.3)	24.3 (15.8)	22.0 (14.2)	21.9 (14.8)	25.7 (15.6)	22.0 (16.3)	23.0 (14.0)	25.0 (15.1)
Pain	admission	11.6 (4.0)	13.2 (3.9)	13.2 (3.7)	12.0 (4.1)	12.6 (3.8)	12.6 (4.2)	13.0 (4.0)	11.0 (3.8)	13.8 (3.6)
	1 month	6.2 (5.9)	5.4 (4.4)	5.8 (4.8)	5.8 (5.3)	4.6 (4.3)	8.3 (5.7)	4.5 (5.3)	3.6 (3.9)	4.5 (5.8)
	6 month	4.7 (5.0	4.6 (4.4)	4.5 (4.8)	4.7 (4.4)	4.0 (4.3)	6.0 (4.9)	3.3 (5.0)	3.2 (4.0)	3.6 (4.9)
Stiffness	admission	4.2 (5.0)	4.6 (4.4)	4.7 (1.9)	4.2 (2.1)	4.5 (2.0)	4.4 (2.0)	4.4 (2.0)	4.2 (1.8)	4.7 (2.1)
	1 month	2.7(2.2)	2.5(2.0)	2.5 (2.1)	2.7 (2.2)	2.2 (1.9)	3.3 (2.3)	2.7 (2.2)	2.3 (2.2)	2.8 (1.9)
	6 month	2.0 (2.0)	2.2 (2.0)	2.0 (1.8)	2.3 (2.1)	2.0 (1.9)	2.4 (2.0)	2.1 (2.1)	2.1 (1.6)	2.2 (2.1)

RLUH/ Broagreen: hospital THA/TKA: Total hip/knee replacement C:control P:passive A: Active

Table 10 Mean scores on bodily state (VAS, Health Inventory, fatigue) questionnaires

Questionnaire	Assessment time	M (SD)	F (SD)	H1 (SD)	H2 (SD)	THA (SD)	TKA (SD)	C SD)	P (SD)	A (SD)
VAS - Intensity of pain	admission	53.0 (26.0)	60.3 (23.6)	59.0 (23.3)	56.0 (26.3)	58.4 (24.5)	55.7 (25.3)	62.5 (24.7)	52.2 (25.5)	57.8 (23.4)
	day 1	52.0 (25.6)	49.8 (25.4)	50.5 (26.6)	50.6 (24.2)	43.7 (23.5)	64.4 (24.6)	59.9 (24.1)	46.4 (28.0)	45.5 (22.5)
	day 3	36.0 (26.1)	41.7 (25.3)	41.9 (24.6)	36.7 (26.4)	37.4 (25.8)	43.8 (29.2)	43.4 (24.5)	34.1 (24.9)	41.1 (27.0)
	day 7	36.6 (25.0)	39.0 (26.0)	36.5 (25.1)	36.7 (26.0)	35.6 (26.0)	43.4 (26.6)	44.8 (27.8)	36.2 (26.1)	35.6 (21.6)
	1 month	20.9 (18.4)	26.7 (19.9)	23.8 (19.0)	25.2 (19.8)	19.6 (17.5)	34.4 (25.0)	29.5 (22.5)	23.4 (19.2)	20.56 (14.6)
	6 month	20.4 (22.7)	26.1 (23.4)	24.5 (23.6)	23.5 (23.0)	18.7 (16.8)	34.9 (25.0)	25.2 (35.5)	23.1 (20.8)	24.2 (23.0)
VAS-Distress caused by pain	admission	49.0(28.3)	54.2 (27.5)	59.0 (26.5)	56.0 (29.3)	52.9 (28.2)	50.9 (27.5)	51.6 (28.5)	49.2 (29.0)	55.9 (26.2)
	day 1	43.3 (27.8)	40.4 (26.2)	43.0 (27.8)	34.7 (25.3)	37.7 (25.9)	49.0 (27.3)	49.5 (28.1)	36.1 (26.7)	38.8 (24.6)
	day 3	32.2 (27.3)	39.0 (27.0)	38.8 (26.8)	32.4 (27.2)	33.7 (26.6)	42.1 (24.3)	45.1 (26.4)	29.8 (26.1)	34.4 (27.8)
	day 7	29.6 (25.5)	34.7 (26.8)	33.6 (25.3)	(27.4)	30.8 (25.8)	36.9 (27.4)	39.0 (28.4)	32.1 (27.8)	27.4 (21.6)
	1 month	21.0 (21.4)	22.8 (21.8)	19.3 (20.1)	23.6 (22.8)	16.5 (19.8)	33.8 (26.0)	27.4 (25.5)	21.3 (20.8)	17.6 (16.4)
	6 month	20.2 (23.5)	21.6 (22.8)	21.1 (23.0)	18.6 (23.2)	17.2 (5.6)	28.9 (5.5)	23.5 (26.6)	17.7 (18.3)	22.4 (22.8)
VAS-Ability to cope with pain	admission	72.8 (20.2)	69.0 (22.6)	66.8 (23.0)	74.4 (19.7)	69.1 (23.2)	73.3 (18.1)	66.2 (24.7)	75.1 (17.7)	70.1 (21.7)
	day 1	70.0 (22.1)	64.5 (24.1)	63.2 (25.4)	63.3 (20.5)	67.6 (23.0)	64.0 (28.5)	63.8 (24.3)	69.2 (24.0)	66.1 (22.2)
	day 3	67.3 (26.0)	66.0 (25.8)	66.0 (24.3)	66.0 (27.5)	65.5 (25.2)	68.2 (25.6)	59.8 (26.0)	70.7 (25.2)	68.9 (25.6)
	day 7	65.6 (27.4)	67.4 (25.6)	67.3 (23.3)	66.9 (29.5)	67.8 (16.9)	64.3 (21.3)	64.4 (27.0)	68.9 (26.2)	66.8 (26.0)
	1 month	73.6 (25.0)	77.8 (21.3)	78.0 (23.0)	77.5 (22.6)	80.6 (20.2)	67.0 (26.7)	73.9 (24.0)	76.8 (23.0)	77.8 (21.3)
	6 month	85.4 (15.0)	79.8 (22.7)	84.7 (20.0)	84.2 (21.0)	85.9 (5.4)	73.0 (5.6)	78.7 (24.0)	80.8 (22.1)	85.8 (11.8)
Health Inventory	admission	30.0 (6.1)	28.4 (5.1)	28.3 (5.1)	29.7 (5.9)	29.1 (5.6)	29.0 (5.5)	29.1 (6.1)	29.0 (4.7)	29.0 (5.8)
	day 1	20.4 (5.4)	18.1 (5.2)	19.0 (5.1)	19.0 (5.8)	18.9 (5.4)	(5.6)	19.0 (5.8)	19.6 (5.0)	18.2 (5.5)
	day 3	22.7 (7.0)	23.0 (5.4)	22.1 (6.0)	22.0 (6.0)	22.0 (5.4)	23.7 (6.9)	22.4 (6.0)	24.2 (6.2)	21.2 (5.6)
	day 7	27.5 (8.6)	25.3 (6.1)	25.3 (6.5)	25.3 (7.8)	26.0 (6.5)	26.2 (8.6)	26.1 (8.3)	25.8 (6.0)	26.4 (7.1)
	1 month	31.1 (7.2)	30.0 (6.1)	30.0 (6.1)	30.1 (7.0)	30.2 (6.4)	30.1 (6.8)	30.6 (7.3)	29.7 (5.6)	30.3 (6.7)
	6 month	35.0 (5.6)	32.9 (6.2)	33.6 (6.2)	33.6 (6.0)	34.2 (5.7)	32.2 (6.7)	33.8 (6.0)	33.3 (5.9)	33.7 (6.5)
Physical Fatigue	admission	23.8 (5.0)	26.4 (4.6)	26.2 (4.8)	24.6 (4.7)	25.3 (4.7)	25.8 (5.3)	25.0 (4.8)	25.1 (5.2)	26.1 (4.5)
	1 month	23.6 (4.8)	24.7 (5.0)	24.7 (5.0)	23.9 (5.0)	23.8 (4.7)	25.4 (5.3)	25.0 (5.4)	24.6 (4.8)	23.4 (4.6)
	6 month	21.2 (5.1)	22.1 (5.1)	21.6 (5.5)	21.9 (4.7)	0.8 (4.3)	23.7 (6.1)	21.4 (5.1)	22.0 (4.2)	22.0 (6.0)
Mental Fatigue	admission	13.0 (2.4)	12.9 (1.8)	13.1 (2.0)	12.6 (2.1)	12.6 (2.0)	13.5 (2.3)	13.2 (1.8)	13.0 (2.6)	13.0 (1.8)
	1 month	12.5 (2.0)	12.8 (1.9)	13.0(2.1)	12.4(1.7)	12.4 (1.6)	13.1 (2.5)	13.0 (2.4)	13.0 (1.7)	12.2 (1.6)
	6 month	12.0 (2.5)	12.4 (2.1)	12.2(2.0)	12.4(2.5)	12.2 (2.2)	12.3 (2.4)	12.3 (2.3)	13.0 (1.7)	12.0 (2.6)

M:male F:Female H1:RLUH H2: Broadgreen C: control P: passive A: active

Table 11 Mean scores on mood questionnaires

	Assessed	M (SD)	F (SD)	RLUH (SD)	Broadgreen (SD)	THA (SD)	TKA (SD)	C (SD)	P (SD)	A (SD)
POMS Tension	Admission	10.0 (7.8)	11.7 (7.2)	12.1 (7.7)	9.9 (7.0)	10.5(7.3)	12.1(7.8)	11.2 (7.1)	10.1(7.4)	11.8(7.7)
	Day 3	10.1 (7.1)	10.3 (6.6)	11.7 (7.4)	8.6 (5.6)	9.8 (6.7)	11.0 (7.0)	11.0 (7.8)	9.5 (6.0)	10.2 (6.6)
	Day 7	8.2 (7.4)	8.8 (6.0)	10.4 (6.9)	6.6 (5.8)	8.1 (6.0)	9.4 (7.6)	9.7 (7.8)	8.1 (6.3)	8.0 (5.4)
	1 month	6.1 (5.8)	7.5 (6.2)	7.7 (5.8)	6.2 (6.3)	6.2 (5.3)	8.7 (7.2)	7.3 (6.5)	7.4 (6.1)	6.4 (5.5)
	6 month	5.8 (5.7)	7.3 (6.1)	6.8 (5.6)	6.6 (6.4)	6.4 (5.8)	7.4 (6.4)	6.3 (6.2)	6.0 (4.5)	8.1 (7.0)
Depression	Admission	7.3 (9.4)	7.6 (8.1)	8.8 (9.5)	7.2 (7.1)	7.6 (8.5)	6.6 (8.7)	7.9 (8.2)	7.4 (9.3)	7.4 (8.2)
	Day 3	8.8 (10.6)	7.0 (8.1)	9.4 (10.3)	7.4 (7.2)	8.6 (8.9)	8.2 (9.8)	7.3 (10.8)	7.9 (8.1)	7.9 (8.1)
	Day 7	6.6 (8.9)	6.3 (7.2)	7.9 (.45)	5.7 (.50)	7.8 6.2)	7.8 (10.2)	5.9 (10.0)	5.5 (6.8)	5.5 (6.3)
	1 month	4.6 (7.2)	4.6 (6.5)	5.7 (8.6)	3.6 (6.6)	7.0 (5.2)	4.9 (8.7)	5.7 (7.56)	3.6 (7.3)	3.6 (5.0)
	6 month	4.3 (6.4)	6.2 (7.7)	6.1 (.48)	5.5 (.50)	5.8 (6.9)	5.0 (8.4)	5.6 (7.2)	6.2 (7.0)	6.2 (8.0)
Anger	Admission	5.5 (.50)	3.8 (.48)	5.2 (5.5)	3.6 (5.2)	4.3 (5.0)	4.8 (6.2)	4.5 (5.9)	4.8 (5.8)	4.0 (4.6)
	Day 3	6.8 (9.6)	3.9 (5.3)	6.4 (7.8)	3.6 (6.4)	4.1 (5.6)	7.0 (9.7)	5.4 (8.8)	4.7 (6.8)	5.1 (6.2)
	Day 7	4.3 (6.0)	3.1 (3.7)	4.2 (5.0)	2.7 (4.4)	2.7 (3.4)	4.9 (6.5)	4.0 (6.4)	3.2 (3.8)	3.1 (3.6)
	1 month	3.9 (4.4)	3.4 (4.4)	4.1 (4.6)	30 (4.1)	2.8 (3.5)	5.0 (5.7)	3.5 (4.9)	4.1 (4.9)	2.9 (3.2)
	6 month	5.1 (.50)	4.9 (.50)	4.8 (6.0)	5.0 (7.4)	4.8 (6.7)	5.2 (6.7)	4.3 (7.4)	5.0 (6.0)	5.4 (6.6)
Vigour	Admission	15.2 (7.4)	13.2 (6.9)	13.5 (7.1)	14.4 (7.2)	13.4 (7.1)	15.0 (7.2)	14.1 (6.7)	14.6 (7.3)	13.1 (7.4)
	Day 3	13.7 (7.5)	10.1 (6.8)	11.3 (7.0)	11.6 (7.8)	10.6 (6.8)	13.1 (8.0)	10.7 (6.4)	12.6 (7.7)	11.0 (7.8)
	day 7	16.1 8.1)	11.6 (6.6)	12.9 6.6)	13.8 (8.5)	12.5 (7.0)	15.0 (8.3)	13.1 (8.3)	14.2 (6.7)	12.7 (7.7)
	1 month	16.8 (7.6)	12.6 (7.0)	13.8 (7.0)	14.6 (8.0)	13.8 (7.4)	14.8 (7.6)	15.1 (&.5)	13.1 (6.8)	14.3 (8.0)
	6 month	18.5 (7.6)	15.2 (7.3)	15.8 (7.4)	17.2 (7.7)	16.1 (7.3)	17.1 (8.3)	17.5 (8.0)	15.6 (7.4	16.2 (7.3)
Lack of Energy	admission	8.4 (6.6)	8.6 (6.2)	9.3 (6.0)	7.6 (6.7)	8.0 (5.7)	9.5 (7.4)	7.9 (6.0)	8.0 (6.1)	9.6 (7.0)
	day 3	9.3 (6.7)	10.0 (6.5)	10.8 (6.8)	8.5 (6.2)	9.0 (6.2)	11.2 (7.1)	10.3 (7.0)	8.5 (6.1)	10.4 (6.6)
	day 7	7.0 (6.0)	8.8 (6.6)	8.8 (6.2)	7.3 (6.6)	7.8 (6.0)	8.7 (7.2)	9.0 (7.4)	8.1 (6.1)	7.3 (5.7)
	1 month	6.2 (5.7)	7.5 (6.8)	7.7 (6.7)	6.3 (6.0)	6.1 (5.4)	8.8 (7.8)	6.7 (7.0)	7.6 (6.5)	6.9 (6.0)
	6 month	6.3 (6.0)	7.0 (6.3)	7.1 (7.0)	6.4 (5.3)	6.0 (5.6)	8.4 (7.0)	5.7 (6.1)	7.2 (5.6)	7.6 (6.9)
Confusion	admission	6.0 (5.0)	5.5 (3.6)	6.4 (4.56)	4.9 (3.6)	5.1 (3.7)	6.8 (4.9)	5.4 (4.0)	6.1 (4.8)	5.6 (3.8)
	day 3	6.8 (5.0)	6.0 (4.0)	6.6 (4.8)	5.9 (3.6)	5.9 (4.2)	7.0 (4.7)	6.3 (4.2)	6.6 (4.4)	6.0 (4.7)
	day 7	5.2 (4.6)	5.4 (3.5)	6.1 (4.2)	4.5 (3.5)	5.2 (3.5)	5.7 (4.9)	5.7 (4.5)	5.4 (4.0)	4.9 (3.5)
	1 month	4.9 (4.1)	4.6 (3.7)	5.2 (4.2)	4.2 (3.3)	4.1 (2.7)	6.0 (5.3)	5.1 (4.4)	4.8 (3.9)	4.3 (3.1)
	6 month	4.7(4.6)	4.6 (3.5)	5.0 (4.2)	4.3 (3.6)	4.5 (3.8)	5.0 (4.2)	4.4 (4.0)	4.9 (3.3)	4.7 (4.5)
Friendliness	Admission	19.1 (5.0)	19.1 (5.1)	19.0 (4.7)	19.2 (5.4)	18.6 (4.9)	20.1 (5.2)	19.3 (4.8)	18.6 (4.8)	19.4 (5.5)
	day 3	17.4 (6.5)	16.8 (5.4)	16.7 (5.7)	17.4 (6.0)	17.1 (5.8)	16.8 (6.0)	16.8 (5.3)	17.3 (5.6)	16.8 (6.5)
	day 7	19.0 (5.6)	18.0 (5.3)	17.8 (5.0)	18.9 (5.9)	18.2 (5.2)	18.6 (5.8)	17.5 (5.7)	19.1 (4.2)	18.4 (6.2)
	1 month	20.5 (5.2)	20.0 (5.4)	19.8 (4.8)	20.4 (5.8)	20.3 (5.4)	19.7 (5.1)	20.6 (5.2)	19.5 (5.1)	20.1 (5.6)
	6 month	21.5 (5.1)	21.2 (4.5)	21.3 (4.8)	21.4 (4.7)	21.2 (4.8)	21.6 (4.8)	21.8 (5.0)	20.3 (4.6)	21.7 (4.6)

M:male F:Female RLUH/ Broadgreen = Hospitals C: control P: passive A: active

Appendix J Mean scores for patients on hormonal and inflammatory responses to surgery

Table 12 Mean comparisons between men and women for hormonal response

	men (SD)	women (SD)	men (SD)	women SD)	men (SD)	women (SD)	men (SD)	women (SD)
	glucose		adrenaline		noradrenaline		cortisol	
Admission	6.2 (1.7)	6.1 (1.4)	.55 (.50)	.53 (.60)	4.2 (2.1)	3.6 (1.8)	366.4 (138.4)	372.2 (134.6)
pre-Ana's	5.3 (.74)	5.2 (.78)	.52 (.34)	.40 (.27)	3.1 (1.5)	3.2 (2.0)	379.7 (157.8)	367.2 (130.3)
1 hour	6.6 (1.1)	6.5 (1.2)	.93 (1.1)	.62 (.58)	3.8 (2.2)	3.6 (2.2)	436.7 (158.3)	458.7 (167.2)
2 hour	6.9 (1.2)	7.2 (1.2)	1.1 (1.2)	1.1 (1.0)	5.7 (3.3)	5.7 (3.6)	741.5 (218.7)	813.1 (232.2)
4 hour	7.3 (1.4)	7.7 (1.4)	1.8 (2.5)	1.2 (1.4)	5.6 (3.6)	6.5 (4.5)	752.1 (232.2)	858.6 (217)
8 hour	7.4 (1.5)	7.5 (1.3)	1.4 (1.6)	.81 (.65)	5.5 (3.7)	5.7 (4.2)	748.2 (257.9)	930.6 (324.4)
12 hour	7.9 (2.3)	7.6 (1.5)	1.4 (4.0)	.59 (.47)	5.5 (3.9)	5.1 (3.6)	868.8 (402.8)	1084.0 (447.3)
day 1	7.4 (2.0)	7.2 (1.4)	1.2 (3.6)	.49 (.41)	3.9 (1.9)	4.0 (2.0)	739.9 (287.6)	948.0 (469.4)
day 2							573.6 (220.8)	860.4 (334.6)
day 3							510.8 (174.5)	529.0 (196.5)
day 4	NOT APPLICABLE						543.1 (171.6)	572.3 (225.3)
day 5							544.6 (206.2)	522.2 (185.2
day 6							550.4 (165.6	568.7 (143.5)
day 7							544.5 (150.7)	555.0 (140.7)

Table 13 Mean comparisons between men and women for Inflammatory response

	men (SD)	women (SD)	men (SD)	women (SD)
	CRP		IL-6	
Admission	8.2 (10.5)	12.0 (14.7)	4.8 (4.6)	7.1 (15.4)
pre-anaesthesia	7.5 (10.6)	12.4 (16.2)	5.9 (7.1)	10.9 (22.6)
1 hour	7.1 (10.4)	11.6 (16.7)	5.7 (7.2)	7.2 (19.3)
2 hour	8.4 (16.1)	11.0 (15.8)	12.4 (11.9)	19. 8 (26.6)
4 hour	7.2 (9.8)	11.2 (15.6)	55.1 (42.7)	79.2 (58.7)
8 hour	9.8 (11.6)	14.9 (18.2)	90.3 (92.0)	100.6 (88.7)
12 hour	23.1 (17.1)	33.4 (26.9)	108.4 (101.1)	118.4 (109.4)
day 1	81.4 (31.5)	105.2 (46.3)	140.7 (106.9)	143.7 (167.1)
day 2	155.5 (49.6)	170.2 (67.0)	84.2 (64.6)	81.9 (97.4)
day 3	156.9 (57.4)	166.4 (59.6)	48.5 (43.6)	46.3 (70.7)
day 4	124.7 (54.4)	132.5 (54.7)	29.6 (26.4)	28.8 (58.5)
day 5	104.8 (47.7)	101.6 (48.9)	26.3 (23.7)	22.4 (30.4)
day 6	83.8 (39.5)	77.7 (38.3)	22.4 (22.4)	20.8 (28.1)
day 7	75.2 (42.4)	69.0 (38.2)	19.3 (18.8)	(29.6)

Appendix K Mean scores for patients on hormonal and inflammatory responses to surgery

Table 14 Mean comparisons between hospitals for hormonal response

	RLUH (SD)	**Broadgreen (SD)**	**RLUH (SD)**	**Broad- SD green**	**RLUH (SD)**	**Broadgreen (SD)**	**RLUH (SD)**	**Broadgreen (SD)**
	glucose		**adrenaline**		**noradrenaline**		**cortisol**	
Admission	6.2 (1.6)	6.1 (1.3)	.57 (.58)	.49 (.37)	4.2 (2.1)	3.6 (1.8)	367.4 (139.1)	376.9 (143.6)
pre-anaes.	5.2 (.66)	5.3 (.88)	.49 (.32)	.39 (.28)	3.4 (1.9)	2.9 (1.5)	433.0 (147.8)	470.5 (179.2)
1 hour	6.1 (1.1)	6.4 (1.2)	.92 (1.0)	.56 (.47)	4.0 (2.1)	3.4 (2.3)	800.6 (205.5)	766.9 (252.1)
2 hour	6.9 (.96)	7.3 (1.5)	.96 (.96)	1.3 (1.3)	5.6 (3.4)	5.8 (3.6)	807.5 (202.2)	832.3 (259.3)
4 hour	7.5 (1.3)	7.6 (1.5)	1.5 (2.1)	1.3 (1.6)	6.2 (3.9)	6.1 (4.5)	876.5 (303.6)	838.6 (324.9)
8 hour	7.4 (1.4)	7.5 (1.4)	1.1 (1.4)	.89 (.79)	5.9 (4.0)	5.3 (4.0)	1031.8 (416.2)	965.3 (473.9)
12 hour	7.8 (2.2)	7.6 (1.2)	1.1 (3.2)	.61 (.52)	5.7 (4.1)	4.7 (3.1)	890.7 (391.4)	848.9 (462.2)
day 1	7.3 (1.9)	7.3 (1.4)	.98 (3.0)	.50 (.43)	5.6 (3.4)	4.7 (23.7)	662.1 (313.3)	614.3 (284.7)
day 2							515.0 (168.8)	531.1 (211.0)
day 3							543.7 (225.8)	585.4 (177.4)
day 4	NOT APPLICABLE						504.4 (180.5)	565.7 (205.2)
day 5							563.6 (164.3)	559.1 (136.3)
Day 5							549.5 (144.1)	552.8 (145.4)
day 7							546.5 9152.6)	579.3 (176.0)

Table 15 Mean comparisons between hospitals for Inflammatory response

	RLUH (SD)	**Broadgreen (SD)**	**RLUH (SD)**	**Broadgreen (SD)**
	Cerial Reactive Protein (CRP)		**Interleukin-6 (IL-6)**	
Admission	12.6 (13.6)	8.1 (12.7)	7.8 (16.2)	4.5 (5.7)
pre-anaes.	12.2 (14.4)	8.6 (14.5)	12.2 (23.8)	5.2 (7.1)
1 hour	11.3 (14.4)	8.2 (14.8)	7.6 (16.1)	6.5 (15.2)
2 hour	11.4 (16.8)	8.2 (14.7)	16.1 (17.8)	18.2 (27.4)
4 hour	11.0 (14.0)	7.9 (13.2)	74.1 (57.1)	64.3 (50.0)
8 hour	14.6 (17.3)	10.9 (14.3)	114.1 (111.6)	74.6 (40.9)
12 hour	31.7 (23.6)	27.1 (25.2)	130.7 (125.1)	95.0 (72.6)
day 1	106.8 (45.8)	84.0 (35.5)	171.8 (185.0)	107.1 (69.3)
day 2	173.5 (59.6)	153.5 (61.8)	95.8 (108.0)	66.2 (41.0)
day 3	168.1 (55.9)	155.8 (62.3)	48.8 (64.7)	44.9 (58.2)
day 4	130.0 (52.8)	128.8 (57.2)	33.6 (62.8)	23.2 (14.4)
day 5	106.3 (44.00)	98.5 (53.2)	27.0 (34.5)	20.0 (15.8)
day 6	83.9 (37.7)	75.0 (39.8)	25.1 (33.0)	16.6 (10.1)
day 7	73.6 (38.6)	68.2 (41.6)	22.9 (32.4)	14.2 (10.4)

Table 16 Mean comparisons between THA and TKA for hormonal response

	THA (SD)	TKA (SD)	THA (SD)	TKA (SD)	THA (SD)	TKA	THA (SD)	TKA (SD)
	glucose (SD)		adrenaline (SD)		Noradrenaline (SD)		cortisol (SD)	
Admission	6.1 (1.5)	6.3 (1.5)	.53 (.44)	.53 (.60)	4.2 (2.1)	3.5 (1.5)	372.7 (148.8)	370.2 (124.7)
Pre-anaes.	5.3 (.81)	5.1 (.66)	.45 (.32)	.43 (.29)	3.3 (1.9)	2.9 (1.4)	461.0 (171.5)	428.8 (145.6)
1 hour	6.7 (1.1)	6.3 (1.1)	.67 (.82)	.86 (.88)	3.8 (2.4)	3.6 (2.0)	811.0 (212.3)	744.8 (248.3)
2 hour	7.2 (1.2)	7.0 (1.2)	.97 (1.1)	1.3 (1.0)	5.5 (3.2)	6.1 (4.0)	818.2 (237.8)	818.7 (209.1)
4 hour	7.6 (1.3)	7.5 (1.5)	1.2 (1.5)	1.8 (2.5)	6.3 (4.5)	5.8 (3.2)	857.3 (326.0)	866.0 (285.0)
8 hour	7.3 (1.3)	7.7 (1.6)	.88 (.82)	1.3 (1.6)	5.4 (4.2)	6.2 (3.6)	1004.8 (458.8)	998.0 (410.0)
12 hour	7.5 (1.2)	8.1 (2.6)	.62 (.55)	1.4 (4.1)	5.0 (3.8)	5.9 (3.6)	881.1 (437.8)	853.7 (396.7)
Day 1	7.1 (1.4)	7.6 (2.1)	.58 (.74)	1.2 (4.0)	4.5 (2.6)	6.6 (3.6)	626.2 (292.3)	669.4 (318.2)
Day 2							504.3 (166.5)	561.2 (226.0)
Day 3							557.2 (223.7)	570.4 (167.8)
Day 4	NOT APPLICABLE						513.8 (173.0)	567.4 (228.5)
Day 5							570.4 (158.0)	543.0 (138.7)
Day 6							563.6 (141.1)	521.3 (148.6)
Day 7							554.1 (150.7)	574.3 (189.0)

THA/TKA: Total hip/knee replacement

Table 17 Mean comparisons between THA and TKA for Inflammatory response

	THA (SD)	TKA (SD)	THA (SD)	TKA (SD)
	CRP		IL-6	
Admission	8.2 (10.0)	15.2 (17.6)	4.6 (8.8)	9.6 (17.5)
pre-anaes.	8.2 (10.9)	15.3 (19.4)	6.1 (11.9)	14.9 (26.7)
1 hour	7.1 (11.2)	13.9 (18.0)	5.0 (5.6)	10.2 (23.5)
2 hour	8.0 (13.7)	14.5 (19.3)	17.6 (14.9)	15.7 (33.5)
4 hour	7.6 (10.5)	14.0 (18.2)	73.8 (47.9)	61.5 (65.5)
8 hour	11.0 (13.2)	17.0 (20.6)	88.4 (78.6)	114.2 (108.3)
12 hour	28.9 (21.5)	31.1 (29.4)	99.9 (89.7)	145.0 (129.3)
day 1	96.1 (43.4)	96.9 (42.1)	127.5 (146.6)	172.6 (144.0)
day 2	158.0 (62.1)	180.0 (56.9)	75.2 (82.5)	100.0 (92.6)
day 3	154.1 (58.8)	181.4 (55.0)	40.7 (60.6)	61.0 (62.8)
day 4	122.8 (51.4)	143.6 (58.7)	26.8 (51.8)	34.0 (40.4)
day 5	97.1 (46.0)	115.0 (51.1)	21.6 (23.7)	28.8 (35.1)
day 6	77.8 (37.3)	85.1 (41.19)	19.7 (21.8)	25.5 (33.9)
day 7	70.4 (41.0)	73.5 (37.5)	18.3 (24.2)	21.4 (29.6)

THA/TKA: Total hip/knee replacement

Table 18 Mean comparisons between intervention groups for hormonal response

	C (SD)	P (SD)	A (SD)	C	P (SD)	A (SD)	C (SD)	P (SD)	P (SD)	C (SD)	P (SD)	P (SD)
	glucose			adrenaline			noradrenaline			cortisol		
Admission	5.3 (.67)	5.1 (.87)	5.3 (.75)	.51 (.50)	.47 (.34)	.62 (.51	3.7 (1.8)	3.9 (1.6)	4.3 (2.4)	341.3 (146.1)	383.3 (124.0)	390.5 (148.7)
pre-anaes.	6.5 (1.2)	6.4 (1.2)	6.6 (.97)	.41 (.29)	.46 (.27)	.46 (.35)	3.0 (1.6)	2.9 (1.2)	3.6 (2.3)	443.3 (192.1)	451.1 (129.7)	456.8 (165.6)
1 hour	7.1 (1.3)	7.0 (1.3)	7.2 (1.1)	.73 (.76)	.89 (1.0)	.63 (.66)	3.5 (1.8)	3.4 (1.8)	4.3 (3.0)	705.2 (241.2)	797.1 (240.5)	865.6 (168.6)
2 hour	7.5 (1.1)	7.3 (1.6)	7.9 (1.4)	.94 (.62)	1.3 (1.3)	1.1 (1.3)	6.0 (3.7)	5.6 (3.8)	5.5 (3.0)	783.0 (222.1)	830.5 (245.0)	841.3 (206.2)
4 hour	7.5 (1.3)	7.2 (1.3)	7.6 (1.5)	1.3 (1.1)	1.1 (.77)	1.8 (2.9)	5.5 (3.2)	5.6 (3.6)	7.2 (5.2)	848.7 (298.7)	864.7 (335.3)	866.5 (308.5)
8 hour	7.6 (1.5)	7.7 (1.5)	7.8 (2.3)	.88 (.94)	.96 (.73)	1.2 (1.6)	5.6 (3.6)	5.0 (3.3)	6.3 (4.9)	970.9 (394.1)	978.7 (401.2)	1053.8 (517.5)
12 hour	6.2 (1.4)	6.0 (1.7)	6.2 (1.4)	.59 (.38)	.70 (.62)	1.3 (4.1)	5.0 (2.9)	4.6 (2.6)	6.3 (5.0)	848.7 (422.5)	863.1 (402.0)	903.7 (450.8)
day 1	7.5 (1.4)	7.1 (1.2)	7.3 (2.2)	.51 (.42)	.56(.46)	1.2 (3.9)	5.0 (2.7)	4.8 (2.7)	5.8 (3.8)	686.7 (359.8)	608.3 (309.9)	626.3 (217.1)
Day 2										520.4 (177.3)	543.4 (210.2)	504.8 (178.4)
Day 3										544.3 (195)	544.1 (158.7)	592.7 (252.8)
Day 4	NOT APPLICABLE									523.2 (192.0)	542.3 (197.2)	526.8 (194.1)
Day 5										564.3 (151.3)	536.0 (163.4)	585.8 (139.0)
Day 6										572.8 (159.1)	543.1 (145.5)	538.1 (128.6)
Day 7										547.4 (177.8)	574.7 (156.9)	559.1 (157.3)

C:control P:passive A: Active

Table 19 Mean comparisons between intervention groups for Inflammatory response

	C (SD)	P (SD)	A (SD)	C (SD)	P (SD)	A (SD)
	Cerial reactive protein			Interleukin-6		
Admission	10.2 (12.7)	11.5 (16.1)	10.0 (11.0)	5.1 (5.3)	5.5 (7.3)	8.1 (19.7)
pre-anaes.	9.9 (14.4)	11.4 (16.1)	10.3 (13.2)	6.3 (8.2)	8.4 (15.2)	12.2 (26.7)
1 hour	8.7 (13.8)	12.3 (16.6)	8.8 (13.6)	5.6 (6.9)	8.0 (18.5)	7.8 (19.8)
2 hour	10.4 (18.9)	11.0 (15.9)	8.9 (12.7)	15.8 (14.2)	17.2 (29.8)	18.0 (21.0)
4 hour	9.0 (13.5)	10.8 (14.7)	9.2 (13.2)	68.4 (46.1)	67.8 (489.8)	73.1 (65.1)
8 hour	12.0 (14.9)	14.3 (18.1)	12.5 (15.5)	98.6 (86.0)	90.5 (60.0)	101.0 (114.5)
12 hour	27.1(20.0)	32.0 (28.5)	29.8 (24.0)	124.1 (106.0)	106.8 (70.4)	113.4 (133.5)
day 1	97.9 (46.2)	97.3 (43.6)	93.8 (39.3)	132.7 (102.0)	124.6 (62.6)	167.8 (222.1)
day 2	157.1 (65.6)	174.3 (63.4)	163.0 (54.8)	82.9 (71.9)	69.0 (35.8)	94.8 (122.0)
day 3	159.0 (61.0)	163.4 (54.6)	165.7 (61.7)	47.0 (40.8)	39.6 (56.9)	54.7 (79.3)
day 4	139.6 (62.4)	115.8 (45.1)	133.6 (53.6)	31.7 (31.0)	19.6 (9.8)	36.1 (76.4)
day 5	111.7 (54.7)	87.7 (35.9)	110.3 (50.3)	26.3 (24.3)	16.3 (87.4)	29.6 (40.4)
day 6	87.5 (44.8)	66.8 (31.8)	85.3 (36.2)	22.0 (23.5)	14.9 (7.8)	26.7 (36.2)
day 7	75.4 (43.8)	58.9 (30.6)	79.3 (41.6)	18.8 (18.4)	14.7 (10.7)	23.9 (38.2)

C:control P:passive A: Active

Table 20 Mean comparisons between men and women for Haematological response

	male (SD)	female (SD)	male (SD)	female (SD)
	white cell count		Lymphocyte count	
Admission	7.4 (2.1)	7.6 (2.3)	1.8 (.63)	1.7 (.69)
day 1	10.8 (2.9)	9.7 (2.3)	1.3 (.50)	1.3 (.52)

Table 21 Mean comparisons between hospitals for Haematological response

	RLUH (SD)	Broadgreen (SD)	RLUH (SD)	Broadgreen (SD)
	white cell count		lymphocyte count	
Admission	7.7 (2.7)	7.4 (1.9)	1.7 (.66)	1.8 (.67)
day 1	10.5 (2.6)	9.8 (2.5)	1.3 (.55)	1.3 (.45)

Table 22 Mean comparisons between THA and TKA Haematological response

	THA (SD)	TKA (SD)	THA (SD)	TKA (SD)
	White cell count		lymphocyte count	
Admission	7.5 (2.3)	7.6 (2.4)	1.7 (.67)	1.6 (.67)
day 1	9.8 (2.7)	11.0 (2.2)	1.3 (.49)	1.3 (.54)

Table 23 Mean comparisons between intervention groups for Haematological response

	C (SD)	P (SD)	A (SD)	C (SD)	P (SD)	A (SD)
	white cell count			lymphocyte count		
Admission	7.3 (1.9)	7.5 (1.9)	7.8 (3.0)	1.7 (.74)	1.8 (.69)	1.8 (.57)
day 1	9.6 (2.5)	10.3 (2.6)	10.6 (2.6)	1.2 (.45)	1.4 (.54)	1.4 (.51)

C:control P:passive A: Active

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The systematic assessment of short-term functional recovery after major joint arthroplasty

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Abstract Despite extensive information about long-term recovery from major joint arthroplasty, little attention has been given to the measurement of functional recovery in the immediate postoperative period. Therefore assumptions about the importance of physical therapy during this period remain untested. We devised a way of recording functional recovery before discharge, based primarily on the achievement of objective milestones. This was incorporated into routine physiotherapy practice and applied to sequential patients undergoing elective hip ($n = 163$) or knee ($n = 66$) replacement. Six months later, we followed up 160 patients, of whom 145 completed questionnaires to assess subjective physical and emotional state and functional recovery. The method was sensitive to known influences on pace of recovery, including type of arthroplasty (hip *vs* knee) and surgeons' differing requirements for mobilization. In addition, we were able to confirm and quantify sources of variation in functional recovery which previously were suspected but unconfirmed: in particular, the timing of early mobilization. Outcome at 6 months was unrelated to objective functional recovery in hospital, although fatigue and wellbeing at this time were predicted by physiotherapists' subjective assessment of patients' motivation before discharge. The findings can be used to inform patients and as a source of comparison data for the assessment of functional recovery in other centres. More importantly, the procedure reported may be applied to quantify functional recovery in routine practice and thereby expose variability in recovery to scientific scrutiny.

Key words: arthroplasty; hip; knee; recovery; evaluation; physiotherapy.

INTRODUCTION

It is assumed that recovery from major joint arthroplasty in patients with osteoarthritis and rheumatoid arthritis depends, not merely on a successful surgical procedure, but on adequate rehabilitation postoperatively.[1,2] Therefore, in order to optimize clinical management, detailed evidence is needed about physical therapy practices and their effect on functional recovery. Such evidence can inform management in two ways. First, evidence in the literature can influence the design of physical rehabilitation programs and provide standards for the evaluation of outcomes. Secondly, assessment of functional recovery in the course of routine clinical practice can help to match care to specific local needs.

Unfortunately, although information is available about recovery after discharge, there is very little published evidence about the progress of rehabilitation while in hospital or about the relationship of this to subsequent recovery.[3] Although formal assessment procedures are available for patients following total joint arthroplasty, they neglect functional recovery. Some measure functional outcome, relying on assessment by the surgeon[4,5] or patient, but are of little help in recording rehabilitation before discharge.[6] Others, including quality of life scales, contain ratings of functional ability but focus on long-term 'outcome' rather than the 'process of rehabilitation.[7] Procedures to assess joint function (mobility, flexibility and power) have been devised. These can be applied during the immediate postoperative period but predominantly evaluate the surgical procedure rather than rehabilitation.[5,8]

The present study therefore describes a new way of recording the course of rehabilitation by documenting the achievement of functional milestones. These were defined precisely and objectively and recorded as part of routine physical therapy practice. The relatively long postoperative stay that was routine in the study hospitals enabled us to observe an extended period of postoperative functional recovery that was uninterrupted by discharge. We assessed the feasibility and value of recording the progress of rehabilitation in this way according to four critera: (i) it should be readily incorporated into routine practice; (ii) it should be sensitive to patterns of recovery that are known to exist; (iii) it should expose sources of variability that are clinically important although previously unaddressed; and (iv) rehabilitation measured in this way should, on the usual assumption that short-term rehabilitation is important to eventual recovery, correlate with functional ability and quality of life 6 months later.

METHODS

Patients

The sample was formed of 229 patients undergoing elective total hip ($n = 163$) or knee ($n = 66$) arthroplasty (excluding bilateral or revision procedures) at one of two general teaching hospitals during 1994–96 and seen sequentially by participating physiotherapists. Of these, 160 were taking part in a study of the effects of pre-operative psychological preparation on postoperative wellbeing, which is not reported here. In brief, patients were randomized to three groups: control, relaxation and imagery. Relaxation and imagery patients were visited by the researcher and listened to audiotapes of relaxation instructions and visual imagery pre-operatively. None of the variables reported here was affected by psychological management. The 69 remaining patients were those who could not be recruited for procedural reasons or because they were excluded (mainly because of insulin-controlled diabetes, other major physical illness, epidural anaesthesia, or steroid medication during the previous 6 months). Patients were under the care of one of 13 surgical teams. Peripheral venous blood samples were collected, and psychological questionnaires completed, at intervals from consent to the 7th postoperative day; results of these are not reported here.

Physiotherapy regimen

Hip patients were seen by a physiotherapist on the day after surgery for chest care and circulatory exercises while on bed rest. Subject to satisfactory radiograph, all patients were expected to leave the bed with assistance and use a frame on the second day after surgery. Daily walking practice graduated from frame to crutches or sticks, and emphasized the improvement of gait pattern and confidence. Distance was gradually increased according to patients' ability. Patients were expected to sit in a chair from day 2 or later, according to each surgeon's requirements; these were 2 days postoperatively (three surgeons, 55 patients), 4 days (one surgeon, 16 patients), 5 days (two surgeons, two patients) or 7 days (seven surgeons, 90 patients). Patients returned either to bed or chair after walking, according to the surgeon's regimen. Before discharge from hospital, all patients were able to walk with aids safely and independently and to climb stairs if required. There was no routine outpatient physiotherapy but home exercises were encouraged.

Knee patients were seen by the physiotherapist on the day after surgery for chest care and circulatory exercises and for straight-leg raising and quadriceps strengthening exercises. At 2 days, all surgeons expected knee patients to transfer to a chair and patients began to walk with a frame, progressing to crutches or sticks and increasing walking distance as appropriate. Subject to satisfactory wound healing, the splint was removed and knee flexion exercises began approximately 1 week postoperatively. All exercises were performed daily and progressed, under the guidance of the physiotherapist, from an emphasis on maximizing range of movement to increasing muscle power. Before discharge, knee patients achieved approximately 90 degrees knee flexion and satisfactory muscle control and walked with aids and climbed stairs if required. Outpatient physiotherapy was provided as necessary.

The physiotherapy service on Saturdays and Sundays was restricted to emergency cover. Therefore patients did not routinely undergo walking practice on these days.

Recording functional recovery

A checklist was constructed to formalize data collection as part of routine physical therapy. First, the date of achievement was recorded for objectively defined milestones: getting on and off the bed, transferring to and from a chair, transferring to and from a toilet, ascending stairs. For each, the dates of both the first assisted and the first unassisted achievement were noted (where the first achievement was unassisted, this date was recorded for both assisted and unassisted data points). Dates of achievement of walking distances of 5, 10 and 25 m were also noted, irrespective of aids and assistance. In addition, subjective assessments were made of: (i) level of pain on first mobilization and final physiotherapy (none, a little, moderate, severe); and (ii) willingness to carry out the physiotherapy instructions on the first and final occasions (very willing with no complaints, willing with minor complaint, willing with much complaint, would only continue with much persuasion, would not continue).

The checklist formed part of the physiotherapy treatment notes and was completed, as milestones were reached, by the relevant physiotherapist. Achievements at weekends were recorded on the following Monday after discussion with the patient or nursing staff.

Additional assessments

The subset of 160 patients recruited to the main study were visited at home 6 months postoperatively by a research nurse who administered self-completed questionnaires; 15 of these patients could not be contacted or declined to take part. Pain was measured by two 100 mm line visual analogue scales, one recording 'how intense your pain is' (anchored at 'none at all' and 'the most intense I can imagine'), and the second recording 'how much distress your pain is causing you' (from 'no distress at all' to 'the most distress I can imagine').[9] Mental and physical fatigue (and their total) were measured by the scale reported by Chalder *et al.*[10] Emotional wellbeing was measured by the positive affect scale of the Mental Health Inventory[11] and physical wellbeing was measured by the Recovery Inventory.[12] The Faces scale provided a global rating of life-evaluation.[13] The extent of functional recovery was assessed by the Western Ontario and McMaster Universities osteoarthritis index (WOMAC), in which separate scales indicate pain, functional impairment and stiffness.[6]

Statistical methods

Data were first examined to ensure that residuals approximated to a normal distribution and were therefore amenable to parametric analysis. Relationships between variables were examined by product-moment correlations. Groups of patients were compared by analyses of variance and covariance. Where data were missing, degrees of freedom were reduced accordingly. This generally occurred where physiotherapists failed to record information; in addition, data for use of stairs were missing for patients in which this was unnecessary and therefore not practised. The analyses were guided by the principal questions that we asked of the assessment procedure. Analyses were by GENSTAT 5 (Rothhamsted Experimental Station, Harpenden, UK) and SPSS 7.0 (SPSS Inc, Chicago, IL, USA).

RESULTS

Sample

Of the hip patients (mean age: 68.5 years; 55 males, 108 females), 157 had osteoarthritis and six rheumatoid arthritis. Of the knee patients (mean age: 66.7 years; 27 male, 39 female), 46 had osteoarthritis and 20 rheumatoid arthritis.

Is the assessment sensitive to known patterns of recovery?

Achievement of milestones

The achievement of each milestone is summarized in Table 1. This confirms two anticipated patterns: progression from the most rapidly attained milestone (getting off bed) to the more difficult achievements (toileting, stairs and walking 25 m) and earlier occurrence of assisted than unassisted achievements. Hip and knee patients were broadly similar but, consistent with

Table 1. Times of achievement of milestones

Milestone	Day on which achieved						F-ratio
	Hip patients			Knee patients			
	Mean	Median	90th percentile	Mean	Median	90th percentile	
Leave bed							
Assisted	3.6	3	6	3.1	3	5	2.52
Unassisted	8.5	7	13	6.1	5	10	9.96**
Transfer to chair							
Assisted	5.0	5	8	3.1	3	5	28.32**
Unassisted	7.2	7	11	5.9	5	10	4.25*
Transfer to toilet							
Assisted	5.8	6	9	3.3	3	6	26.49***
Unassisted	7.7	7	13	5.6	5	10	13.72***
Ascend stairs							
Assisted	13.3	12	19	14.5	13	21	2.17
Unassisted	13.8	13	20	14.4	13	21	0.65
Walk							
5 m	3.7	3	6	3.8	3	6	0.23
10 m	5.0	5	8	5.5	4	11	0.97
25 m	7.8	7	14	7.0	6	14	1.56
Discharge from hospital	19.4	18	27	20.1	17	29	0.56

F-ratios are shown for comparison of means of hip and knee patients. *$P < 0.05$; **$P < 0.01$; ***$P < 0.001$; d.f. is approximately 1210.

their differing physiotherapy practice, knee patients were faster than hip patients to transfer from bed without assistance and to a chair and toilet with and without assistance.

Surgeons' differing requirements for transfer to chair in hip patients.

Table 2 shows that, where surgeons aimed for 2 or 4 days, the large majority of patients (76 and 69%, respectively) achieved this expectation. By contrast, where surgeons aimed for 7 days, 43% of patients had already transferred to the chair before this.

Does the assessment expose important sources of variation in recovery?

Age, gender and type of surgery

Gender was unrelated to any measure. Unsurprisingly, older patients were slower to use stairs with or without assistance (each $r = 0.24$, $P < 0.001$) and to leave hospital ($r = 0.26$, $P < 0.001$).

Relationship of later progress to initial mobilization

Subsequent progress, notably discharge, was quickest in those patients who left the bed and transferred to a chair the earliest, particularly unassisted, and slowest in those whom the physiotherapists found were unwilling or complained of pain upon initial mobilization (Table 3).

Day of surgery

Because physiotherapy services were available only on Monday through to Friday, physiotherapy started later for patients whose operations took place on Thursday or Friday than for those who were operated on earlier in the week. There was a suspicion among physiotherapists that, because of this delay, patients operated upon early in the week progressed more quickly. The assessments confirmed this: patients operated upon later in the week were slower to achieve eight out of 12 recorded milestones (Table 4). This comparison is, however, confounded by different surgeons operating on different days.

Table 2. Day of first assisted transfer to chair in knee patients and in hip patients operated on by surgeons with differing requirements for when this should occur

Surgery	Surgeon requirement for transfer	Day on which achieved 1	2	3	4	5	6	7	8	9	10+	Missing data
Hip	Day 2	0	38	4	5	1	1	0	0	1	0	5
	Day 4	0	0	2	11	1	0	1	1	0	0	0
	Day 7	0	5	4	4	7	17	34	7	1	8	3
Knee		2	28	14	8	6	2	0	0	1	1	4

Table 3. Product-moment correlations of day of achievement of later milestones with physiotherapists' initial assessments and day of achievement of first milestones in total sample

Later milestones	Early milestones and assessments: Chair Assisted	Chair Unassisted	Bed Assisted	Bed Unassisted	Ratings at first physiotherapy: Unwilling	Pain
Toilet						
Assisted	0.75***	0.47***	0.55***	0.54***	0.06	0.09
Unassisted	0.58***	0.76***	0.57***	0.78***	0.22**	0.23**
Stairs						
Assisted	0.22**	0.43***	0.31***	0.50***	0.14*	0.08
Unassisted	0.29***	0.45***	0.31***	0.54***	0.15*	0.09
Walking						
5 metres	0.29***	0.26***	0.38***	0.30***	0.03	0.06
10 metres	0.26***	0.28***	0.27***	0.29***	0.18*	0.16*
25 metres	0.31***	0.35***	0.35***	0.33***	0.30***	0.24***
Discharge	0.15*	0.58***	0.26***	0.58***	0.19**	0.24***

$^*P < 0.05$; $^{**}P < 0.01$; $^{***}P < 0.001$; d.f. is approximately 210.

Surgeons' differing requirements for transfer to chair in hip patients

Timing of milestones in hip patients was compared among those operated upon by surgeons with contrasting requirements for the time at which patients were expected to transfer to a chair with assistance (2 days *vs* 7 days; the smaller number of patients operated upon by surgeons who specified 4 and 5 days were excluded from this analysis). Whereas the 2-day group was, as intended, quicker to transfer to a chair with assistance (2.56 *vs* 6.56, $F_{1135} = 122.74$, $P < 0.001$), they also were quicker to achieve this unassisted (5.56 *vs* 8.11, $F_{1135} = 13.88$, $P < 0.001$) and to use the toilet (assisted: 3.5 *vs* 7.2, $F_{1135} = 39.92$, $P < 0.001$; unassisted: 5.3 *vs* 8.7, $F_{1135} = 27.71$, $P < 0.001$). These effects remained significant ($P < 0.001$) after adjustment by analysis of covariance for whether surgery was early or late in the week.

Table 4. Mean day of achievement of milestones in total sample divided according to timing of operation: early (Saturday–Wednesday) versus late (Thursday, Friday)

Milestone	Early	Late	*F* ratio
Bed			
Assisted	3.1	4.0	10.27**
Unassisted	7.2	8.7	4.89*
Chair			
Assisted	4.1	5.0	6.07*
Unassisted	6.8	7.1	0.15
Toilet			
Assisted	4.6	5.8	7.23**
Unassisted	6.5	8.0	8.70**
Stairs			
Assisted	13.0	14.3	3.42
Unassisted	13.3	14.8	4.13*
Walking			
5 metres	3.1	4.5	13.86***
10 metres	4.7	5.7	5.26*
25 metres	7.4	7.8	0.27
Discharge	19.4	19.9	0.31

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$; d.f. is approximately 1210.

Does the assessment predict 6-month outcome?

We examined whether time of achievement of later milestones (toileting, stairs, walking 25 m, discharge), or physiotherapists' subjective judgements at the end of physiotherapy, predicted mental and physical state at 6-month follow-up in the hip and knee patients for whom follow-up information was gathered (Table 5). Age, sex and type of pathology were not systematically related to outcome but, because knee patients were worse on many measures, partial correlations were calculated to control for joint replaced. Patients who were unwilling at the end of physiotherapy reported more pain and fatigue, were functionally more impaired and were less happy with their lives at 6 months (nine out of 11 correlations were significant).

Pain was a less consistent predictor of impairment (four out of 11 correlations were significant). Time taken to use the toilet, walk 25 m or to be discharged did not predict outcome. By contrast, patients who were later to use stairs generally reported a worse subjective state at 6 months, with greater pain and fatigue, although not more impairment functionally. Analyses of variance confirmed that 6-month outcome was unrelated either to requirement for transfer to chair (contrasting those expected to transfer at 2 *vs* 7 days) or to day of operation (early *vs* late in the week).

DISCUSSION

We have described a method of measuring functional recovery from hip and knee arthroplasty before discharge from hospital. It records, primarily, the time of achievement of functional milestones and was acceptable to physiotherapists and readily incorporated into their routine practice. Our findings show that it is possible and informative to gather detailed information about this crucial phase of recovery.

The validity of the method was confirmed by its detection of known patterns of variation in recovery. Early milestones were achieved approximately 2 days

Table 5. Prediction of 6-month follow-up of hip and knee patients by assessments late in inpatient physiotherapy

Hospital	Pain			Fatigue		Wellbeing		Life-	WOMAC		
assessments	Intensity	Distress	Mental	Physical	Total	Physical	Emotional	evaluation	Pain	Function	Stiffness
Unwillingness	0.21**	0.26**	0.25**	0.20*	0.23**	−0.19*	−0.23**	−0.29**	0.17	0.22*	0.11
Pain	0.20*	0.14	0.05	0.06	0.06	−0.21*	−0.13	−0.28**	0.12	0.26**	0.13
Stairs (unassisted)	0.18*	0.20*	0.26**	0.29**	0.30**	0.03	−0.22*	−0.24*	0.07	0.02	−0.04

Correlations with time of toileting, walking 25 m and discharge were not significant and are not shown. Partial correlations are shown, controlling for joint replaced. *$P < 0.05$; **$P < 0.01$, d.f. is approximately 135. WOMAC, Western Ontario and McMaster Universities osteoarthritis index.

earlier in knee than in hip patients. Furthermore, for hip patients, surgeons differed in their requirements for transfer to a chair and our assessments were sensitive to these.

The utility of the assessment procedure was confirmed by its detection of sources of variation in recovery which, although the subject of clinical speculation, had not previously been evaluated. For instance, a large proportion of patients operated upon by surgeons with the longest requirement for transfer to a chair (7 days) had transferred before the expected day, suggesting that the earlier requirements of other surgeons (2 or 4 days) were more appropriate. The assessments confirmed, also, that patients who were earlier to transfer from bed or to a chair, whether assisted or unassisted, went on to more rapid achievement of later milestones, including use of toilet and stairs, walking distances and discharge.

The role of 'assisted' early transfer suggests that these relationships reflect the importance of physiotherapy practice rather than merely individual patient variation. This view is consistent with our finding that patients operated upon late in the week, for whom physiotherapy services were not available 2 days postoperatively when all patients required help to walk, achieved certain milestones less quickly than those operated upon earlier in the week. In summary, the results have identified sources of variation in later functional recovery that relate to the timing of early physiotherapy. Further work with a larger sample would be needed to disentangle confounding factors and confirm whether the relationships are causal. Until the effects of variability in treatment are explored, it may be misleading to assume that variability in outcome necessarily reflects variability between patients and it will be premature to design clinical pathways on this assumption.[14]

Despite finding faster mobilization in knee than in hip patients in this study, we have previously found that their functional recovery following discharge is slower.[15] Indeed, across the whole sample in the present study, the pace of functional recovery in hospital was completely unrelated to function or wellbeing at follow-up, 6 months later. This calls into question assumptions about the importance of postoperative physical therapy for longer-term recovery. The measurement procedure included not only objective milestones, but also the physiotherapists' subjective assessment of patients' motivation. Such assessments at the time of first mobilization predicted the pace of subsequent functional recovery in hospital. More strikingly, we found that fatigue and pain 6 months postoperatively were predicted by physiotherapists' assessments before discharge, which is consistent with our theory that a motivational response to surgery underlies fatigue and other aspects of recovery.[16] Clinicians' ability to identify motivational factors which relate to recovery is a skill that has not been greatly exploited.

The information that we have reported can help surgeons, nurses or physiotherapists to provide arthroplasty patients with accurate expectations of recovery and to identify gross departures from the 'normal' range of recovery. Our data were gathered as part of routine clinical practice and relate to sequential patients in a single university teaching trust. Thus, aspects of the results reflect specific practices in the trust. In particular, mean length of hospital stay was longer than in many centres. Nevertheless, the assessment procedure that we devised can readily be incorporated into routine practice in any setting. In this way, it can guide rehabilitation practice and resource allocation. Naturally occurring variations in functional recovery can be quantified and, once confirmed, opened to scrutiny and to attempts to identify the cause.

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PATIENTS' REACTIONS TO ATTEMPTS TO INCREASE PASSIVE OR ACTIVE COPING WITH SURGERY

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Abstract—It is generally regarded as valuable for patients to exercise control over aspects of their medical treatment. Although psychological and other interventions are commonly used with the aim of increasing patients' ability or willingness to control events, it is not known whether patients experience these procedures in the way assumed. The present study compared responses to (i) a psychological intervention designed to increase patients' readiness to exercise control and cope actively and (ii) a comparable intervention intended to induce acceptance and passive coping. Hip or knee arthroplasty patients were visited preoperatively by a researcher who administered the active ($N = 15$) or passive ($N = 15$) intervention in a dialogue with the patient. Patients' verbal responses to the interventions were analyzed qualitatively to identify the range of reactions to each type of intervention. Patients readily accepted the passive message on the grounds of doctors' and nurses' authority and the value of the patients' emotional detachment from their surgery. Few responses to the active message indicated acceptance that patients have control over their care and its outcomes; instead, recipients typically interpreted it in terms of the need for obedience to medical and nursing authority. In conclusion, patients do not automatically accept messages intended to change ways of coping. In particular, the attempt to increase patients' readiness to take control over aspects of care can be perceived by patients in an opposite way to that intended. This and previous studies suggest that patient control over aspects of treatment is a professional and theoretical construction that often means little to patients.

Key words—control, choice, active coping, surgery

INTRODUCTION

Control over stressful events such as are involved in medical care can reduce their negative effects (Steptoe, 1983; Affleck *et al.*, 1987; Dantzer, 1993). Furthermore, providing patients with control or choice over treatment can increase its acceptability and improve compliance and satisfaction (Totman, 1976; Lowe *et al.*, 1995). This scientific case for the value of control in health care converges with culturally and politically derived beliefs that responsibility for health rests with the individual (Brownell, 1990) and that patients should help to shape their own treatment (Helman, 1994; Hopton and Dlugolecka, 1995). There is, however, very little evidence about how patients experience procedures which professionals view as enhancing control.

Patient-controlled analgesia (PCA), in which patients use an electronic pump to self-inject an analgesic drug, is one form of treatment which has universally been assumed to afford patients a feeling of control over one aspect of their care. Upon interviewing patients who received this procedure, it was found that control was unimportant to patients and that PCA was, in general, valued for other reasons (Taylor *et al.*, 1996a,b). Indeed, patients commonly described the decision to administer analgesia as so constrained as to represent a lack of control and some patients experienced the procedure as disempowering.

PCA is intended to increase patient control by providing a new relationship between behaviour and treatment. By contrast, a psychological approach can be used to increase patients' readiness to exercise such control as is already available. Psychological approaches to control reflect two overlapping theories. The first concerns effects of a contingent relationship between an individual's behaviour and consequent environmental events (Seligman, 1975; Dantzer, 1993). The absence of such a relationship, whereby the individual cannot influence what happens to him or her, is thought to have harmful psychological and biological effects. Applications of this theory to health and institutional care have included interventions which emphasize choices open to individuals and the ways

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that these choices can shape their care (Langer, 1983). The second relevant theory is focused specifically on stressful events and distinguishes two broad types of coping intended to reduce the impact of such events. Active, or problem-focused, coping modifies the event or the way that it is perceived; it contrasts with passive, or emotion-focused, coping which merely reduces the emotional distress that the event produces (Lazarus and Folkman, 1984; Dantzer, 1993; Ursin and Olff, 1993). Many psychological interventions in health care are designed to enhance feelings of control or active coping. Despite the clear evidence that such interventions can reduce the negative impact of stressful procedures and improve recovery from them, the use of questionnaires which measure ways of coping has typically failed to show appreciable effects of these interventions on the ways that patients do cope (Ho *et al.*, 1988; Manyande *et al.*, 1992, 1995). It is therefore possible that these interventions have not been experienced as influences on coping and control. However, we are unaware of any attempt to describe the ways in which such a procedure has been experienced by its recipients.

The present report arose from the use of a psychological intervention intended to encourage control and active coping in surgical patients. This was compared with an intervention designed to discourage the taking of control in favour of passive, emotion-focused coping. This study differed from previous work in that patients were encouraged to interact with the researcher so that the intervention could be individualized and the patient's reaction observed. This procedure allowed us to ask a question which has been previously neglected: how do patients interpret psychological interventions intended, respectively, to enhance or reduce feelings of control and active coping? This report sets out a theory of the ways that patients react to these contrasting interventions. We began with the simple assumption that different patients' reactions would show different degrees of acceptance or rejection (Krantz *et al.*, 1980). The qualitative analysis reported here led to a more complex account of the principal ways in which patients interpreted, and even "transformed", the messages.

METHOD

Subjects

The sample was drawn from two teaching hospitals in Liverpool serving predominantly working class areas of the city. Patients scheduled to receive elective unilateral primary hip or knee arthroplasty were approached as soon as possible after admission, 1 or 2 days preoperatively. Patients were excluded on the grounds of: disorientation in place or time, insufficient understanding of English, history of major psychiatric illness, pituitary-adrenal disease, liver disease, insulin-controlled diabetes, steroid medication during the previous 3 months. Operations were scheduled for the morning but were occasionally delayed to the afternoon. Each patient was asked for consent to take part in the full study, including randomization to one of the interventions (see below) or a control group with no intervention, to completion of questionnaires and provision of blood samples (neither is reported here). Of 228 patients who were suitable and were approached, 188 were recruited and 40 declined to take part (21 stating reluctance to provide blood samples, the remainder stating a variety of reasons or no reason). Of those recruited, 160 went on to have surgery and remained in the study. The remainder were eliminated because of cancellation or change of surgery ($N = 11$), procedural problems or protocol violations ($N = 10$) or because of withdrawal of consent or noncompliance ($N = 7$). Recruited subjects were randomly allocated to three groups: active coping, passive coping and control. Qualitative analysis requires intensive study of a small number of subjects (Patton, 1990). The present report is therefore based on 30 patients (15 passive, 15 active). These were chosen at the rate of approximately 1/month throughout the study (January 1994–February 1996), depending on the availability of recording equipment. The passive group contained 11 females and 4 males (mean age: 66 years; range: 41–79); the active group contained 9 females and 6 males (mean age: 66 years; range: 34–79). Individual patients are detailed in Table 1. The patient identification number is shown for each statement presented.

Procedure

Each patient was visited by the female researcher (DP) one or two days before surgery. Following completion of questionnaires and blood sampling (not reported here), the researcher administered the designated intervention in a dialogue with the patient, lasting 40–60 min. She recorded the dialogue on audiotape with the patient's consent. For 4 interviews in which audiotaping was not possible because of equipment malfunction or background noise, relevant parts of the dialogue were transcribed immediately afterwards from notes.

Passive intervention. This was designed to discourage active coping and the exercise of control by the patient. The researcher emphasized the necessity and value of the patient accepting his or her inability to influence treatment and management. The message was illustrated by reference to the timing of admission and the routine of the surgical ward, to both of which the patient was required to comply, and the expert ability of surgical, nursing and physiotherapy staff which afforded them superior knowledge of patients' needs to that available to patients themselves. The researcher emphasized that the patient need not question staff who would,

Table 1. Details of patients whose responses contributed to the analysis

Patient	Age	Sex	Surgery	Intervention
19	72	Female	Hip	Passive
30	69	Male	Hip	Passive
34	34	Female	Hip	Active
48	74	Male	Hip	Active
59	78	Female	Hip	Active
66	53	Female	Knee	Passive
68	74	Female	Knee	Passive
77	73	Male	Hip	Active
80	54	Female	Hip	Active
83	57	Male	Hip	Passive
84	66	Female	Knee	Passive
89	67	Male	Hip	Active
92	79	Female	Hip	Active
93	79	Female	Knee	Active
95	72	Male	Knee	Active
102	74	Female	Hip	Passive
108	79	Female	Hip	Passive
112	55	Male	Hip	Passive
113	79	Female	Hip	Passive
116	60	Male	Hip	Passive
120	66	Female	Hip	Active
127	48	Male	Hip	Active
140	63	Female	Knee	Passive
141	41	Female	Hip	Passive
152	38	Female	Knee	Active
156	78	Female	Hip	Passive
159	75	Male	Hip	Active
160	76	Female	Hip	Active
165	72	Female	Hip	Passive
180	72	Female	Knee	Active

Patient number is that shown for each statement in the text.

unprompted, tell patients what they needed to know. In addition, patients were encouraged not to concern themselves with the future, but to accept what was happening and to try to relax and distract themselves from thinking about their arthroplasty and its implications. The principal components of the intervention are summarized in Table 2.

Active intervention. This was intended to encourage the use of active coping and the exercise of choice and control by the patient. The researcher emphasized that patients could influence many aspects of their care, such as medication and pacing of physiotherapy exercises and that patients should, as the best judge of their needs, exercise this power and be involved as much as possible with their care. Patients were encouraged to feel that it was their right to question staff and express their needs. In addition to control exercized through staff, the researcher emphasized patients' ability to contribute to their recovery by their own mental activity. This involved planning and preparation for rehabilitation following surgery; including setting realistic targets for regaining mobility, but also mental rehearsal of the movements that form the first steps in the mobilization programme to be instituted by the physiotherapists postoperatively. It was explained that mental rehearsal would facilitate subsequent performance. The intervention is summarized and compared with the passive intervention in Table 2.

Throughout the course of all interviews, patients were prompted for their reactions to the researcher's message and for their views of its implications for them.

Analysis

The method of analysis used established techniques to ensure that the findings were "grounded" in the data rather than reflecting authors' preconceptions (Patton, 1990; Dey, 1993; Stiles, 1993). The contribution of authors from different backgrounds permitted a "triangulation" of the analysis, and "cycling" between data and analysis enabled progressive testing and modification of the analysis. Two authors (PS and GMH) first listened to — and transcribed relevant material from — 8 audiotapes (4 from each group; each tape being heard a minimum of 3 times). In general, many immediate responses to the researcher's statements were uninformative about a patient's understanding or acceptance. These included responses which merely assented to the interviewer's suggestions (e.g. That's right; I agree; Yes, I would do that), which were commonly contradicted by subsequent statements which suggested that assent had merely reflected an unwillingness to be seen to disagree. Other discarded comments simply described features of the environment without signifying the patient's attitude to them (e.g. *Well that does happen at the moment...the charge nurse has been and explained everything to me and told me exactly what was going to happen*[89]). Such responses were ignored in favour of statements, often made without specific reference to the researcher's preceding prompt, which indicated how patients had construed the researcher's message or the value that they had attached to it. These included statements which were considered to reveal a patient's view by reporting successful or intended ways of coping (*Only me can make myself better*[95]) or by recounting impediments to an intended way of coping (*It's not difficult to motivate myself to get better. I know what I have to do but sometimes when you're in hospital your brain turns to jelly*[34]). A preliminary categorization of reactions to each intervention was tested and clarified by discussion with the researcher, and by listening to 10 further audiotapes (again, on a minimum of 3 occasions each), and reading records of the 4

Table 2. Principal components of each intervention

Passive	Active
Do not ask questions	Ask questions wherever possible
Fit into hospital routine	Make sure staff know your individual needs
Let others look after you	Do as much as possible for yourself
Trust the experts and rely on them to make decisions	Be as involved as possible with your treatment
Don't think about the future	Make plans and set targets
	Prepare mentally for what is going to happen and let the researcher and staff know your worries and concerns
Don't worry about what is going to happen	

additional interviews which could not be recorded, until no further modification was necessary. The comprehensiveness of the final analysis was confirmed by general discussion of complete transcripts of 8 further audiotaped interviews. Patients' statements in response to the interviewer are used below to illustrate the different types of reaction that were identified. The ellipsis (...) indicates omitted speech. Responses in the active and passive groups are presented separately.

RESULTS

Passive intervention

Emotional disengagement. The clearest evidence of acceptance was agreement that *There's nothing you can do by worrying about things*[102] and that one should *try to blank it out*[83]. There was, however, acceptance of the limitations of this strategy: *it always comes back doesn't it*[83].

Acceptance of authority

The intervention was met by many statements of complete obedience: *I'll do exactly what I'm told*[102]; *going to their every whim as you might say, everything they say you've got to go along with*[83]. Although statements such as this did not evoke the source of the professionals' authority, others went on to refer specifically to one of three distinct sources of authority.

Faith. References to having *your life in their hands*[165] were typical. Religious metaphors were clear in references to the staff as *angels*[102] and to the need to have *faith*[30].

Expert authority. Patients typically agreed that *They know what's best*[102] and it followed that patients should *just go along with what they're doing for you because they know more about what they're doing for you than you do*[102]. Professionals' control over the patient's body was described in a way that relegated the patient to a passive observer: *They* [physiotherapists] *get the job done. And when they think that they can't get any more results from that joint then they don't push it any further then, when they think they've got the maximum out of the joint*[66].

Territorial authority. Patients commonly concurred with the researcher's message by expressing their desire to be *a model patient*[68] and not a *nuisance*[68]. A great many responses were more explicit that staff exerted authority by virtue of their ownership of the surgical ward: that is, requirements on the patient were defined in terms of staff's needs: *Sometimes when I'm sort of settled in a place, I can sort of cope with it better and know what I've got to do next. When you come into a strange place, you know, you don't know whether you're doing the right thing or whether you're putting people out*[83].

Finding out. Patients varied considerably in their responses to the suggestion that they should not ask questions. Many statements indicated ready acceptance. Reluctance to ask was ascribed either to one's nature: *I'm not one for pushing forward and asking questions*[68]; or to confidence in hospital staff: *If you have a lot of trust in hospital staff maybe you don't question things as much*[30]. However, its deprecation of asking questions was the only aspect of the passive message which a patient overtly denied: *I think there's probably a balance between the two somewhere. I like to know exactly what's happening*[141].

Active message

In general, the responses to the active intervention were very similar to those of the passive group, despite the contrasting message which had been given. Thus, for example, patients in both groups provided responses to the researcher that implied emotional disengagement; whereas this was concordant with the message for the passive group it was discordant with it in the active group.

Emotional disengagement. The most direct denials of the active intervention were statements of a patient's need to disengage from surgery to the extent of investing all responsibility with others: *I'm going to try and forget all about it, the whole thing. Let them get on with it*[48]. One patient (despite her relatively young age of 54) identified this as an age-linked variable: *your attitude changes a lot when you get older. You youngsters are inclined to be more inquisitive than us old people*[80].

Involvement as acceptance of authority

Another common response to prompts to the patient to describe how he or she might become involved was to interpret involvement as cooperation with staff. This was clearly a relationship, not of partnership, but of obedience to authority: *just...cooperate as much as you can*[93]. Again responses evoked three distinct sources of authority in describing why being involved required obedience.

Faith. For some, the invitation to question staff was met with expressions of implacable confidence in which not questioning was central: *You feel I'm in their hands, I know I'm going to be alright*[59]. Again, religious connotations were often explicit: *Just put yourself in their hands and God's hands. You know, I'm not bothered*[93].

Expert authority. Professionals' expertize also precluded attempts to influence them: *I mean I can't contradict what they do because I can't do any better can I?*[120] as well as questioning of them: *They will know more about it than I know. So in asking a question I probably wouldn't really know what they were talking about*[77].

Territorial authority. Again, patients defined their task in terms of the staff's needs: *It's up to you to help them*[89]. In this context, for a patient to assert his or her own needs by questioning staff was to risk being seen as a *nuisance*[93] or *difficult*[89]. These considerations clearly constrained patients' readiness to question: *I wouldn't ask him* [surgeon] *that* [duration of operation] *because I think he's got enough to cope with*[59]. Other patients would only ask questions *as long as it doesn't put them* [staff] *to any trouble or anything*[92]. Others were more ingenious in asking *when I felt was the right opportunity* [and not] *if they were very busy*[89].

Involvement as finding out. Many patients, when prompted to describe how they might become involved in their care, described a need to question and understand what was happening to them: *So I just checked why there were different dosages. So I got the answer...That was all I wanted*[89]. Questioning was not necessarily seen as easy; it was sometimes necessary to *sort of chat to people and gain information without being pointedly asking for it*[89]. Information was not valued to inform choice and decision-making. Instead, one function was to reduce uncertainty: *I feel that the more I ask, the more I get to know, is helping me better, to get to know the problem*[95]. A second was to maintain self-respect and dignity: *They should answer your questions to the extent of respecting you as an individual, not as a lump of meat*[127]. Indeed, some comments were clear that, rather than control and involvement, dignity and respect were the crucial issues: *You're treated with the height of respect and kindness and that's all you want really*[59].

Patients' desire to find out information was sometimes revealed in responses which described constraints that the hospital environment imposed: *I feel it's a good thing to be involved, but...I had Dr X here, all the students and everyone, and I had all set out what I was going to say...I did have little questions to ask, personal ones and that, but I forgot and then he went*[152].

Personal service. A striking way in which the active message was accepted by a few patients was in terms of their acceptance of their right to identify their needs and have them met: *Well they're only here for your comfort aren't they and to help you and that*[80]. Staff were viewed as *getting paid for doing a job*[77] and providing a service: *It's getting the service isn't it, that they're providing really*[80]. Taking this approach could entail asserting one's own needs over staff: *I need some pillows. I've already asked for some pillows. I have not received the pillows. I asked for them three hours ago*[77].

Willpower and personal responsibility. Instead of taking control over the hospital staff and environment, some patients focused on control over themselves, describing the importance of having *good willpower*[180] or the need to *start fighting to get back on my feet*[180]. More specifically, targets were described: *I know it sounds a little childish but it's* [visiting the toilet] *an objective which makes me want to get up and get out and do things for myself*[159]. Willpower could, of course, be insufficient: *I know what I have to do, but sometimes when you're in hospital your brain turns to jelly*[34].

DISCUSSION

Patients' empowerment to control or influence what happens to them is widely advocated and increasingly shapes the way that health care is delivered. It is universally assumed that procedures that are intended to provide control are necessarily recognized by the patient in this way and that the opportunity for control is valued. This assumption has remained largely untested, but the present study shows that, as a view of psychological procedures intended to foster control, it is inaccurate.

Our initial theory had been that some patients would accept and others would reject the central message of their respective intervention. However, a more complex picture emerged. First, aspects of the messages were accepted which patients could identify with attitudes which are culturally salient and acceptable. Thus, the active message was accepted in contrasting ways: in terms either of patients' right to personal service from hospital staff or reliance on "willpower". Future attempts to increase patients' feelings of active coping or control should emphasize these themes. The main components of the passive message were readily accepted: patients willingly accepted the importance of complying with staff's authority and the need to avoid thinking about surgery and recovery.

Outright rejection of either message was extremely rare. The passive intervention met with clear rejection by only a very few patients, for whom it contradicted a desire to question staff. In the active intervention, despite the absence of overt rejection, no responses suggested that patients had accepted the value of active mental planning and rehearsal, or of patients' expert knowledge of their own needs. Moreover, an unpredicted finding was that patients had commonly transformed the message into one for which the term "active coping" was no longer appropriate. One response was to view involvement as finding out information, but the function of this information was generally to help the patient accept what was being done rather than take control. An association between seeking information and rejecting control has been described previously (Miller and Brody, 1988). The most striking way in which the active message was transformed by recipients was to interpret "being involved" in their care as obedience to, or cooperation with, authority. Although staff's identity as god-like and expert contributed to their authority, the clearest statements of this kind defined patients' role as being to anticipate and meet the needs that the staff had by virtue of their ownership of the surgical ward. Although this role required ingenuity and effort on the part of the patient, it would not conventionally be regarded as active coping or the exercise of control. These results bear out previous evidence of patients' resistance to taking control over aspects of treatment (Waterworth and Luker, 1990).

These findings emerged from a predominantly elderly group of patients in a city with traditionally high unemployment and associated high levels of deprivation. Styles of coping with stress change over the life-span (Aldwin *et al.*, 1996; Diehl *et al.*, 1996) and it is possible that a younger sample, with greater experience of economic power, would yield different results. Indeed, one patient was explicit that her age militated against being "inquisitive". The possibility that a younger group would respond differently remains to be tested. Similarly, the possibility that patients with different attitudes to taking control can be identified who would respond differently to these interventions should be addressed (Krantz *et al.*, 1980). Nevertheless, our findings, if generally applicable, could help to explain why interventions designed to change patients' ways of coping have failed to show appreciable effects on questionnaires which measure ways of coping (Ho *et al.*, 1988; Manyande *et al.*, 1992, 1995). Such studies have, however, shown significant effects on recovery. It therefore follows that these effects might not result from changes in coping. Instead, other psychological processes should be considered. One possibility is suggested by the animal experimental literature, in which procedures which were previously thought to act by influencing control over events are now suspected to exert many of their effects by changing predictability of events (Maier, 1993). (Unacceptability of the coping message might reflect patients' need for the feeling of predictability or safety which results from dependence on experts). Alternatively, "coping" interventions may be effective vehicles for social support (Salmon, 1992). A third possibility is that such interventions enhance feelings of respect and dignity, the importance of which is shown by many patients' comments in the present study. Although physiological and psychological effects of emotional support are well-established, the significance of respect and dignity remains to be explored.

Perceptions of the psychological intervention in the present study were similar to patients' accounts, in a previous study, of patient-controlled analgesia (Taylor *et al.*, 1996a,b). In both studies, the validity of professional assumptions was challenged by the methodological novelty of asking patients for their experiences in such a way that professional assumptions can be refuted. This is seldom attempted, perhaps because psychological procedures and psychological aspects of medical procedures are commonly viewed as comparable to drugs. That is, references in research literature or health care management to "giving control" imply a tangible material which can be conveyed unaltered in the manner of a drug. Our findings show that this kind of metaphor is misleading: what professionals consider they are "giving" does not necessarily correspond to what patients "receive". Specifically, an intervention regarded by the professionals who designed and administered it as a way of increasing active coping can be experienced by the patients who receive it in very different, and even opposite, ways.

Rather than being, as is usually assumed, a fundamental dimension of patients' experience, patient control over medical care appears to be a theoretical and professional construction. Future research should examine the patient experiences that mediate the psychological and physiological effects of procedures which are regarded as increasing patient control. Until this is done, attempts to "empower" patients should be regarded with caution.

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