FACTORS INFLUENCING DENTAL ANXIETY IN RELATION TO TREATMENT UNDER GENERAL ANAESTHESIA IN 5 TO 8 YEAR-OLD CHILDREN

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by

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To my father,

Professor Pinyo Phinainitisatra

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ABSTRACT

Factors influencing dental anxiety in relation to treatment under general anaesthesia in 5 to 8 year-old children.

P Phinainitisatra

Fear of dentistry is a common problem for children and dentists. The management of children's dental anxiety and behavioural problems continues to be the focal point of much research. It seems clear that dental anxiety is a multidimensional phenomenon and many factors can contribute to the development of dental anxiety in children. The child's intellectual level has been reported to be a significant intervening factor that modifies the effects of anxiety-provoking stimuli in the dental situation whereas previous dental treatment experience has been cited as a cause of dental anxiety. Although there are results showing that injection and drilling are the most common sources of dental fear, there are also reports of increasing levels of dental anxiety following extraction under general anaesthesia among children.

Anaesthetic induction does not affect only children but it also causes anxiety and stress in parents as some of them are concerned about the procedure. Recent findings have suggested that parental attitudes and behaviours significantly affect the child's response to dental and medical stress. Therefore, it raises the implication that pre-operative information may reduce parental anxiety and the child will, therefore, become less anxious because of this.

However, only the child is directly affected by the post-operative states such as

analgesia, discomfort and fatigue that may be caused by anaesthetic agents during general anaesthesia. Although other studies have compared the pharmacological characteristics of halothane, the anaesthetic agent mostly used for paediatric anaesthesia, compared with sevoflurane, the new alternative agent, no prospective clinical studies appeared to compare the long-term psychological effects of these two agents when they are administered to children. The aims of this research were therefore to investigate the effects of intellectual level and previous experience in dental anxiety of the 5 to 8 year-old children who received extraction(s) under general anaesthesia. The influence of parent's informative leaflet and anaesthetic agent on child's dental anxiety were also investigated.

The dental anxiety of 313 children and their parents were examined pre-operatively and post-operatively: a) at first visit before the child had treatment; b) at 1 month follow-up visit; and c) at 3 month follow-up interview. The participants were divided into two randomly selected groups. Firstly, the informative leaflet was randomly given to all parents who participated in the study. Secondly, a total of 126 children were randomised by sessions to the administration of sevoflurane and halothane (SEVO = 77, HALO = 49).

In order to present the data without the bias of the new anaesthetic agent, sevoflurane, the investigations of intellectual level, previous experience and the informative leaflet consisted of 203 children, who were anaesthetised with halothane, and their parents.

The data analysis revealed that children with high intellectual levels who had no experience with either dentistry or general anaesthetic procedure showed less dental anxiety ($n = 84$, $r = 0.38$, $p < 0.05$) at the beginning of the first dental visit (before treatment). The significant correlation was found between child's previous experience and parental report of child's post-operative dental anxiety. However, the children whose anxiety remained high both before and after treatment exhibited most negative behaviours on their way home from hospital (i.e. in pain, crying, distressed, vomiting, nausea and bleeding) compared with those who became more anxious after treatment, those who became less anxious after treatment and those whose anxiety remained low all the time ($p = 0.05$). Furthermore, the degree of trauma from the extraction procedure was indirectly associated with the child's dental anxiety or reactions following treatment.

This study found no relationship between parent's and child's dental anxiety, however parents who rated themselves as highly anxious rated their children as more anxious as well ($p < 0.01$).

A repeated measure of analysis of variance demonstrated no significant interaction between the informative leaflet and dental anxiety in both parents and children. However, the parents who received the informative leaflet reported their children showing less negative behaviours, when they left the hospital and when they were at home, than those who did not receive the informative leaflet reported of their children ($p = 0.05$).

The comparison between sevoflurane and halothane showed that children aged 5 to

8 years anaesthetised with sevoflurane and children aged 7 to 8 years anaesthetised with halothane exhibited a decrease in their post-operative dental anxiety ($p < 0.05$), as reported by the children. Furthermore, young children (aged 5 to 6 years) seemed to respond well to the sevoflurane administration by showing fewer negative behaviours following treatment when they were at home ($p < 0.05$).

In summary, more research is required on the causes of dental anxiety in children. The results described in this thesis have addressed only some of the issues. Investigations into compounding factors such as number of dental visits, oral hygiene status (DMFT) and parents' dental attendance patterns may provide new clues for researchers. The association between the different anaesthetic agents and children's dental anxiety also warrants further investigation regarding the long-term effects of these findings in different age groups of children. The present study represents an initial step in examining the psychological effects of dental extractions under general anaesthesia in children.

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INTRODUCTION

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There has been a growing research interest in the nature and mechanisms underlying the manifestations of anxiety in children. Perhaps nowhere is the effect of anxiety on children better seen in clinical settings than it is in dentistry. It would, in fact, appear that no area of health is more associated with anxiety than dentistry. Furthermore, dentistry provides an ideal venue in which to study acute clinical stress and the effects of anxiety on a child's responses. A number of studies have investigated the occurance of dental anxiety, employing adult subjects and retrospective designs (Scott *et al.*, 1984; Davey, 1989), with little reference to young children. To date, there are few prospective experiments concentrating on the effects of dental stressors in children.

The study of a child's dental anxiety and its development is an important factor in the understanding and relief of distress during dental treatment. It is recognised that many of the difficulties presented in childhood continue into adult life. The literature review is directed initially at the way that dental anxiety presents itself and how it affects the child's various attitudes and those who are in contact with the child. The review will also look into the process of general anaesthesia, which has become the treatment of choice for many children where extraction becomes necessary. Although this can eliminate dental pain and improve quality of health by enabling the child to carry out normal activities, general anaesthesia and dental treatment can be identified as life stress inducers for the child.

In the case of a child, negative emotional outcome is not only experienced by the child, but also affects family, friends and dentists. Practising dentists find fearful and uncooperative children to be one of their most troublesome problems. These children not only make treatment difficult but also arouse uncomfortable feelings in dentists themselves. For the dentist who considers himself or herself as someone who wishes to help patients, it is important to have a deeper theoretical understanding of the psychological ramifications of dental anxiety.

If the dentist is to practise efficiently, he/she should not only observe and record what he/she sees, but should also be able to recognise the psychological disturbances he/she encounters in particular children, and the techniques he/she would employ to treat these problems. In order to grasp and understand the complex development of the child's anxiety and behaviour, the dentist should also be able to formulate certain conclusions as to how and in what connection specific theoretical concepts and their relating factors apply in the case of that particular child-patient, and to use these as a guide for improving the child's psychological preparation routine. By enhancing the child's capacity to understand and to cope with dental treatment and its outcomes, relatively low-cost efforts at psychological preparation may reduce stress and improve the child's attitude towards dentistry.

The purpose of the proceeding chapter is to provide an overview of substantive issues associated with research involving dental anxiety in children. The development and change in the way dental treatment is performed and the potential benefits of a psychological approach and/or preparation, increase the need for theoretical analysis and hypothesis testing research in this area.

CHAPTER 2

A REVIEW AND ANALYSIS OF DENTAL ANXIETY IN CHILDREN

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2.1. Introduction of dental anxiety

Dental anxiety is often considered a problem for both dentists and patients. It is rated as the principal management problem encountered by dentists and is implicated as an important factor in broken or cancelled appointments (Ingersoll *et al.*, 1978). Anxiety about dental treatment and fear associated with it remains widespread, despite technological advances such as better anaesthesia and dental procedure techniques.

Previous research has reported that dental anxiety was found to have significant effects on utilisation measures, i.e. numbers of dental visits and time since last dental visit (Wisloff *et al.*, 1995); patients with extreme dental fear were more likely to seek only symptomatic dental care (Milgrom, 1986). A number of studies have shown that dental anxiety is associated with negative expectations about future events, particularly pain (Kent, 1984; Wardle, 1984; Arntz *et al.*, 1990; De Jongh & Ter Horst, 1995); and that very often this fear of dentistry is learned primarily through experiences in childhood (Murray & Niven, 1992). Until recently many studies were conducted to determine the prevalence and aetiology of dental fear in children. The main problem encountered in most of the studies about dental anxiety lies with the reliability of the subject's memory.

The assessment of the child's present behaviour is a necessary, but not sufficient, step for the dentist. Because of the complex nature of anxiety and psychological functioning, the same behaviour phenomenon will acquire a different perspective, depending on its relationship to other characteristics in the child. For example, age, sex and past experiences will largely determine the meaning of the child's behaviour here and now. For this reason it is recommended that information, obtained through both the child's and parents' reports and observation of the child's behaviour at the time of treatment, be integrated with his/her developmental status and any other influences (e.g. parent, type of dental procedure) before it is used for the dentist's evaluation.

Dental anxiety is a complex phenomenon which resides as a cognitive construction (Melamed, 1986). It is the present investigator's purpose to provide a better understanding of the basic aetiologies of dental anxiety in children which is essential for diagnostic interpretation. Although these following factors are well known to those who study anxiety, they bear this repetition.

Therefore, the aim of this review is to concentrate on three aspects of research into child dental anxiety. The first part provides an outline of the nature of anxiety, whilst its aetiology is discussed in the second part of this review. Many factors influence both how a child develops dental anxiety and how anxious a child feels. Techniques of preparing children psychologically for treatment are then discussed in the final section.

2.2 The nature of dental anxiety and related problems

In order to understand more about dental fear, it is important to address the question of what "fear and anxiety" might be, and to know how it might affect child's behaviour. Fear and anxiety are two concepts that are closely associated and confusion can result when the words are used to indicate specific attitudes. Usually fear is defined as "an unpleasant feeling of threat or harm" while anxiety can be described as "a vague, unpleasant feeling accompanied by a premonition that something undesirable is about to happen" (Locker, 1989). Both fear and anxiety are complex emotional reactions in that they depend on a variety of psychological, social and situational factors (Melamed & Siegel, 1980).

The term "dental anxiety" has become associated with an unpleasant subjective emotion characterized by worry, apprehension, or fear, which the patient experiences when confronted by dental treatment (Wright *et al.*, 1980). Although there are many studies on dental anxiety; much of the research has been done with adults. For example, it has been established that a large percentage of the population experiences some degree of dental anxiety, whilst a minority of the population are so anxious that they avoid dental treatment all together (Scott *et al.*, 1984).

Research has demonstrated that more than half the population of countries such as the United States, United Kingdom, and the Netherlands experience at least some degree of anxiety about the dental visit and treatment (Gatchell *et al.*, 1983; Stouthard & Hoogstraten, 1990). Extreme dental anxiety can affect the individual's oral health and psychological well-being (Berggren & Carlsen, 1986). It may even be said that severe dental anxiety can influence one's whole life (Stouthard *et al.*, 1995).

Many research studies have shown that negative attitudes towards dentistry do indeed play an important role in an individual's life: first, it is stressful for the person who experiences it; second, it can result in irregular visits to the dentist; and third, dental anxiety can interfere with effective treatment (Horst *et al.*, 1987). What is less clear, and is the question proposed here, is: when does dental anxiety develop in an individual's life and what can it tell us?

Very often the fear of dentistry is said to develop in childhood (Bailey *et al.*, 1973; Kleinknecht *et al.*, 1973; Sermet, 1974; Shaw, 1975; Schwarz, 1990; Murray & Niven, 1992), and there has been a considerable interest in identifying the source of dental anxiety. Although the origin of dental fear is usually thought to lie in the child's past direct experiences, many authors place a lot of emphasis on vicarious experiences and threatening information (Rachman, 1977; Ollendick & King, 1991; Milgrom *et al.*, 1995). The development and evaluation of dental anxiety is perplexing, however, especially in children, because it relies largely on data collected reports. Therefore, the acquisition and development of children's dental anxiety will be the next major area of concentration in this review. Before discussing anxiety research, the present investigator will first consider the picture that emerges from the influences of children's dental anxiety. Despite the limitations in the scope and validity of the approach, it may be helpful to identify some of the behaviours associated with children's anxiety. The special place that dental anxiety holds in behaviour-related problems is illustrated by many studies (Lindsay & Roberts, 1980; Winer, 1982; Brown *et al.*, 1986; Lee *et al.*, 1989).

Dental anxiety has been found to be an important barrier to the achievement of dental services for many children (Murray *et al.*, 1989; Chellappah *et al.*, 1990), and is also rated as a significant factor in broken or cancelled appointments (Vassend, 1993). Milen and colleagues (1990) found that about 15% of young children in Finland avoided dental care because of fear of dental treatment, and an American survey had also specified fear as the restrictive factor in dental care for 5% of children aged 13 or younger (Kleiman, 1982). As many as 16% of school-aged children are afraid of dentists, and they consequently avoid attending for dental treatment (Kent & Blinkhorn, 1991). The results of dental anxiety have predominantly been related to inadequate dental behaviour, both in terms of irregular dental attendance (Schuurs *et al.*, 1984) and of management problems in the dental clinic (Cuthbert & Melamed, 1982).

In the study on the relationship of children's anxiety to their potential dental health behaviour in 200 children aged 7-13 years by Wright (1980), he could not demonstrate direct associations between dental anxiety and potential health behaviours. However, children with a low level of illness anxiety were likely to have preventive dental visiting behaviour. This study was based on the assumption that if a child held a particular dental health belief, then that child was more likely to present a behaviour consistent with that belief than a child who did not hold the same opinion.

It thus appears that anxiety is associated with dental health in children, initiated prior to treatment and serving to distract attention from regular visits. We might speculate that anxious children may not have as good dental health as non-anxious children have; however, the lack of association between dental health and dental anxiety has been reported by many studies (Duivenvoorden *et al.*, 1985; Schwarz, 1990). The similar finding from Brown, Wright and McMurray study (1986) in children aged 7 to 11 years (n = 243) also indicated that the highly anxious children had fewer dental visits and better dental health status (mean dmft = 1.70) than the low anxious children (mean dmft = 1.94), although Lahti *et al.*, (1989) reported that Finnish children who had active dental caries were more anxious than other children. However, when Vignehsa and colleagues (1990) investigated the effect of dental anxiety on the oral health of children, they found no difference in dental caries activity between the high- and low-fear Singaporean 8-9 year-old children, with the prevalence of untreated caries being high in both groups.

The non-association between dental anxiety and oral health status in children is supported by Bedi and colleagues (1992), who reported no difference in the oral health of a large group (n = 1103) of children, aged 14 years, with high dental anxiety compared with the other children involved in the study. Children with high dental anxiety were 62% more likely to have at least 1 missing tooth due to caries. They concluded that high dental anxiety was not associated with a poor clinical outcome; however it has been suggested by the authors that the dental health of those anxious children displaying negative attitudes towards dental health might be affected in later life.

Apart from the dental attendance problem, dental anxiety may also play a significant role in a child's disruptive behaviour. Much psychological research on behavioural management problems in relation to dental treatment has paid considerable attention to detecting factors underlying children's behavioural problems. It has been suggested that the relationship between dental anxiety and behaviour in children is complex and could not be clearly demonstrated (Wright, 1980).

Many studies of children's behaviour have been reported by clinicians representing a wide range of findings. For example, Melamed *et al.* (1975a) was unable to find any significant relationship between the fear which children reported and their behaviour during treatment. However, this study involved a small group (n = 16), without previous dental experience. Other findings suggested that the anxiety levels of frightened children with painful previous experiences could be measured from their behaviours (Horst *et al.*, 1987; Ter Horst & De Wit, 1993; Veerkamp *et al.*, 1995).

Holst *et al.* (1988) found behavioural management problems in Swedish children to be related to fear of visiting a dentist. Carlsen *et al.* (1993) reported that the subjective experience of a child's anxiety may cause increased expectations of pain, and lead to disruptive behaviour. Vassend (1993) further speculated that the possible link between anxiety and management problems may lead to children receiving less than adequate dental care. This suggestion is consistent with the findings from the study by Klingberg and colleagues (1994) who investigated dental behavioural management problems in 4505 Swedish children, aged 4-11. They reported that these problems were found in 10.5% of children, particularly in younger children.

Moreover, those children who had behavioural problems had more carious teeth and fewer fillings. Regrettably, the investigators did not report on dental anxiety in these children.

In the major review of studies of children's fearful behaviours in dental settings, Winer (1982) concluded that the majority of children younger than 7 or 8 years had shown themselves to be relatively cooperative. On the other hand, when older children were investigated, he found some indication of an increase in dental fear which supports a positive relationship of dental anxiety to age. The physiological and psychological changes of maturity and the likelihood that older children received more invasive treatments than younger were possible explanations proposed by Winer (1982) to help understand this phenomenon.

Bringing all of this material together, it appears that the child's behaviour in dental conditions is actually quite complex. Although a history of negative dental experiences may strengthen anxiety sensitivity by exhibiting disruptive behaviour, age is also an important clue. These factors will be explored later.

It is proposed here that dental anxiety has an influence on a child's behaviour even though it may not produce the disruptive responses we might expect. However, we cannot assume that the child who cooperates well with the dentist is without fear (Lindsay & Roberts, 1980); a child who now cooperates with white knuckles and palpitations might be dentally avoidant in the future (Wright, 1980).

It is difficult to argue that children cope with their anxiety in the same way as adults.

The studies summarized here indicate that one of the problems children have in dealing with anxiety is that behaviours which help them lessen their sense of threat are difficult to identify, and total avoidance of the treatment becomes the only way of coping with their feelings. Additionally, many studies put forward the view that children learn a variety of anxiety responses and behaviours in order to deal with the specific stress of the dental situation (Venham *et al.*, 1977; Venham *et al.*, 1979a, 1979b; Kent & Blinkhorn, 1991).

In the following review, the present investigator will demonstrate that construction of anxiety is associated with many factors. For example: unpleasant dental experiences, family attitudes, socioeconomic factors, dentist's behaviour (Kleinknecht *et al.*, 1973; Marks, 1978; Freeman, 1985; Neverlien & Johnsen, 1991), and psychological development, especially its emotional and cognitive aspects, must be taken into account (Klingberg & Berggren, 1992). It is important to examine the aetiological components of dental anxiety in children in order to assess the extent of anxiety and significant changes in dental health behaviour and attitudes.

2.3. Aetiology of dental anxiety and preparation methods to reduce anxiety

Much has been written about the aetiology of anxiety in general (Gross & Eifert, 1990; Berggren, 1992) and dental anxiety in particular (Wright, *et al.*, 1980). To date, the concept of a multifactorial aetiology for dental anxiety is now accepted (Freeman, 1985). To identify an anxious child is to distinguish him/her from others; therefore, the dentist should be familiar with the factors underlying the development of dental anxiety in order to understand the causation of dental anxiety and the subsequent behaviour of dentally anxious child-patients.

Demographic factors such as previous experience (Brown *et al.*, 1986), effects of child's expectation of pain (Lindsay *et al.*, 1984), socioeconomic variables (Winer, 1982) and parental anxiety (Johnson & Baldwin, 1969) have been addressed in many studies. Particular attention has been directed towards how dentist's behaviour (Alwin *et al.*, 1994) and types of dental treatment (Venham & Quatrocelli, 1977) influence the child's behaviour and anxiety. These also include developmental factors such as intelligence (Toledano *et al.*, 1995), gender (Wright *et al.*, 1980) and age (Cuthbert & Melamed, 1982). A weakness of most of these studies is that they relied on memory of the subject or parents. These retrospective studies and even prospective research show inconsistent results (Lindsay, 1984). This review will also provide a critical overview of pain and anxiety, associated with research concerned with dental extraction under general anaesthesia in particular, as both of these treatments have been regarded as significant stressors for children.

The literature review will now briefly present summaries of the demographic factors and developmental factors that have been shown to be related to dental anxiety. The psychological preparation to reduce anxiety in children will also be reviewed.

2.3.1 <u>Demographic and psychological factors</u>

2.3.1.a. Previous experiences

The origin of dental anxiety is usually focused on an individual's past experience. This is a reasonable conclusion and a number of observations and hypotheses about the historical origins of dental anxiety supports this argument. Some of these findings suggested that highly anxious people were likely to report more negative dental experiences than those with low or moderate dental anxiety (Scott *et al.*, 1984; Freeman, 1985; De Jongh & Ter Horst, 1995).

Lautch (1971) found the clinical condition of dental phobia seemed to stem in most cases from identifiable traumatic dental experiences in the person's past. All 34 of his phobic patients reported at least one painful experience during childhood, as opposed to 10 of 34 matched control patients. The finding that painful dental experiences was identified as one of the major sources of adverse reactions to dentistry was consistent with the reports of others (Kleinknecht *et al,* 1973; Neverlien, 1994). However, these results are based on adult's memories and several factors may intervene in the process (Kent, 1990).

The problem is raised here whether previous dental experience is responsible for dental anxiety development in children. As more became known about children's psychological needs, more attention was turned toward the effects of previous experience on the child's dental anxiety, as unpleasant dental experiences have been claimed as one of the causes of a child's dental anxiety (Venham & Quatrocelli, 1977; Brown *et al.*, 1986; Murray *et al.*, 1989). However, a search of the dental literature revealed that many of the investigations were based on mothers' reports of the effect of prior experience on the children's behaviour in the dental office (Johnson & Baldwin, 1969; Brown & Smith, 1979). Wright and Alpern (1971), for example, investigated the variables which influence children's cooperative behaviour at the first dental visit. The authors found a significant relationship between the behaviour and the child's past medical experiences. This result was consistent with the work by Bailey *et al.* (1973) who demonstrated that the child's attitude in recent contact with physicians had an influence on his/her behaviour in the dental setting.

One of the studies to address specifically the question of the psychological effects of painful experiences on children was conducted by Shaw (1975). This author found that anxious children, as reported by their mothers, were more likely to have had a painful experience on their first visit. He concluded that the mother was likely to recall her unfavourable dental experience if she had had these experiences as a child. Like some other studies, most of the results were dependent on mother's recall of events (Lumley *et al.*, 1993; Milgrom *et al.*, 1995). Although this information is valuable, many variables can influence the mothers in their accounts, for example: their attitudes and their dental experiences (Wright *et al.*, 1973; Veerkamp *et al.*, 1994).

The validity of memory recall has been studied in mothers. Dasanayake and her colleagues (1995) investigated the validity of memory recall by mothers of the child's antibiotic history with children aged 5 to 12 years. They found mother's memory was more sensitive than specific and often underestimated. In other words, the correct classification of the child's antibiotic use by the mother was greater when the child had actually been given antibiotic prescriptions, than when the child had not been given antibiotic prescriptions even though the sensitivity of her recall of the child's antibiotic use was similar to that of her recall of her own antibiotic use. Mothers often recalled a fewer number of antibiotic courses than indicated in the record.

It seems reasonable to expect, from any one of a number of studies above, that the more prior negative dental experiences children have, the more anxious they would become. However, many of the investigations do not support this conclusion (Melamed *et al.*, 1975a; Melamed *et al.*, 1975b). An inconsistent finding has been reported by Venham and his colleagues (1977). They studied the response of young children aged 2 to 5 years old (n = 29), who had no previous dental experience, to their initial series of dental visits (i.e. an examination visit, four visits of restorative treatment and a final visit to polish the restoration, clean the teeth and apply topical fluoride). They found a consistent increase in the child's negative response over a series of three treatment visits, followed by a decline through the fourth visit to a low point during the final polish visit. This suggests that dental anxiety does not accumulate in a linear manner.

In 1977, Venham & Quatrocelli restudied responses in children, aged 2 to 5 years, with no previous experience. These children were repeatedly exposed to a series of six specific dental procedures. Each child received an oral examination visit, four visits involving restorative treatment and a final visit of polishing. Each visit was divided into three periods corresponding to specific dental treatments. It was shown that a series of dental visits reduced the children's anxiety in nonstressful procedures such as the mirror and probe examination while sensitizing their apprehension toward the stressful injection procedure. It was predicted that injection would produce the greatest negative response in children. Surprisingly, the children's responses became increasingly negative over the series of four injections. However, this study was limited to only 29 children and some personality characteristics may intervene between stimuli and response, modifying the effects of the stimuli (Brown *et al.*, 1986; Venham *et al.*, 1979a).

Additional evidence is suggested in some of the studies investigating experiences in children. Brown *et al.* (1986) examined children aged between 7 and 11 years directly for total number of primary carious, missing and filled teeth (dmft) and number of permanent carious, missing and filled teeth (DMFT) as indicators of past and present experiences. In contrast, Murray *et al.* (1989) collected their data by examining dental records to determine the pattern of attendance and type of procedure each child was submitted to during the 3 years of their study. At the beginning of the period under study, the mean age of children was 9.36, at the end it was 12.46. From both these studies, it was found that dental anxiety in children decreased with repeated exposure to dental settings. In other words, the exposure might have acted prophylactically.

Brown and his colleagues (1986) concluded that children who had better dental health and, it was assumed, paid fewer dental visits, were more anxious than those who showed greater evidence of dental problems. They suggested that neither perceived medical nor perceived dental vulnerability was significantly related to high dental anxiety in children. Partly consistent with the previous study, Murray *et al.* (1989) found that children who had not had invasive treatment experience, whether or not they attended the dentist regularly, were the most anxious. Interestingly, anxiety in children who attended regularly and had invasive treatment experience did not change during this longitudinal study. It was found that dentally anxious children rated medical fears, fears of the unknown and fears of injury higher than nondentally anxious children. They suggested that earlier related experiences might have predisposed these children to finding dental situations more aversive than was the case for the nondentally anxious children. However, neither of these studies attempted to demonstrate the effect of anxiety from vicarious or critical experiences on dental anxiety. In summary, the studies just presented make it seem that anxiety, at least in the dental context, is not a linear-dimensional construct; yet dental anxiety is determined by a number of phenomena. As such, it is unclear why the children who had repeating painful dental experiences do not develop anxiety.

The foregoing review of previous negative dental experiences relating to the child's overall appraisal of dental treatment is not intended to be exhaustive, but merely introductory. The present author is trying to provide a substantive basis for theories that seek to explain how the child acquires his/her dental fear.

It has been suggested that the way in which dental anxiety could be learned from experiences is through a process termed "classical conditioning". Classical conditioning theory was proposed by Pavlov who hypothesized that there could be many such associations between biologically significant experiences (e.g. food, water) and neutral stimuli in the environment. This could account for human learning. Watson and Raynor (1920) also used this process to explain conditioned fear of a white rat in a 11-month-old baby, by pairing the rat with a loud noise. There was some supporting evidence for this kind of learning in Sermet's (1974) samples of anxious children; he found dentally anxious children had a history of hospital admissions and negative attitudes towards the care they were given.

In a major study on self-report of university students, Davey (1989) found that the majority of anxious patients had had at least one painful experience, while some who have never been anxious patients had had at least one painful event and yet were even more relaxed with dental treatment. This is inconsistent with the conditioning process. Davey suggested the influence of **latent inhibition** which protected those who had encountered painful or traumatic experiences but did not acquire anxiety, and predicted that a long term of non-painful treatments prevented patients from becoming anxious. This latent inhibition hypothesis was supported by De Jongh *et al.* (1995). They examined 224 undergraduate psychology students to investigate how their attitudes to dental treatment had changed during their life, with reference to painful experiences, negative cognitions and dental attitudes. The result showed that painful and traumatic experiences were significantly related to dental anxiety, and students were less likely to acquire dental anxiety if they received a number of relatively painless treatments prior to conditioning.

Another explanation of how dental anxiety developed was invoked by Wardle (1984) and Arntz *et al.* (1990). A high anxious patient develops an attitude to dental visits in which the negative aspects figure the most prominently. The authors also suggested that the anxious state made the patient more sensitive to possible negative aspects of dental experience. The patient became hypervigilant regarding the threatening aspects of that experience, and might then engage in a cognitive response in the form of overestimating the threat the dental experience actually posed. The experience would contradict the patient's expectation (i.e. be less aversive than expected) if the anticipated threat did not appear. However, this contradiction would not change the patient's attitude regarding the dental visit, nor the patient's recollection of pain when asked about it later. The authors concluded that if the unexpectedly pleasant experience was attributed to something external to the patient, or if the process of the dental situation was not sufficient for the patient to recognise the unexpected outcome, then the memory of the experience would not be accurate and the patient would not change his/her original attitude.

It should be noted that these results are based on retrospective research in adults and several factors may interfere in the process of measuring dental experience. Moreover, there have been questions over the reliability of the subjects' recall of events. In Wardle's study, the author used only a single item to measure general anxiety; also, Wardle used pain expectation ratings as ratings of anxiety. The Arntz *et al.* (1990) study had a different problem; the investigators did not measure state anxiety and the findings were based on measurements of general dental anxiety. Had they recorded measures of situational anxiety the results might have been different.

The importance of cognitive responses was explored in a study of dental anxiety in children, aged 6 to 18 years, by Alwin *et al.* (1991). The investigators combined behavioural and cognitive measures of anxiety to compare children (n = 65) who had been referred with problems of poor cooperation with a control group of children (n = 42) who had been referred for other reasons. The authors reported that dental anxiety appeared to be a specific situational anxiety which developed in children who paid less attention to the dental situation; that is they noticed less about the dental environment and were less likely to recognise the positive benefit of the dental experience. Poor attention to an environment could lead to increased pain expectation in the dental settings. The findings supported the cognitive theory which suggests that anxiety is an over-reaction to a potential threat. Also, these authors suggested that children with no previous dental experiences might be anxious owing to other children and relatives recounting their own unpleasant dental visits. These factors seemed to determine the child's initial level of anxiety while dental experiences on subsequent visits have an influence on the child's fear response. It is noteworthy that previous direct traumatic dental experience is not the only significant factor associated with dental fear.

Kleinknecht *et al.* (1973), on the other hand, reported that the most frequent reason given for dental fear was the negative expectations from others (as reported by 17% of subjects). The experience of having had "painful dental work" was second in importance (as reported by 13% of subjects). Past aversive experience seems to play a role here. While Rachman (1977) discussed the acquisition of general fear via the past actual experience, he also suggested two other pathways; through vicarious experiences and through transmission of threatening information and/or instruction. He further noted that the research evidence to support the final two routes was sparse, and to a large extent indirect.

In a test of Rachman's hypotheses, Ollendick and King (1991) examined the origin of ten prevalent fears in 1092 American and Australian children and adolescents. Children were investigated because the authors believed that children would have more accurate memories for traumatic experiences that might lead to fears. They concluded that for cases of subclinical (i.e. non-phobic) fears, the majority of children attributed their fears to either modelling factor, usually the observed behaviour of parents or friends, or to information acquired indirectly about the situation. Only a minority (36%) acquired their fears through actual aversive experience with the feared situation. The authors further suggested that the three sources of fear: direct experience, modelling and information, acted synergistically. The more sources of fear that were present, the more fearful the child would be. However, the authors did not report on a fear of dental procedures.

In addition to the exploration of Rachman's theory of fear acquisition, Milgrom, Mancl, King and Weinstein (1995) studied 895 children between the age of 5 and 11 years. Among the retrospective measures were estimation of "direct conditioning" (i.e. oral health status score) and parental modelling influences (i.e. measures of mother's fear of dentist). Children's dental fear, measured using the Dental Subscale of the Children's fear Survey Schedule (Cuthbert & Melamed, 1982), was predicted by both mother's dental fear and child's oral health status score, as well as by parents' education and child's nondental fear. The results were found to provide support for the importance of both direct experience and modelling in children's dental fear. It should be noted that the correlation with mother's dental fear was interpreted by the authors as evidence of modelling despite the fact that no evidence was demonstrated that the child ever observed dental fear in his/her mother. Also, the correlation of dental fear with oral health status score was interpreted as the effect attributable to direct conditioning, or experience, without any supporting evidence that children with worse oral health status had actually had more aversive dental experiences. Nevertheless, this work reflects the current study of the origin of dental fear in children.

The purpose of the literature review section is to aid in the evaluation of the child's dental anxiety. To this end, the history of negative dental experiences called for therein should be integrated with the child's developmental level at the first dental visit and the context of the visit, such as the presence of a mother on the dental visit. The number of preventive treatments prior to aversive treatment is also an important factor to consider.

The evaluation should also consider the child's characteristic pattern of coping with environmental demands. Against the background of such evaluations which are based on descriptive material, further prospective study on the effects of negative dental experiences on children's acquisition of anxiety is needed. As it has long been argued that the real correlations do not exist between anxiety and pain experienced, but between anxiety and pain expected, the child's expectation and memories of pain will be the next subject of this review.

2.3.1.b. Children's expectation and memories of pain

There is some consistency in many studies that fear of pain makes a significant contribution to dental anxiety (Bailey *et al.*, 1973; Lindsay *et al.*, 1984; Frazer & Hampson, 1988; Kunzelmann & Dunninger, 1990). It is also illustrated in many studies that non-anxious patients make low predictions of the degree of discomfort they will feel during dental treatment, whereas anxious patients always make overpredictions and tend to expect more discomfort than they are likely to experience. For example, Wardle (1984) reported a significant relationship between a five point rating scale representing anxiety experienced during the injection, and extraction and a similar scale which represented the severity of pain which could be expected. The scores on the two scales were positively correlated, the fearful patients expected their treatment to be painful while fearless patients expected little pain.

In the similar studies, Kent (1984, 1990) indicated that memory for dental pain is reconstructed over time. The author had anxious and non-anxious dental patients rate their expected pain, their experienced pain and, 3 months later, their remembered pain. In general, Kent found that for high anxious patients there was a higher association between remembered pain and expected pain than there was between remembered pain and pain actually experienced. Prior to the dental treatment, highly anxious patients tended to overestimate the pain they would feel, and tended to overestimate the pain when asked to recall it later.

Such results have led to the question of whether children would expect and overestimate their pain prior to dental treatment as adults do. Although Prins (1985) found that the focus of a child's dental anxiety was nearly always pain from dental procedures, as reported by the child, there is not much research on the relationship between dental anxiety and expectations of pain, as with adults. One explanation of this could be dentists' fear that asking a child-patient about expected pain may enhance discomfort by labelling sensations as painful (Leventhal *et al.*, 1979).

In one of few efforts concentrating on pain and child's dental anxiety, Humphris *et al.* (1991) conducted an experiment in 58 children aged 7 to 16 years. The investigators reported the result, consistent with studies of adults, that children expected more discomfort than they actually experienced. However this finding was confined only to uncooperative children.

A similar type of study was conducted by Carlsen and colleagues (1993), but with the samples of routine child patients (n = 195). However, this effect (i.e. routine patients as opposed to uncooperative children) did not make a difference in the result, which was found to be consistent with Humphris *et al.* (1991) study. Also, this investigation demonstrated that there was no influence of pre-treatment questions of anxiety and pain on the child's subsequent discomfort. In the tasks described so far, it appears that the anticipatory pain and effective pain are very closely identified in the minds of children.

An alternative approach has been made to examine the effects of children's memories of painful experiences on their anxiety. Huq and colleagues (1992) found that memories of pain had less influence on children's than on adults' dental anxiety. In other words, although children's expectation of pain, regardless of their previous memory of pain, can influence anxiety regarding an unpleasant event during dental treatment, it may not lessen their ability to cope with a painful experience. However, it could be argued that it is the impact of anxiety which affects children's recall of dental events.

The findings from the study by Vandermaas and her colleagues (1993), investigating the effects of stress on a child's report of memory for dental procedure, showed that a child's age, experience and level of anxiety played a role. When memory was assessed immediately after either the check-up or operative procedure, it was found that the memory performance of older children (7-8 years) declined at higher levels of anxiety, while the performance of younger children (4-5 years) remained approximately the same regardless of anxiety level. All children in this study had had at least one prior visit to the dentist and the finding indicated that experience with the dentist mediated the effects of anxiety and age on recall.

In summary, the literature review has shown that there is a positive association of pain expectations with the evaluation of dental experiences in children. Also, the situational dental anxiety appears to play a role in the pain experience, but does not contribute greatly to the evaluation of the dental experience, which is primarily determined by the contributions of children's pain expectations and the pain experienced. As commented earlier, research on expectation of discomfort in children receiving dental treatment is scarce. These sources provided only limited information about children's experiences and pain expectations.

Clearly, more research is required of the patterns of child's responses, particularly longitudinal trials and trials with specific painful dental procedures to see if the patterns are stable. However, in the child's case, other very significant influences on eventual dental stress will probably be those concerning family. Among these influences are socioeconomic backgrounds and parents. What is needed, therefore, is a greater understanding of how such family functioning becomes the focal part of anxiety research in children.

2.3.1.c Socioeconomic factors

Common sense has it that description of the socioeconomic environment is sometimes essential for an understanding of child's behaviour functioning. For example, the socioeconomic status may reveal acting out of disturbed relationships between parents, as well as between parents and children. Downward social mobility may produce insecurity feelings which are compensated for by a heightened striving for gratification in a marital partner or a child. This home background can have either a positive or a negative emotional impact on the child, and the teaching of values, methods of discipline and child-rearing practices may accurately be reflected in the child's behaviour. However the analysis presented up to this point has presented contradictory results.

A study by Wright and Alpern (1971) which tried to test whether there was any relationship between socioeconomic status and the child's behaviour, showed that the better behaved children were of the upper socioeconomic group. This finding was confirmed by many studies (Shuval 1970; Hawley *et al.*, 1974; Perrin *et al.*, 1993). However Frankl *et al.* (1962), Winer (1982), Bedi *et al.*, (1992) and Corkey & Freeman (1994) reported no difference in pattern of anxiety and adaptive behaviour in children linked to social class. If the association between family background and child's dental anxiety is not clear, parental role will probably become meaningful and relevant data for clinical study, rather than routine information which may never be used. Apart from its contribution to a better understanding of parent-child relationship, such data will elucidate the effect of parental influences on the child's behaviour, attitude and ability to cope with dental situations.

2.3.1.d. Parental influences

Family psychological resources are often cited as major determinants of the child's emotional health and adaptation to life stress (Perrin *et al.*, 1993). However, it has been difficult to integrate the various concepts regarding parental influences which have been formulated by many hypotheses. From a practical point of view, the parent is the central unit which can illustrate the interaction of specific psychological influence between parent and child in the stressful situation. Therefore, information about the parent which has been gathered as a result of the combined efforts of interdisciplinary professional work is worthy of careful exploration for the improvement of theory and dental practice.

The purpose of this section is to support the point that the understanding of a child's behaviour within the context of the family system is a prerequisite for enhancing coping responses during dental procedures. However, parental factors have been studied through many approaches; the organisation of the data and current functioning have varied. It is, therefore, important to formulate a pattern for selecting such data for inclusion in our study. The following review will deal first with the relationship between children's fear of dentistry and their parents' attitude towards dental care which has been reported in many studies (Johnson & Baldwin, 1969; Bailey *et al.*, 1973; Shaw, 1975; Veerkamp *et al.*, 1994).

Not all children who report being highly dentally anxious can report a negative previous experience (Lindsay, 1984; Davey, 1989). This suggests that other factors also play a part. As for the environmental contribution to child dental fear, a recent study by Milgrom *et al.* (1995) has found direct conditioning and modelling to be independent predictors. In other words, the parent is a very important source of modelling during childhood (Long *et al.*, 1994). It seems that the anxious parents act as a model, displaying a kind of treatment they expect from a visit to a dentist (Kent & Blinkhorn, 1991).

The special place that parents hold in a child's dental anxiety is illustrated by several studies. Holst *et al.* (1988), for example, in a study of 101 children aged 3 to 16 years, investigated prediction of behavioural problems. The authors reported that parents who expressed their negative attitudes toward dentistry could cause their young children to have problems in this area. However, Holst and colleagues did not specify the details of fear levels in parents.

In the recent study, Klingberg and Berggren (1992) investigated 99 children, aged 3 to 18 years, who had severely fearful parents with long standing (average 16 years) avoidance of dental care. The results of this study were found to support the relationship between dental fear in parents and their children. Furthermore, behavioural problems occurred in 45% of the children with a high frequency of missed or cancelled appointments, and also high DMFT scores. However, this retrospective study was performed on dental records and the relatively small size of the sample in each age group made the results less relevant than it should be.

Parental anxiety has been suggested as a contributor to children's anxiety (Greenbaum *et al.*, 1988), and mothers are claimed especially to leave their mark as they were found to have more influence on the child (Milgrom *et al.*, 1994). Several studies indicated that mothers with high levels of dental anxiety had a negative influence on their children's behaviour in dental situations (Wright & Alpern, 1971; Bailey *et al.*, 1973; Wright *et al.*, 1973; Sexton *et al.*, 1993; Peretz & Zadik, 1994). Johnson and Baldwin (1969) found that children with mothers who reported being high on a measure of anxiety were more likely to exhibit negative behaviours during dental treatment. Mothers of anxious children were themselves more likely to be dentally anxious (Shaw, 1975).

A question may be raised at this point: why does a mother have such an influence on her child? One of the explanations that can be offered is because of her important role in detecting a problem and communicating to the dentist the child's symptoms which may lead to the need for treatment, preparing the child and helping in the adjustment to a dental procedure. Moreover, the mother interacts with the family in terms of her anxiety and knowledge of the child's coping ability (Melamed, 1992).

Coping skills in children refer to their ability to voluntarily ameliorate stressors. These skills employed by child-patients in stressful situations such as dentistry include distraction, emotional focus, information seeking, reattribution, and relaxation. Coping responses, in particular, appear to be influenced by preexisting emotional state, especially anxiety (Miller *et al.*, 1992).

In order to gain a more complete picture of child's dental anxiety, it is also important to give due consideration to the mother-child relationship which may influence the child both specifically and generally. Unfortunately, little is known about the relationship between coping styles of mothers and their children in stressful situations. During such an event, children may initiate active and purposeful efforts on their own to cope with the requirements of the situation and with their own emotional reactions to the treatments (Curry *et al.*, 1988).

In addition to drawing on the literature review on maternal influence on children's coping styles, there are other studies which provided data correlating maternal anxiety and actions in the face of medical and dental stressors with the child's anxiety. These studies, where anxiety was the central focus, showed a tendency for concordance in incidence of anxiety in families. For example, in the studies on children's responses to dental stress, Venham and his colleagues (1979a, 1979b) found that insecure and unsatisfied mothers more often had children who posed management problems. In other words, the child's anxiety increased and cooperative behaviour decreased when the mother's anxiety was high, whereas the child's anxiety decreased and cooperative behaviour increased when the mother's anxiety was low.

In order to understand more about maternal-child interaction and her influences on the child's anxiety and coping behaviour, Bush *et al.* (1986) observed mothers and children aged 4 to 10 in the waiting room. The results showed that maternal use of information provision in response to questions was associated with less distressed behaviour and more positive coping in children than mothers' use of emotion-focused behaviours of agitation and ignoring. Consistency between information providing or information avoiding (distraction) and the child's coping style was found to be the significant factor in the child's adjustment to stressful situations (Greenbaum *et al.*, 1988).

The study by Pistone (1989) investigated the influence of the mother's interaction with the child (4-10 year-old) on her child's distress by evaluating the use of maternal coping strategies during venipuncture and the surgeon's examination. The result of this study also supported the above result that mothers who used active, problem-focused behaviours, as opposed to reactive, emotion-focused behaviours, had children who were less distressed and showed positive coping behaviours. Furthermore, maternal self-reported trait anxiety during the waiting period related significantly to her exhibiting agitation. Her state anxiety was also predictive of child's distress during the venipuncture. It indicated that mothers who were anxious had children who were anxious in response to a medical procedure. However, it was found that older children's behaviours associated less with the mothers' behaviour than those of younger children. These reciprocal interactions between the mother and her child established the child's abilities to cope effectively with the stressor. Some mothers might display disorganised behaviour at times of stress which led their children to develop anxiety rather than adequate coping skills (Melamed, 1992).

In the study of maternal influences on children's adjustment to a medical condition (Perrin *et al.*, 1993), maternal beliefs about the locus of control of her health had been suggested as contributors to 7-18 year-old children's abilities to cope with the experience of their illness. Maternal attitudes and children's intelligence appeared to interact together with the specific nature of the child's medical condition to strengthen or weaken the child's adjustment. Those mothers who were high on self-rated health locus of control, tended to rate more intelligent children as better adjusted. However, the study by Perrin *et al.* (1993) included a larger number of children (n = 187) with several variations of health conditions which might verify the findings or detect other more subtle effects. As intelligence seems to be an important background variable for the child's coping ability, it will be discussed further in section 2.3.2.a.

These correlations between parent's and child's anxiety in the stressful situations have persuaded some health professionals (i.e. doctors, dentists) to exclude parents from the operatory, except with very young children, in an effort to reduce the child's possible disruptive behaviour (Kamp, 1992). However, prior studies of the effect of the mother's presence have produced contradictory results, both increasing and decreasing the child's distress. Many studies indicated a positive influence of the parent by increasing the cooperative coping behaviour of the child in an unfamiliar environment (Frankl *et al.*, 1962; Melamed, 1993; Hannallah, 1994; Vassey *et al.*, 1994). As many as sixty-six percent of the parents who wanted to be present with their children for dental care, felt their presence would make the children feel better about their care (Kamp, 1992). Frankl *et al.* (1962) investigated the effect of the mother's presence on the cooperative behaviour of the child-patient during examination and subsequent treatment visits. The result showed a significant increase in cooperative behaviour for children 41-49 months of age when the mother was present in comparison with parental absence group.

Some studies concluded that parents' presence during treatment, however, was not always beneficial (Bevan *et al.*, 1990; Pinkham, 1991). It was suggested that mother's presence might reinforce the child's overt expression of fear. The work by Shaw and Routh (1982) has done much to emphasise the importance of maternal-child interaction with particular emphasis on the differences in development of the children, as judged by their responses during the vaccination procedure. The main findings of this study were that children, of both 18-month-old and 5-year-old groups, had the most disruptive behaviour during the injections with their mothers' presence. In other words, the presence of the mother disinhibited the expression of whatever emotional arousal the child was experiencing. In fact, they suggested that the mother's presence in the doctor's treatment room during the injection procedure led to more intense and longer lasting crying in young children, particularly under the age of five, than older children. This behaviour was described as a form of protest, since the children believed that the parents would emit comforting responses at the sign of their distress.

Venham *et al.* (1977) and Fenlon (1993) found no difference in behaviour between children treated with parents' presence and treated without parents, when Venham allowed the parent or child to make the decision concerning separation for dental procedures. It was found that initially, the parent and child preferred not to be separated, but over the course of treatment, more separation voluntarily occurred. There was increasing evidence that coping styles of mother and child might influence the effects of the mother's presence on the child's response to stressful events. Koplik *et al.*, (1992) found that the mother's presence or absence alone did not account for differences in the child's response (aged 6-12) to dental stress. Children with monitor coping styles were more disruptive than children with blunter coping styles in the mother present situation. A main effect of mother pressure was also found. Children in the 'mother present' condition were found to be more cooperative than children in the mother absent condition. It was suggested that the mother's presence had a small beneficial influence on some children's anxiety and cooperative behaviours in the dental setting. However, the different dependent measures employed in this study may have been tapping different aspects of anxiety and cooperative behaviour in children. A variety of measures of anxiety and cooperative behaviour, used in this study, which are not highly correlated with one another may result in contradictory findings with other studies. Furthermore, this study did not report the child's response to a particular dental procedure as the majority of children (88%) either received polishing, sealant or simple filling and the remainder received local anaesthetic.

Taking all of these sources of information together, then, it appears that the parental influences we are interested in here are actually quite complex, particularly maternal influences. They compose a child's core of modelling, coping and situation-specific anxiety. However, some studies illustrated a contradiction. For example, in an attempt to isolate the variables most closely associated with dental anxiety in children, aged 6-18 years, Alwin *et al.* (1991) reported little connection between parent's and child's dental anxiety which implied that children did not learn their fear of dentistry from parents. The child's self-report of general anxiety on the Child Manifest Anxiety Scale was not different between cooperative and non-cooperative children which suggested that dental anxiety was a specific reaction to a certain environment. This finding supported the study by Humphris (1990) who showed little to no relationship between child's and mother's dental anxiety. From the result of 418 children aged 9 and 15 years, the correlation coefficient between mother and child dental attitudes was 0.08 ($p > 0.05$). Also a study by Holst *et al.* (1993) could not find any correlation between maternal anxiety and negative reaction of the 3-year-old child in the dental situation.

In summary, these varying reports will help dentists to understand the complex influences of maternal or parental anxiety on children. It remains unclear what specific parenting behaviour enhances children's responses to dental stress, how situation and child-specific these effective parenting behaviours are, and how their reaction is related to parental anxiety and other variables. Nevertheless, a further study of children's coping styles is needed, with evaluation of interactions between parents and children to help predict elements of successful or turbulent adjustment in children and to reduce child's anxiety.

Despite the fact that much research gives weight to "parental influences" as an aetiological factor in children's dental fear, we should not ignore the importance of dental conditions which can affect the child-patient directly. Many studies have agreed that one of these effects can be traced directly to the dentist (Kunzelmann & Dunninger, 1990; Lahti *et al.*, 1992). Therefore, the present investigator will discuss and attempt to identify problems with child's anxiety which are related to the dentist in the following review.

2.3.1.e. Dentist's behaviours

The dental encounter is very much an interaction of the patient with the dentist. An important aspect of the dental situation, therefore, is the set of demands and contingencies on behaviour that are external to the patient, applied by the dentist. In short, the influence of dentist's behaviour on the situational aspect of dental treatment has become the focal attention in many studies with adults. For example, in an early study, Kleinknecht *et al.* (1973) found that, when recollecting childhood experiences, young adults attributed a negative reaction to dentistry to personal dislike of the dentist and a positive reaction to personal liking for the dentist. Some of them (11.5%) believed that the dentist's behaviour and personality had caused their fear and their negative attitudes towards dentistry.

When Corah and colleagues (1985) investigated the relationship between dentist's behaviours and patient's satisfaction and anxiety, they reported that a warm and personal manner was related to the patient's satisfaction but not related to patient's anxiety during dental treatment. On the other hand, Rouse and Hamilton (1990), in a study of 236 undergraduates, reported that perceptions of technical competence and defined behaviour were the most significant predictors of anxiety and relaxation in patients.

In the studies reviewed so far, dental anxiety has far-reaching implications on practitioners and researchers; surprisingly, little is known about the direct influence of the dentist's behaviour on either facilitation or reduction of a child's fear. Moreover, not many studies have attempted to determine whether there is an underlying construct fundamental to the dentist's perception. Studies evaluating the effect of the dentist's behaviour on the child's behaviour have either observed occurring dentist-child patient interactions (Greenbaum *et al.*, 1993) or experimentally manipulated dentist's behaviours (Reyes, 1993). Weinstein and colleagues (1982a, 1982b), in a study of interaction between dentist and children, aged 3-to 5-years, in routine dental visits, examined the possibility that children would respond with fear-related behaviour dependent on various dentist's behaviours. The authors found that non-directed (random) talk from the dentist to the child-patient led to increased anxiety and more fear-related behaviour. The interpretation of this result was that the dentist was interfering with the child's coping ability with dental treatment. On the other hand, empathic behaviour on the part of the dentist (i.e. asking the child how he/she was feeling) had a good impact on the child's behaviour. Also, guidance behaviour from the dentist, in the form of systematically shaping and reinforcing appropriate child's behaviour in the dental situation, showed good outcomes, whereas explanation of rules, coercion and coaxing did not.

In addition, many researchers (Prins *et al.*, 1987; Alwin *et al.*, 1991; Veerkamp *et al.*, 1995) reported that dentists more frequently responded to high-anxious children and allowed them to express their fear by empathising more and attempting less treatment than with low-anxious children. This may imply that the specific effects of treating a child and a child's anxiety may have influence on the behaviour of a dentist (Lindsay & Roberts, 1980). Finding effective ways to reduce fear and manage disruptive behaviour in children have been a common concern for dentists and many management strategies have been suggested (Brown & Smith, 1979; Fields, 1986; Ridley-Johnson & Melamed, 1986; Holst, 1988; Holst & Ek, 1988; Greenbaum *et al.*, 1990; Klein, 1991; Slovin & Shakin, 1992; Festa *et al.*, 1993; Houpt, 1993; Pinkham, 1993).

Among the most prevalent responses placed on children's disruptive behaviour by dentists are aversive, such as loud voice commands. Ridley-Johnson and Melamed (1986) suggested that for punishment technique (i.e. voice control) to be an effective modifier of a child's behaviour, it had to be applied with predictable regularity. The authors concluded, in addition, that application of this technique might lead to negative emotional arousal and in fact cause an increase of dental anxiety. However, the long-term effects, such as increased disruption and avoidance, were not investigated in this study.

In a study of the efficacy of methods to reduce children's disruptive behaviours, Greenbaum and colleagues (1990) compared loud versus normal voice commands technique on children aged 3.5 to 7 years undergoing restorative treatment. Surprisingly, it was reported that disruptive children who received loud voice commands tended to self-report more pleasure and less arousal when compared to those who received normal voice commands. Moreover, increased fear or negative effect was not observed among loud-voice patients. These findings contradict widespread expectation that undesirable emotional side effects accompany punishment. It is not clear, however, whether any lasting negative results would proceed from the use of punishment for disruptive behaviour, or what effect punishment would have on child's perception of dental procedures.

The voiced control technique, as described above, is indicated for children with behavioural management problems. Furthermore, for the most part, this method applies to the treatment of disruptive behaviour, not the child's dental fear. However, the application of basic techniques, such as reassuring touch and request and reinforcement, have been advocated as well. Greenbaum *et al.* (1993) conducted an investigation in 38 children, aged 3.5 to 10 years. The authors reported less fearful behaviour in children (i.e. repetitive hand or leg, foot movement, inappropriate mouth closing which prevent dentist from continuing treatment) when they applied physical contact (i.e. patting, stroking). Although the investigators assessed the child's situational emotion, they did not report on fear of dental treatment. The combined effectiveness of request and reinforcement has also been reported by Pinkham (1993). The author found that the limited cognitive abilities of young children, particularly under three years of age, made it difficult for them to respond to the expectations of dentists. Making a request of the child therefore reduced the need for learning and the dentist's additional use of reward and punishment provided maximal communication about both cooperative and uncooperative behaviours.

In the recent study of dentists' behaviour by Alwin and colleagues (1994), the authors reported that aspects of dental behaviour such as vocalization, direction and empathy were all significantly related to children's dental anxiety, as this data was presented on the Venham Picture Scale and the subscales of the Weinstein Dentist Behaviour Scale. It was suggested that a dentist's behaviour which altered when treating fearful children, aged 6 to 18 years, could affect a child's perception of dentistry.

In summary, these studies of the dentist-child relationship have revealed the vital role that interpersonal communication plays in child's dental anxiety. It is proposed here that the role of dentist should be neutral, and entail minimal anxiety arousal in children. Therefore, it is important to bear in mind that the effective and selective use of dentist's behaviour will be greatly enhanced if he/she can extend the usefulness of this basic information to the highly complex reactions of children in the dental situation.

Whatever the underlying mechanism between dentist and child interaction may be, another interesting aspect of any dental situation lies in the nature of dental treatment. An awareness and consideration of this aspect will help us to increase clarity into the development of children's dental anxiety which has been reported to be linked with this factor. The following review will focus on this relationship.

2.3.1.f. Types of dental treatment

Representative findings of relevant research and clinical studies have been previously reviewed to facilitate our view on the construction of children's dental anxiety. The present author will now turn to the studies of dental procedure variations in order to illustrate which dental situations are associated with anxiety. Once again, the reader is reminded that this review is limited to the sources of retrospective data, particularly with children. However, the present author wishes to review some specific areas which were covered and to discuss the implications of the findings for the potential usefulness of such data in the dental practice.

Many investigations have concentrated on the consequences of intensity of pain caused by dental procedures which suggested that pain is probably the most important of the sensory components of dental anxiety (Lautch, 1971; Wardle, 1982; Scott *et al.*, 1984). Despite the technological advances in dentistry, there have still been reports of procedural pain from patients. For example, in the recent study of pain associated with dental treatment, Vassend (1993) found that large proportions of the adult respondents (n = 3670) described dental treatment to be associated with pain. It was shown that 30% of the adults rated their last dental treatment as moderately painful, about 60% reported having at least one very painful experience and 6% experienced dental treatment in general to be very painful. Surprisingly, there were no differences between the young age group (15-19 years) and the rest of the study group regarding dental pain ratings. However, the authors did not report on which dental procedure was associated with most anxiety.

It has been illustrated in many studies that some dental procedures are more anxiety provoking than others (Kleinknecht *et al.*, 1973; Kent, 1984). For example, when Wardle (1982) asked adult patients to rate how anxious they would feel if they had to undergo each of a list of procedures, the author found that patients rated their anxiety to be highest when they were asked about extraction.

Surprisingly, there are few studies on the relationship between children's dental anxiety and the type of dental treatment. In one of the first studies examining dental fear in children, Eichenbaum and Dunn (1971) used the projective drawings in children for better understanding of dental anxiety. The authors reported that the greatest fear of dental treatment in children was the fear of the needle, especially with children who had had a prior traumatic dental experiences. This finding was also supported by Venham and Quatrocelli (1977) who studied children's responses to dental procedures and found oral injections resulted in a negative response from the child; on the other hand the unstressful procedures such as the mirror and explorer examination desensitized the child's fear. In the study on the relationship between children's disruptive behaviour during dental treatment and report of pain, Rowland *et al.* (1989) reported a significant association between facial expression of pain in children aged 6-to 12-years and disruptive behaviours during injection and drilling.

A few other studies also found that oral injection and drilling of teeth were anxiety eliciting stimuli in children (Holst *et al.*, 1988; Alvesalo *et al.*, 1993). Regrettably, these investigators did not ask children to rate their anxiety on extraction procedure. It is proposed here that their reluctance of doing this was based on the belief that making enquiries about extraction might arouse children's anxiety.

Although some types of dental procedures appear to cause an increase in children's anxiety, there is evidence that the dental environment is also an area of children's stress (Swallow *et al.*, 1975). For example, it has been suggested that infection-control barriers can influence anxiety and behaviours in children. Therefore, the recent study evaluating the use of masks in the dental operating and anxiety behaviours in children aged 3 to 6 years was based on the prediction that wearing of masks by dentists might contribute to the fear in young children (Siegel *et al.*, 1992). The investigators expected the preschool age-group to be at risk for reacting disruptively to the use of such procedures because of their level of cognitive development and limited conceptual understanding of the purpose for such unfamiliar techniques. It was found that wearing a mask during dental treatment tended to be a minimal stressor for the young child with previous dental experience. On the other hand the child with no previous experience tended to be more anxious (as demonstrated by increased heart rate) when in the mask condition as compared to the no-mask condition.

In the tasks described so far, children could easily become anxious after they received dental treatment. However, it is difficult to know whether interference or attention arising from dentist's awareness of this implication is involved. For reasons to be discussed below, the present investigator believes that anxiety may occur in children during treatment without the dentist being aware of this.

While the dental literature recognizes the subjective nature of pain; inadequate pain control for dental care, at least for adults, appears to be relatively commonplace (Kent, 1984; Baron *et al.*, 1990). The perception of pain experienced by children is believed to be uncertain and dentists often hold misconceptions about children's pain and tend to underestimate it (Milgrom *et al.*, 1994). Such procedural pain is often exacerbated by anxiety and by a perceived lack of control within the clinical setting. A recent study by Milgrom *et al.* (1994) found that ten percent of dentists regularly denied pain expressed by a child and many did not believe dental care was particularly painful but only unpleasant. The consistent finding from the study by Murtomaa *et al.* (1996) was the negative relationship between the dentist's pain management behaviour and their perceptions of the pain experienced by the child-patient during treatment. Nearly 25% of dentists in the study believed that children confused pressure and dental pain, and more than half of the dentists (n = 428) did not think that children's pain reports were credible.

Before reviewing pain research on children, the present investigator will consider the questions that arise from the Wardle(1982) results. Why are patients most anxious about having tooth extraction? Is that because of fear of pain during treatment; or because of fear of pain after extraction? It could be objected that there is no need to be anxious about procedural pain because either local anaesthetic or general anaesthetic will be administered. It seems that the answer lies on post-extraction pain which may be an important clue to patient's fear. Therefore, this idea has led us to another question; does the fear of post-extraction pain exist despite possibility of taking analgesics? If it does, it may not be much of a problem to adult-patients since they can state their pain and ask for pain control. However, children behave differently to adults (Lander *et al.*, 1992). They lack not only experience but also knowledge of extraction, which is why they can respond differently compared to adults.

Little is known of how much pain children expect after their tooth extractions or what leads them to verbalize their pain and request pain relief. The possible explanation may be that it is difficult to obtain information about a procedure such as extraction, of which not many children have had experience. This information can be obtained by asking the children to describe in a standard manner before or immediately following treatment, the sensations which they had undergone. However, post-operative interview cannot be done easily, particularly when the child received extraction under general anaesthesia.

Most research on postoperative pain therapy has concentrated on adult patients (Owen *et al.*, 1990; Moote, 1994); longstanding misconceptions surround the traditional approach to postoperative analgesia in children. The myths persist that (1) children do not feel as much as adults, (2) children do not remember pain, (3) children may become drug addicts, (4) drugs are not safe for children, and (5) children who do not act as if they are in pain are not in pain (Pounder & Steward, 1992; Forward *et al.*, 1993). It was obvious that some children did not know what was available for them as some had not had extractions before; the whole experience of postoperative pain was a new experience. Children would appear to distract their feelings of pain and discomfort by reading a book or focusing on other forms of escape, such as television. Therefore, they could appear to be pain-free when upon direct questioning they would confess pain (Mather & Mackie, 1983).

Not many research projects have investigated how postoperative pain following extraction affects the child's anxiety. It has been suggested that disruptive behaviour in children can be evidence of discomfort and need not be evidence of fear. Sometimes it is difficult to evaluate with children because some of them seem to conceal their feelings by becoming withdrawn when suffering from pain. A child would rarely ask for medication for pain relief because the child would think he or she had to put up with pain (Maher & Mackie, 1983). In some children the experience of postoperative pain was a new experience and they did not know how to cope with pain. In conclusion, children do suffer pain but seem reluctant to show it. It is relevant to focus educational efforts on contemporary theories of anxiety and pain, to improve dentists' skills in behavioural aspects of anxiety and pain management, and to create a new standard for dental pain management in children.

Bringing all the material together, it appears that the nature of dental procedure that we are interested in is more than simply the effective state of dental instruments. It gives rise, however, to the proposal of causal relationships between the influence of dental treatment on a child's sense of pain and the development of anxiety. In short, "the pain-free technique" may be the most important part of dental procedures for children, in part due to the analgesic effect (from local anaesthetic or general anaesthesia).

The general dental practitioner in the U.K. relies largely on general anaesthesia when treating very young children. Poor cooperation, young age and multiple extractions are the main reasons for its use. Over the last 30 years, changes in dental anaesthetic practice have been developing, partly as a result of the increasingly sophisticated requirements of dentists, and partly as a consequence of the introduction of new anaesthetic agents and techniques (Burns *et al.*, 1992). With the improvements in anaesthetic standards, more attention has been concentrated on the psychological effects of anaesthesia on post-operative behaviour in children and influencing variables (Morgan *et al.*, 1981; Meursing, 1989; Phinainitisatra, 1993).

The proceeding review, therefore, concerns itself with the brief discussion on general anaesthesia based on various sources of information. The emphasis in that presentation is different theoretical orientations and methods of evaluation. To this end, related subjects, such as anaesthetic agents, will be brought into sharp focus. Finally, the comparison between inhalational agents will emphasize their differences in the complexity of anaesthetic procedure. The implications of such differences for general anaesthesia in children will be further discussed.

(a) *General Anaesthesia*

The word "anaesthesia" means absence of sensation and general anaesthesia therefore implies unconsciousness. General anaesthetics include any agents capable of producing total insensibility in a reversible manner. It is convenient to consider the anaesthetic state as consisting of a triad of sleep, analgesia and controlled muscular relaxation. Different patients undergoing different surgical procedures will require different anaesthetic agents for different degrees of analgesia (Vickers *et al.*, 1978).

Although adults have shown high levels of satisfaction with general anaesthesia (Whitty *et al.*, 1996), comparable studies with children have not been reported. In the recent study by Shaw *et al.* (1996), the authors reported that 79% of those parents who had previous experience with general anaesthesia with either the child, another sibling or personally, showed less satisfaction with general anaesthesia compared to inhalation sedation. While some parents still express concern about the child's failing to wake up or developing permanent central nervous system dysfunction after anaesthesia, some parents prefer general anaesthesia because they think it is less anxiety provoking for children and takes less time (Vessey *et al.*, 1994). Murray (1993) reported that 35 children died while receiving dental treatment under general anaesthesia between 1970 and 1990, with 40% of these deaths occurring within the hospital. The increasing awareness of the mortality associated with dental anaesthesia has led to the use of alternative inhalational sedation. A question that can be raised to the use of general anaesthesia in dentistry is: why do we still provide this procedure?

It has been illustrated in many studies that general anaesthesia has become the treatment of choice for many children who are too disruptive or too young to have tooth extraction under local anaesthetic (Kemp & Broadway, 1986; Smallridge *et al.*, 1990). For example, Shaw *et al.* (1996) conducted a study to assess the viability of operating a regular inhalation sedation treatment for extractions in children aged 4 to 17 years. Treatment was successfully completed for 120 of 133 children and the remaining 13 were treated under general anaesthesia. It was reported that general anaesthesia was still required for extractions to relieve pain because not all children were cooperative enough to accept inhalational sedation.

While much effort has been spent in the provision of post-anaesthetic care on children, not enough attention has been paid to the problem of post-extraction pain. One explanation which can be offered to this is many physicians do not believe that there is post-extraction pain, since analgesia effect is the major characteristic of general anaesthesia. Nevertheless, in one of few studies examining pain and extraction, Acs and Moore (1984), investigated pain and analgesic consumption in children following dental extractions. The authors showed that 38% of 221 children (mean age = 9.1 years) reported post-operative pain which was associated with surgical trauma and with extractions carried out in both dental arches. However, there was no report as to whether the teeth were extracted under local or general anaesthesia.

Fung *et al.* (1993) revisited this area again and studied the post-operative pain reports in children after extraction under general anaesthesia. Pain was reported by children immediately following the treatment. The influencing factors were the age of the child and distress, although the results did not reach statistical significance. The most significant factor influencing post-operative pain was the relationship of the accompanying adult to the child: the pain report was greater when the mother was present. It is interesting to note that more children reported severe anxiety after treatment than before.

The study just presented makes it appear that the administration of general anaesthesia in the dental setting has produced unsatisfactory results, leading to the persistence of post-extraction pain and possibly post-operative anxiety. It has been suggested that the psychological effects of anaesthesia on children is another important aspect, because children are different from adults in many physical, developmental and psychological aspects which make it a questionable assumption that a child's behaviour will be affected by anaesthesia in the same way as an adult's behaviour (Morgan *et al.*, 1981; Ullyot, 1992; Goresky & Whitsett, 1994). Their lack of knowledge about and experience with general anaesthesia could result in different responses compared to adults. In reviewing the literature, the following stressors were identified: separation from the parent during procedure, a fear of loss of control, having to interact with strangers, expectation of painful treatment and fear of anaesthesia induction or loss of consciousness (Melamed & Siegel, 1985; Melamed, 1992; Miller *et al.*, 1992; Melamed, 1993).

Although most studies on general anaesthesia in children have focused on whether children had received post-major operative analgesia (Hannallah, 1992; Pounder & Steward, 1992; Carpenter *et al.*, 1993; Lansdown, 1994) and/or had suffered any anaesthetic complications (Morgan *et al.*, 1981; Johannesson *et al.*, 1995; Epstein *et al.*, 1995), some studies have reported that general anaesthesia has a psychological impact on children. For example, in a retrospective study of behavioural consequences of anaesthetic procedure, Meyers and Muravchick (1977) examined 85 children who were premedicated before elective surgery for head and neck. The authors reported that children who were asleep before anaesthetic induction had fewer post-operative behavioural problems than awake children did. However, they did not describe the nature of awake inductions, other than to comment that some of those awake children were frightened and screaming in the operating room. Also, no assessment of child's anxiety was made. The similar result was also reported by Beeby and Morgan-Hughes (1980), in a study of 373 children's responses to anaesthetic induction. The authors reported that 63 children, aged 2 to 9 years became disruptive in the anaesthetic room although they had been orally sedated.

The recent study which addressed specifically the question of the presurgical anxiety effects on children was published by Lumley and colleagues in 1993. The investigators addressed the issue to determine the child's reaction to anaesthesia induction in children aged 4 to 10 years. The prediction was based on the child's age, quantity and quality of previous medical experience, and how maternal response could influence this behaviour. It was reported that young children, with medical experience and/or prior surgery and showing presurgical distress, expressed more negative stress reactions. The quality of previous experience was the single variable accounting for the variance. However, the results relied largely on reports from the mother and from the experimenter. The study, although limited to 50 children having elective ENT surgery requiring general anaesthesia, also suggests that increased discussion on the effect of general anaesthesia on child's anxiety is needed.

However, these works have been conducted in which the change of child's anxiety was evaluated with respect to medical settings. Furthermore, some children had been premedicated to improve their cooperation with general anaesthesia. Perhaps nowhere is the relation between anaesthetic procedure and anxiety more easily seen in clinical situations than it is in dentistry. It appears that dental extraction provides an ideal venue in which to study the effect of general anaesthesia on a child's anxiety without any influence of preoperative medication. Also, dental extraction is of a predictable and short length of time, performed with well-established and practised procedure which increases the safety of anaesthetic procedure; yet the relationship between the psychological effects of anaesthetic induction and children's change in dental anxiety has been illustrated in very few studies. For example, Burns *et al.* (1992) found that only 60% of children, with an average age of 5 years, were reasonably cooperative in the operating theatre when they were presented with dental emergencies requiring tooth extraction under general anaesthesia. In other words, the children did not know that they had to undergo anaesthetic procedure. However, this study concentrated only on the evaluation of children's behaviour before they were made unconscious and not on their post-operative behaviour and anxiety. For those young children suffering from toothache for which the inevitable solution is tooth extraction under general anaesthesia, the nature of the anaesthesia can influence preoperative anxiety and postoperative behaviour (Meursing, 1989). Therefore, it is imperative to enquire about events immediately preceding the current procedure and after the treatment.

The special place that general anaesthesia holds in children's dental anxiety is illustrated by the study by Phinainitisatra (1993) which looked at the overlap of anaesthetic procedure, post-extraction pain, parental anxiety and child's anxiety reports. The investigator examined 104 children, aged 6 to 15 years, who had been appointed to have tooth extraction under general anaesthesia. The self-report of the child's dental anxiety (from the Modified Children's Dental Anxiety Scale (Humphris *et al.*, 1991)) demonstrated significant change in his/her anxiety on general anaesthesia procedure where the child reported being more anxious than before this treatment ($t = 2.66$, $p < 0.05$). However, no significant change in anxiety was reported on other dental procedures (i.e. examination, scale and polish, injection, filling and extraction). Surprisingly, the children tended to be less anxious if they were given analgesics at home. The degree of reduction in the child's dental anxiety was related to frequency of analgesics given to the child at home by parents. This study apparently provides support for the importance of both anaesthetic procedure and post-extraction pain. This is a little troubling because the author did not find an association between parental and the child's anxiety before and after treatment, while Acs & Moore (1984) and Fung *et al.* (1993) did report parental influence on the child. The explanation which can be offered to this may have to do with the wide range of samples' age. In other words, parental anxiety may have an influence on young children's responses, but not on the older children's.

The studies presented have generated results suggesting that psychological preparation may make it possible to ensure that children experience an acceptable level of stress in the face of extraction under general anaesthesia. They also give the implication of key components in operative preparation, the keys are coping strategies and information. These subjects will be explored later in part 2.3.3.a and part 2.3.3.b respectively. It is evident that the limitation of this review is the absence of prospective children's report in most of the studies. Therefore, a stage is set for more pre-operative work which should seek to investigate more about children undergoing extraction under general anaesthesia, and also to characterize the value of psychological preparation. Further discussion on the relative factors which influence children's dental anxiety is needed.

In summary, the previous discussion of the nature of dental anxiety has focused on the idea that perhaps a multifactorial aetiology is the key to understanding dental distress and plays a basic role in children's dental anxiety. Furthermore, no prospective study has yet demonstrated that anaesthetic induction in children causes long-term psychological problems.

In the broadest sense, anaesthetic procedure includes premedication drug and route, induction technique and the approach of the anaesthetic personnel. However in the narrower sense, general anaesthesia requires an anaesthetic agent in order to gain control of the patient's consciousness and to activate the process of anaesthesia. In a general discussion of psychological effects of anaesthesia in children by Meursing (1989), the author suggested that the main element of general anaesthesia is anaesthetic agent which is an affective factor that can exacerbate this stressful experience on children.

The point of all of the foregoing discussion is not simply to engage in an academic exercise. It has led to the development of this present study to investigate young children who develop dental anxiety and those who seem to be unaffected by general anaesthesia, which is similar to the work done in the study with older children by the present author in 1993. To proceed with this work, many questions have been raised in regard to anaesthetic procedure. Firstly, what can it tell us about a child's anxiety? And what is the connection between a child's post-operative anxiety and general anaesthesia as represented by anaesthetic agent? It seems that the clinical characteristics of anaesthetic agents might be an important determinant of children's distress experience in dentistry: therefore, the present investigator will discuss some of the research in this area. In short, the exploration of the anaesthetic's characteristics might lead to a significant contribution to our understanding of its interaction with child's distress.

(b) *Anaesthetic agents*

Over the past few decades, numerous studies have been conducted in which the effects of anaesthetic procedure on child-patients were improved with respect to the outcomes representing quick induction and full recovery with minimal post-operative side effects such as nausea and vomiting (Pandit & Green, 1994; Watcha & White, 1995). As mentioned earlier, the main working process of general anaesthesia is based on anaesthetic agents. Although the choice of anaesthetic agents for paediatric anaesthesia is not strikingly different from adults, selection is still based on the clinical characteristics of anaesthetic agent with addition of the individual anaesthetist's skill (Vickers *et al.*, 1984).

For dental extraction, a common practice of general anaesthesia requires the anaesthetic agent to maintain sleep and provide analgesia with nitrous oxide supplemented either with low concentrations or with incremental doses (Cook, 1989). The ideal anaesthetic agent for paediatric patients should provide for a rapid, smooth and pleasant induction of anaesthesia, facilitate maintenance of an adequate depth of anaesthesia by permitting rapid changes in the effect site concentration and result in short recovery. Despite the fact that there are many new anaesthetic agents introduced into anaesthetic practice, none has yet been discovered that possesses all these properties. To date, there are two volatile anaesthetics used mostly for inhaled induction of anaesthesia in children, namely: halothane and sevoflurane which has been recently introduced.

Therefore, the review in the following part will be on the historical background and conceptual framework of clinical guidance for using halothane and sevoflurane. Representative findings of research and clinical studies will also briefly be summarized and shown in Table 2.1. It is the present investigator's purpose to remind the reader that this review wishes to discuss the development of children's dental anxiety and its related aetiological factors; the review is not designed to investigate the quality of either halothane or sevoflurane. Therefore, it will present some general information which might be useful for the basic understanding of how the anaesthetic agent reacts with the patient, particularly with children.

(b.1.) Halothane

With the increased use of electrical apparatus in operating theatres in the 1940s, there was a need for a safe, potent, non-flammable, non-explosive, volatile anaesthetic agent. In 1956 halothane was released into clinical practice in the U.K. and in 1958 in the U.S.A. (Smith & Aitkenhead, 1985). Halothane is a safe and effective anaesthetic agent if used properly. Proper usage includes adjusting the concentration administered to produce adequate anaesthesia for the procedure without excess depression of cardiac, respiratory and neurologic function (Short, 1992; Pandit & Green, 1994).

Since its introduction, halothane remains the main drug for most types of operation. The deeper the level of anaesthesia, the greater the degree of respiratory depression and hypotension. Induction is smooth and not unpleasant for the patient as the vapour is non-irritant and consciousness is quickly lost. Respiration is usually quiet and muscle relaxation is good (Taivainen *et al.*, 1994). The advantages claimed for halothane anaesthesia are suppression of salivary and bronchial secretions, suppression of sympathetic activity and rapid recovery when the anaesthetic is withdrawn (Vickers *et al.*, 1978). Another outstanding effect of halothane is the effect on the cardiovascular system by reducing blood pressure proportional to the depth of anaesthesia. This hypotension reflects the myocardial depressant action of halothane. The speed of recovery, however, is dependent on the concentration of the vapour employed and the length of administration. Restlessness is common in the immediate post-operative period due to the poor analgesic action of halothane (Vickers *et al.*, 1984; Tomi *et al.*, 1993).

On rare occasions halothane may cause liver damage; though there is no evidence that liver damage is more likely in the presence of existing liver disease. Animal models of halothane hepatotoxicity have been described, although its application to human is of doubtful significance (Ray & Drummond, 1991; Kenna & Jones, 1995).

(b.2) Sevoflurane

Sevoflurane is a new inhalation anaesthetic which has been of great potential interest in paediatric anaesthesia. It was first synthesized in 1968 and has been used in clinical use in Japan since 1990. Between that period, further work was slow because of its problems of biotransformation and stability with soda lime (Smith *et al.*, 1996). It has low blood: gas solubility (Stern *et al.*, 1990; Yasuda *et al.*, 1991; Eger, 1994; Frink 1995), which promotes both rapid induction and awakening as compared with halothane anaesthesia (Furuya *et al.*, 1993; Fukuda *et al.*, 1993; Nakae *et al.*, 1995).

The fast recovery characteristic of sevoflurane has been illustrated in many studies (Nathanson *et al.*, 1995; Sarner *et al.*, 1995). For example, in the study of comparison between sevoflurane and halothane, Naito *et al.* (1991) reported that the use of sevoflurane for induction and maintenance of anaesthesia permitted significantly more rapid eyes opening (4.3 ± 1.1 vs 9.5 ± 2.7 min) after the end of induction. The difference in recovery time allowed the children who were anaesthetised with sevoflurane to be discharged home almost 50 minutes earlier than those who received halothane. The study by Taivainen and colleagues (1994) also showed that the psychomotor performance in the group of paediatric in-patients was significantly better, for at least 6 h, after sevoflurane anaesthesia compared with halothane.

The major breakdown toxic products of sevoflurane is serum inorganic fluoride concentration (Kharasch, 1995). However, the rapid elimination of sevoflurane reduces the total amount of drug available for metabolism, resulting in a rapid decrease in organic fluoride concentration after sevoflurane administration, and probably preventing exposure to fluoride ions for a long enough duration to lead to renal toxicity (Morio *et al.*, 1993; Brown, 1995; Malan, 1995; Smith *et al.*, 1996). Although increases in hepatic enzymes are detected, these are less marked than the increase caused by multiple exposures to other volatile anaesthetics. Therefore, the toxicity of sevoflurane seems to be more of a theoretical than a clinical problem (Brown & Frink, 1993; Frink, 1995).

(c) *Summary of the comparison between halothane and sevoflurane*

While it is unlikely that inhalation anaesthesia will replace the use of rapid acting intravenous induction agents; injection of I.V. anaesthetics may cause considerable discomfort, especially in children. Induction anaesthesia by mask may be preferable for many parents, assuming that this could be accomplished rapidly and smoothly (Smith *et al.*, 1996).

Inhalation induction is practised more commonly in children than in adults, and halothane has been considered the drug of choice (Short, 1992). Some early investigations have reported inhalation induction times in children to be similar, irrespective of whether sevoflurane or halothane was administered (Malviya & Lerman, 1990; Piat *et al.*, 1994). However, anaesthetic agents with low blood:gas solubility coefficient should permit rapid induction of anaesthesia as the alveolar concentration equilibrates rapidly with the inspired concentration. Considering the solubility characteristics, inhalation induction should take longer with halothane and become more rapid with sevoflurane (Yasuda *et al.*, 1991; Yurino & Kimura, 1993; Green, 1995). In short, the ability to deliver an inhalational anaesthetic with a sufficiently high concentration to induce anaesthesia depends on the effects of the anaesthetic vapour on the patient's airway. It is noted that both halothane and sevoflurane are pleasant smelling and relatively non-irritating to the airways, permitting a high inspired concentration without side effects or discomfort (Doi & Ikeda, 1993; Smith *et al.*, 1995).

In comparison with halothane, the use of sevoflurane for induction in children permitted significantly more rapid recovery after the end of administration (Naito *et al.*, 1991). The difference in recovery time allowed the children who had received sevoflurane to be discharged earlier than those exposed to halothane (Kleinman *et al.*, 1992; Furuya *et al.*, 1993; Epstein *et al.*, 1995). However, Johannesson and colleagues (1995) suggested that the discharge might have been delayed by a high incidence of post-operative nausea/vomiting despite more rapid awakening and early recovery with sevoflurane.

The studies presented thus provide some of a substantive basis for devising a table that seeks to bring all the characteristics of halothane and sevoflurane discussed together, including their physical properties and toxicity. The table (Table 2.1) will allow the reader to see the differences between these two agents.

Taking all of these sources of information together sevoflurane appears to be an appropriate alternative to halothane as the inhalation anaesthetic of choice in children.

Although its properties may be of benefit to adult patients, it is claimed that sevoflurane will become even more popular choice for paediatric anaesthesia. However, the rapid recovery and emergence from anaesthesia, compared with halothane, may result in rapid post-operative pain in the recovery room which can contribute to children's distress. To the present investigator's knowledge, although there are many studies investigated the pharmacology of sevoflurane and halothane, no prospective work has been done to distinguish the psychological effects of using these agents. Further investigation is required before halothane can be replaced by sevoflurane for paediatric anaesthesia in the future.

With regard to research, it would appear that these findings might be useful for studies of dental anxiety in children. However, the implications are incomplete unless we discuss individual information regarding the patient. Although much of the meaning and significance of a child's present anxiety, behaviour and responses can be understood in the light of the demographic factors, the child's individual differences are equally important. Therefore, the proceeding parts of this chapter will review the developmental factors which can influence the child's process of coping in the dental situations.

Table 2.1 Comparison between halothane and sevoflurane

	Halothane	Sevoflurane
Physical properties	Boiling point 50°C Saturated vapour pressure (SVP) 243mm Hg at 20°C Blood/gas solubility 2.5 at 37°C Minimum alveolar concentration (MAC) 0.75% Colourless liquid with sweet odour Mixed with thymol as stabilising agent	Boiling point 58.6°C SVP 160mm Hg at 20°C Blood/gas partition coefficient is 0.6% MAC 0.66% Colourless liquid with pleasant smell Does not contain thymol or any preservatives
Pharmacology	Induction and recovery are rapid 20% of halothane is metabolised Inhibition of salivary and bronchial secretion, coughing is not easily provoked	Induction and recovery are more rapid than halothane 3.3% of sevoflurane is metabolised The incidence of coughing or vomiting is comparable to that seen with halothane
Toxicity	Halothane itself is not hepatotoxic although there have been reports of liver damage associated very rarely with its use. It has a reductive metabolic pathway with intermediate hepatotoxic metabolites. The reductive pathway is stimulated by hypoxia. The risk of post-operative liver dysfunction associated with halothane is increased in the presence of short interval between administration (four weeks to three months), enzyme induction by drugs, hypoxaemia and obesity.	Sevoflurane breaks down in the presence of soda lime and Barolyme at elevated temperature. Both processes result in potentially toxic products. Studies in animals have demonstrated that the metabolism of sevoflurane catalysed by drug-induced enzyme leads to serum inorganic fluoride concentration and urinary excretion of fluoride ions.

2.3.2 Developmental factors

There is increasing evidence that children with unpleasant dental experiences are at a somewhat greater risk of becoming anxious than those without experience (Rachman, 1977; Lindsay, 1984; Ollendick & King, 1991; Milgrom *et al.*, 1995). What factors of psychosocial risk experienced by these children are associated with attributes of their dental anxiety, and what factors are common to children with unfavourable experiences but do not develop fear to dental treatment, are controversial questions.

Among the determinants of the impact of influences like previous experiences are developmental factors that determine in part how children respond. They refer to a child's characteristics, development and its functioning. When the child's present behaviour constitutes a continuation of a direct adjustment to the dental situation, then the individual differences may be easily accessible and will suffice to enable us to understand such present behaviour (Sermet, 1974). In one of the first studies examining predictors of dental anxiety in children, Shaw (1975) studied 100 dentally-anxious and 100 non-dentally anxious children. Although dental anxiety was found to be a complex phenomenon which reflected multiple interacting variables, the author reported that developmental factor was one of the significant differences between the two groups of children. The studies by Venham *et al.*, (1979a, 1979b) have consistently reported that this factor was important for the child's ability to cope with the dental situation. They suggested that child-rearing methods and the child's personality trait influenced the child's co-operative ability. The developmental level may additionally also contribute to the child's ability to benefit from adjustment (Rud

& Kisling, 1973; Eiser, 1989; Holst *et al.*, 1993). Further evidence which reflects the importance of children's individual characteristics was illustrated in the study of psychological factors in children by Brown and colleagues (1986). The investigators found that the important factor explaining a child's dental fear was his/her individual level of general anxiety. This finding was consistent with the earlier research reviewed by Winer (1982) showing that children might exhibit more general anxiety, rather than fear learned in response to a specific situation.

The studies presented give the impression that the accurate recording of the child's presently manifested behaviour is a necessary, but not sufficient, step for dentists. Because of the complex nature of dental anxiety, the same behaviour phenomenon will acquire different analysis, depending on its relationship to the child's individual characteristics. For example, intelligence, gender and age will largely determine the meaning of the child's behaviour in the dental setting. These issues will, therefore, be reviewed in the following parts. It is important for dentists to be familiar with these developmental factors so that they can help us to recognise how different children cope with anxiety and respond to the stress of dental situations. With increased understanding of development-specific responses to anxiety, one can communicate with children more effectively and help them with their dental anxiety better.

2.3.2.a. Intelligence

In section 2.3.1.c, 2.3.1.d, and 2.3.1.e the literature review has reviewed factors external to the child, shown to be important: socioeconomic factors and parental anxiety as well as the dentist's behaviour. The issues of psychological development of the child patient, however, remained an area of question. Some information is available on this aspect on the basis of mental characteristics and intelligence of the child. Before reviewing anxiety research using developmental factors, the present author will first consider the picture that emerges from studies of psychological assessments in child dental patients. Despite the limitations in the scope and validity of this approach, it may be helpful to clarify the terms of mental characteristics and intelligence and identify some of the experential phenomena that can be used to develop hypotheses accounting for a child's dental anxiety.

Mental characteristics refer to the development of mental ability in social and intellectual skills. The degree of mental ability is determined on the basis of developmental tests in infancy and intelligence quotient tests (IQ) in childhood (Palisin, 1986). Although many studies have used these terms in different terminologies, but all have been proposed to encompass the phenomenon of children's adaptability in experimental ways that might advance our understanding.

Many studies have suggested that the result of the process of learning depends on the child's mental development and that it helps the young dental patients to modify the effects of the unpleasant stimuli (Marks, 1978; Brown *et al.*, 1986; Schuurs, 1986; Curry *et al.*, 1988); these implications are interesting. A question then arises: can we identify dentally anxious children from their mental development or from intelligence? However, since mental development and intelligence are closely correlated, disentangling their effects can be difficult. For reasons to be discussed below, it seems that at least some degree of connection between anxiety and mental development/intelligence can be expected to exist.

In the initial attempt to investigate this question, Rud & Kisling (1973) showed that the child who reached a mental development corresponding to 29 months of age was able to cooperate in the dental situation. The authors reported that acceptance of dental treatment in children aged of 3-9 years, with no previous dental experiences, was influenced to a greater extent by mental age and intelligence quotient than by chronological age. Furthermore, it was found that the degree of the acceptance of dental treatment was increasing with the increased IQ levels. Children with lower IQs had more fearful behaviours but the IQ scores had to be extremely low to demonstrate effects. It should be noted that the children's IQ scores were calculated from mental age which was determined by an observer.

Venham *et al.*, (1979a, 1979b) conducted surveys to observe the child-rearing methods and the child's personality traits which influenced the child's cooperative ability in children aged 3 to 5 years with no previous dental experience. The investigators (1979a) reported that neither child's maturity nor IQ as measured by the Vineland Social Maturity Scale (VSMS) and Peabody Picture Vocabulatory Test (PPVT) was related to anxiety or heart rate, although social age and social quotient on the VSMS were negatively correlated with both heart rate and anxiety while percentile rank on the PPVT was negatively correlated with heart rate. In other words, these studies showed that dentally anxious children were likely to have weaker socialization and language development which resulted in additional anxiety when meeting unknown people or situations.

Another piece of evidence in favour of IQ as a factor comes from a study of temperament in children. In 1983, Schor studied 25 children aged 3-to 7 years; 16 of the children had phenylketonuria (PKU) and 9 were siblings of children with PKU. For children with PKU due to phenylalanine hydroxylase deficiency, restricting the intake of phenylalanine has been associated with relatively poorer performance IQ compared with verbal IQ. According to the parental review, Schor found that children with PKU showed a higher rate of behaviour disorder compared to their siblings. He suggested that these behavioural styles could arise from the effect of their intellectual achievement. However, the data relied largely on parental rating of their children and there was the absence of IQ scores for children in the sibling group. Whether this is due primarily to the lower IQ or to more emotional disturbances in mental impaired children with PKU is difficult to determine.

Similar studies were conducted by Holst and colleagues (1988, 1993); the authors set out to determine whether a prediction of behavioural problems in children could be made. The first study (1988) was conducted on 105 children, aged 3 to 16 years. The other (1993) was conducted on 300 children, aged 3 years old. The authors reported that the personality factor was among the factors that contributed to the child's behaviour. Regrettably, they did not report on the intellectual factor.

In the study of predictors of dental anxiety in 60 children, aged 6 years, Corkey and Freeman (1994) assessed the child's psychological development on maternal report of the Behaviour Screening Questionnaire. The authors reported that normal psychological development was delayed in 6-year-old children with high dental anxiety. It was demonstrated that the child's ability to cope with dental treatment was based on his/her degree of psychological development. These findings are important, since they point to a need to assess those children who are of special need with regard to their dental anxiety levels. However, there is some concern in interpreting this result because a mother might react very positively to the questions regarding the development of her child. In the recent work, Toledano *et al.* (1995) measured IQ and dental anxiety in children, aged 8 to 16 years, with no previous dental experiences. The investigators reported that children with high IQ showed less dental anxiety at their first dental examination visit.

In summary, these results suggested that IQ may serve to support children's adaptive behaviour. It is composed at the child's core of his/her characteristics plus personality pattern and emotional stage of development. However, other factors of the child's individual differences, such as gender, which frequently appear in the dental literature should not be blurred.

2.3.2.b. Gender

There is disagreement as to whether boys or girls suffered more from dental anxiety. Some studies found that girls were more fearful than boys because they expressed a higher level of dental anxiety on survey questionnaire (Kleinknecht *et al.*, 1973; Brown *et al.*, 1986; Chellappah *et al.*, 1990; Neverlien & Johnsen, 1991; Ollendick & King, 1991; Alvesalo *et al.*, 1993; Neverlien, 1994; Milgrom *et al.*, 1995; Toledano *et al.*, 1995), but others found that there was no difference (Wright 1980; Holst, 1988; Corkey & Freeman, 1994). This difference in anxiety scores might reflect a greater willingness for girls to admit anxiety (Chapman, 1991). Conversely, girls may exaggerate their anxiety as an expression of socially desirable behaviour.

Winer (1982) suggested that other factors like age should be taken into account; he found sex differences increased with age. Murray *et al.* (1989) confirmed that anxiety increased with age and that girls were generally more fearful than boys. Sex differences became marked only after the age of nine years. Another study has also noted higher levels of dental anxiety in adolescent girls when compared to adolescent boys (Kleinknecht *et al.*, 1973). These results indicate the relationship between the differences of sex and age.

Liddell (1990) and Toledano *et al.* (1995) reported that these differences might indicate a tendency for boys to be more influenced by external stresses, whereas girls might react to a greater degree than boys to internal factors. Nevertheless, personality factors partly accounted for the boys' dental anxiety, as the lack of persistence and general fearfulness were related to their anxiety, as opposed to the girls, whose anxiety seemed to be dependent on one fear factor, namely: fear of the unknown. Another interesting result from the study by Neverlien (1994) was that dental anxiety among girls tended to increase from childhood to adolescence while anxiety among boys remained stable. It is clearly demonstrated that other factors than gender also influence child anxiety. The following section will, therefore, review age factor in more detail.

2.3.2.c. Age

Age has been considered as one of the developmental factors which helps children to understand the situation; children's response changes as a function of age (Eiser, 1989). With age changes there is the possibility of change in processes underlying the experiences and the child's self-control of behaviour. However, the mechanisms that are responsible for the development of a child's anxiety are not well understood. Considerable research evidence has shown that preschool children are more likely to show anxiety at separation from the parent (Meursing, 1989; Pinkham, 1991; Fenlon *et al.*, 1993) or in an unfamiliar environment (Swallow *et al.*, 1975), whereas the older children may expect punishment or criticism of emotions if they express their anxiety (Melamed, 1986). In short, younger children report more anxiety regardless of the situation, while older children seem to inhibit their fearful behaviour.

Similarly, it is difficult to hypothesize about how age may affect dental anxiety in children, as this relationship is likely to be complex. For example, The British National Children's Dental Health Survey (1973) showed that the proportion of children who were dentally anxious increased during the primary school years and then decreased during the secondary school period to about 50% of the population (Bedi *et al.*, 1992). The important finding from the Lautch (1971) study was that the most frequent age of the patients at the time of the first painful dental experience was between 6 and 10 years. While dental anxiety can develop at any period of life, in this study the majority of patients developed dental phobia in childhood and adolescence and only a few as adults. Bailey *et al.* (1973) also reported the tendency of increase in dental anxiety in younger children (9-11 years) compared with the older children (12 years) in the group of 9- to 12-year-old children.

However, in a major review of research on children and dental anxiety, Winer (1982) concluded that the majority of children younger than seven or eight years appeared to be cooperative while there was an increase in dental anxiety with age in older children. Winer suggested that age related changes in dental anxiety should be considered with physiological and psychological changes. On the other hand, some studies reported that dental fear decreased as age increased (Johnson & Melamed 1979; Cuthbert & Melamed, 1982). A recent study by Lumley and his colleagues (1993) reported a nonlinear decrease in anxiety with increasing age. The younger children, aged 4 to 5 years, were reported to be more anxious than the 6 to 7 year-old children; however, the 8 to 10 year-old tended to reverse this pattern.

In summary, it seems that there is the possibility of other factors underlying the changes in age. It might be hypothesized that older children are no less anxious than younger children but that they have learned to control the way they show their fear. Also, with respect to age and incidence of negative behaviours there are three findings that are often supported: the high incidence of relatively co-operative behaviour among younger children, the absence of major signs of overtly disruptive behaviour among large numbers of children by age 5 or 6, and decline of anxiety in the pre-school years (Winer, 1982). There is a potential contradiction here. The studies just presented would make it seem as though age is not easily explained and leave much room for study.

In an exploratory review on developmental factors, the present investigator has carried out several analyses of children's dental anxiety, to investigate whether we can use intelligence, gender and age to predict the child's responses in the dental settings. Although a variety of evidence was obtained across several researches, these factors are still important for us. With regard to the child patient, such data pertaining to the child's individual characteristics is of primary value for administrative purposes and for survey research.

Up to this point, this review has been on theory and experiments in research of child's dental anxiety. It gives rise to the impression that psychological preparation (i.e. communication, modelling) may play an important role in minimizing the effects of dental anxiety which is of primary significance in child-cases.

2.3.3 Psychological preparation to reduce anxiety

The goals of psychological preparation are to reduce anxiety and develop in the child a positive attitude toward dentistry (Houpt, 1993). The interventions apply principles of learning to teach patients adaptive methods of anxiety management. It is important that dentists develop the requisite knowledge and skills to manage children in the dental environment. Familiarity with psychological studies of anxiety and development in children can help one to recognise how different children cope with anxiety and respond to the stresses of dental care. With this knowledge, the dentist can prepare children for treatment more effectively and anticipate less pre-operative disturbance. This part of the literature review will present some strategies for preparing the child for the dental settings. Specific issues regarding communication with children and their parents will be discussed. Finally, it will discuss the effectiveness of modelling and coping skills in children.

2.3.3.a Communication

Communication is usually thought of as a two-way process in which the dentist appears active, talking and the patient passive, listening. This is a difficult situation for both dentist and patient since their communication can be affected by stress and anxiety: the anxiety of both dentist and patient and the anxiety which occurs as a result of their interaction (Freeman, 1992). By increasing awareness of this relationship, many researchers began to investigate the effects of affective communication on patient's stress (Ellis & Leventhal, 1993; Jackson & Lindsay, 1995). This review will attempt to provide the overview of research in the area of communication between patient and physicians.. It will also focus on methods for improving communication.

Communication has been intensively investigated and can be divided into verbal and non-verbal communication (Ley, 1988). It is important that any message between physicians and patients should leave the source and reach the receiver without any distortion. The failures in verbal communicating with patients engender increasing concern as communications, intended to inform patients about their condition, frequently fail and patients also do not follow the professional advice given to them. It is probably worth emphasising at this point that although these problems are often referred to as failures of patients' comprehension and memory, it is obvious that patients are not at fault. This problem accounts, in part, for patients frequently feeling anxious about their encounters with health care personnel and also contribute to the high frequency with which advice is not followed (Ley *et al.*, 1976).

Many of the studies reviewed in this chapter were preliminary demonstration evaluations to discuss the effects of providing health information to patients. It was indicated that patients exhibited a surprising lack of knowledge concerning their illness even though they attached considerable importance to gaining such information (Boreham & Gibson, 1978). However, most of the studies have concerned communications of physicians with their patients. Little could be found which concerned investigation of communicating compliance with the dentist.

In the approach to understand the effective communication in stressful medical and dental situations, researchers studied the influence of this skill on adults in such events (Ley *et al.*, 1973; Kupst *et al.*, 1975; Hulka *et al.*, 1976; Boreham & Gibson, 1978; Leventhal *et al.*, 1979; Bartlett *et al.*, 1984; Humphris *et al.*, 1993; Meredith, 1993; Jackson & Lindsay, 1995). Much of the literature confirms that the failures result in part from lack of understanding by patients of what has been said to them (Boyle, 1970; Bradshaw *et al.*, 1975) and in part to forgetting what they have been told (Robinson & Merav, 1976; Sahm *et al.*, 1990). It has been shown that patients do have problems in understanding some of the medical words used, even if they appear simple to the doctors or dentists (Cole, 1979; Freeman, 1992). The explanation that can be offered is that simple enumeration of phrases in a terminology is not sufficient to convey the meanings of the terms and because of this, lack of understanding can and does frequently occur in the field of health communication (Cimino, 1993). Nevertheless, it should be noted that the development of patient's knowledge and understanding can be improved by effective communication. In general, what seems to be required in reconstructing doctor-patient communication is effectiveness and adequacy of information, particularly of written information

(Tring & Hayes-Allen, 1973).

It is obviously tempting to consider the use of written information as a way of supplementing and improving communications (Ellis *et al.*, 1979; Gauld, 1981; Kinnby *et al.*, 1991). Furthermore, the majority of patients receiving written information express favourable attitudes towards it (Fleckenstein *et al.*, 1976; George *et al.*, 1983). Ley (1982) reported that there seemed to be a reduction in length of recovery, and a need for fewer analgesics in patients receiving these communications. Patients with high anxiety benefit more than less anxious patients from such preparatory information. It is worth noting that improving communication by increasing the amount of information provided can often lead to increased understanding and a more relaxed state of mind (George, 1992). It can be seen that in the majority of studies the provision of written information has been found to have beneficial effects (Ley, 1982).

The advantage of written information was also found in the study by Jackson and Lindsay (1995). The investigator studied the effect of an informative leaflet, including information about management of pain (surface anaesthetics, injecting slowly, solution at room temperature) and stop signals, on pre-treatment anxiety in 50 patients attending a dentist who was new to them. The patients who received an informative leaflet reported their anxiety to be decreased significantly before they met their new dentist. Interestingly, those who were provided with a comparison leaflet, sympathetic and including a description of reasons for dental fear, did not show reduction in their anxiety. The authors concluded that simply reassuring and understanding was not enough to reduce fear in patients. It was the anticipation of pain, as distinct from the experience of treatment, which caused patients most concern. In their discussion they further speculated that it was the information about pain management that acted favourably with patient's distress.

In the recent work by O'Neill, Humphris, and Field (1996), they set out to determine whether there was an influence of the informative leaflet on adult-patients. The authors studied the possibility that some patients would perceive the arousing effects of informative leaflet by showing improvement of knowledge and higher levels of satisfaction. Four groups of patients undergoing wisdom tooth removal under local anaesthesia were tested. The first group were provided with the informative leaflet and prompted by the dentist to read it and the second group were given the leaflet without any prompt. The two other groups acted as controls. A dental health education leaflet, but unrelated to wisdom tooth removal, and prompt were given to the third group, and no written material, only verbal information was provided to the final group. Those who received the wisdom tooth information leaflet reported greater knowledge whereas the control groups showed no improvement. Although the highest level of patient satisfaction was reported in the second group (a leaflet without prompting), it was not related to the provision of the leaflet. However, the authors did not report patients' dental anxiety.

Although these findings seem to indicate that written information can reduce anxiety in dental-patients, it could be argued that this may not be true on the part of children. To the present investigator's knowledge, there are few data on the influence of information on children's coping with the dental situation. Unlike adults, children are unable to process information about health accurately and consistently show errors in their understanding (Claflin & Barbarin, 1991). In the early study of the effects of health information on children, Lovius and his colleagues (1973) used pictures along with presenting information on oral hygiene to children aged 12. The authors reported that the children who had received the pictures and the information did not gain an improvement in knowledge about oral hygiene compared with those who were given written information only. Also, it seemed that the children did not benefit from the informative leaflet. However, it was noted that the written information used in this study was too long and too complex for the children.

The influence of information on children in dentistry was explored again in a study of children's dental health behaviour by Knapp (1991). Seventy eight children, aged 10 to 12 years, were assigned to receive a leaflet of two different types of value (health vs social) and also differed in valence (positive vs negative) whereas the control group (n = 20) were provided with basic dental information. In contrast with adults, this study failed to find an influence of health information on children whereas negative social appeals were effective in encouraging children to undertake behaviours regarding dental health. The explanation could be due to the differential cognitive abilities of children and adults. While the thought processes of children tended to be confined to the present situation, adults were able to think about the future. Although this study did not attempt to examine the child's anxiety, the results of this investigation may have implications for hypothesis development. It is hypothesized by the present researcher that the effective impact of an informative leaflet on children may be achieved if the information is given to a parent.

As a result of the findings that maternal anxiety is communicated both verbally and non-verbally to the child (Bush *et al.*, 1986), there has been increased interest in the communication between physician, mother and child in stressful situations. For example, Korsch *et al.* (1968) found that 27 per cent of the parents did not ask the doctors questions even though they wanted more information. In addition they found that 76 per cent of the parents' main worries were not communicated to the physician. When discussing the problems of parent's and child's anxiety with communication it was pointed out that the majority of parents appear to want to know as much as possible about their child's treatment (Francis *et al.*, 1969; Korsch, 1989). However, the reluctance of some health professionals to provide patients with certain kinds of information was based on the belief that provision of such information would have adverse effects. In particular, the information might cause undue anxiety or distress to parents. However, it is possible that parents are much more robust than we imagine.

Bringing a young child for dental treatment is likely to be stressful for most parents (Milgrom *et al.*, 1994). In 1991, Baron and colleagues examined the effect of verbal communication from dentists, in terms of information and friendliness, on the stress levels in the parents of paediatric dental patients. As predicted, the information and friendliness from dentists were associated negatively with parental distress regarding the dental treatment. The study by Kinnby and her colleagues (1991) also showed that the parents of children aged 5 years old showed satisfaction and benefitted to a great extent from a combination of written and verbal communications. Additionally, the level of parental education did not influence the knowledge and dental health of children.

Based on this review, there is considerable evidence to show that the communication gap between physicians and patients or parents needs to be closed. We usually overestimate what patients or parents have understood and that they have less knowledge of dental treatment than most dentists think. The highest dissatisfaction is where neither the parent's expectations nor his/her main worry about the child receives attention. It is clear that dentists should pay more attention to communication with the parents. However, there is little in the dental literature to stimulate the dentist about this communication because most dentists seem to put their interest on the child's treatment outcome. It should be our interest in understanding the process of effective communication with parents and the complex influences of parental characteristics which may result in reducing the child's fear. Another technique of anxiety reduction in children, modelling, will be reviewed in the proceeding section.

2.3.3.b Modelling

Some studies have demonstrated that modelling is effective in reducing fearful avoidance behaviours and increasing adaptive behaviour in a variety of situations (Bandura & Walters, 1969; Melamed & Siegel, 1975; Melamed *et al.*, 1976; Melamed *et al.*, 1978; Klingman *et al.*, 1984). However, the effectiveness of modelling cannot be assumed without understanding how the child's previous experience in the dental situation modifies this consideration. Two studies by Melamed and her colleagues (1975a, 1975b) were designed to evaluate the potency of a peer modelling film for the preparation of children with no prior dental experience. The use of modelling with children having no prior experience with the dental setting was based on an assumption that information about what to expect and how to behave contributed centrally to the fear that elicited dental anxiety.

In the first study (Melamed *et al.*, 1975a) children between the ages of 5 and 9 years attending the dentist were studied. Fourteen children were studied in the relevant dental-related peer modelling film condition in comparison with a control group (n = 14) involving a drawing task unrelated to dental work. The result indicated that children who had viewed the peer modelling were more co-operative and reported fewer fears on self-reported fear scale immediately prior to their dental treatment as compared with the children who observed no film. The study was replicated, by Melamed and her colleagues (1975b), with the control group that involved viewing a film unrelated to dental treatment and the children ranged from age 5 to 11 years. The authors reported that the use of a peer model rather than a demonstration led to a greater retention of information with a corresponding improvement in co-operation. In addition to the opportunity to observe a model undergoing treatment, modelling film also provided procedural information to the child-viewer.

A similar type of study was conducted by Melamed and her colleagues (1978), on the different levels of therapeutic effectiveness according to the child's previous treatment experiences. They reported that children might learn coping skills by watching another individual master a stressful situation. Observing a peer successfully undergo dental treatment (prophylaxis, dental examination and dental restorative treatment) was effective in reducing child's dental anxiety especially for the inexperienced child. Young, dentally experienced children (4-6 years) were sensitized by modelling procedures which might elicit their own negative recall of prior experiences without correcting them. Interestingly, children with previous dental experiences benefitted most from a demonstration of the administration of local anaesthetic in the absence of a peer model. It is interesting that the authors suggested that age and previous experiences should be considered in determining the type of information most beneficial for each child because these two factors might affect how well children could learn coping skills. Also, Ridley-Johnson and Melamed (1986) further speculated that peer modelling is more successful when coping skills are also demonstrated, particularly if the child is encouraged to practice along with a videotaped peer model demonstrating coping strategies, than exposure to the same modelling without rehearsal.

Although researchers are becoming increasingly sophisticated about how adults cope with pain and stress, less is known about children. It has been suggested that the child's coping style influences his/her responses to medical/dental stressors (Bush *et al.*, 1986; Murray & Niven, 1992). In the dental situation, Siegel & Peterson (1980) found that pre-school children taught such coping skills as relaxation and pleasant imagery, in addition to receiving sensory information, demonstrated less distress during restorative treatment than a control group.

Coping styles in children may be cognitive or behavioural in nature. The cognitive coping styles involve the manipulation of experiences or emotions during which the child tends to be silent and often unnoticed by the dentist. Behavioural coping styles are verbal or physical activities in which the child engages to deal with the stressful situation. It is quite apparent to the dentist as the child attempts to obtain information by asking questions about upcoming dental treatment (Curry *et al.*, 1988). The study of coping styles is difficult, as there are problems of definition and measurement. Another way to understand children's coping responses is to focus instead on the variations in behaviour and on effective functioning, competence and mechanisms of coping (Perrin *et al.*, 1993). However, there is no measurement that takes all these aspects into account.

The studies summarized here indicate that the child's age and dental experience have a significant influence on the child's ability to benefit from the information. Furthermore, the link between such information and coping styles may predict the child's overall perception to dental stress.

2.4. Summary of the literature review

From these studies, it is clear that child's dental anxiety has been demonstrated to have many possible causes. The prevalence of anxiety is affected to an extent by several demographic and psychological factors such as: socioeconomic status, previous experiences, a child's expectation of pain, parental influences, dentist's behaviours and types of dental treatment. The developmental factors including intelligence, gender and age are also implicated.

There are some indications from the literature that dental fear develops across visits but it does not increase in a linear type as experiences accumulate. In addition, children's expectation and their previous memories of dental procedures can influence anxiety regarding an unpleasant dental treatment. There seems to be some relationship between anxiety and variables relating to the child's home; however, the effect of social class on child's dental anxiety is still debatable. Parental influences, on the other hand, have been frequently correlated with anxious behaviours in children. The mother is claimed to have more influence on the child as she has taken an active role in the family in the process of preparing her child and helping in the adjustment to a dental procedure. The studies reviewed have put forward the possibility that the response of the child to anaesthesia induction can be influenced by parental anxiety.

There are some interesting associations between dentist's behaviour and child's anxiety suggesting that reassuring and physical contact, patting or stroking, result in less fearful behaviour. In the part of the review of child's anxiety in relation to types of dental treatment, there are many findings. General anaesthesia, among many procedures, is of great concern as there are a number of correlations between children's anxious reactions and anaesthesia induction. There are some hints from the literature that the new anaesthetic agent, sevoflurane, has several advantages over the other volatile agent, halothane, in many terms. Surprisingly, there is no study on the anaesthetic agent differences and children's postoperative anxious behaviour.

With respect to developmental factors, there are three variables that are often of interest: intelligence, gender and age. Children at different developmental stages respond to stress with different mechanisms and with different cognitive potential; however, there are not many studies on intellectual level and anxiety development in children. Interestingly, the results on gender have not been entirely consistent. Experimental studies on age changes present some contradictory results and indicate the possibility of other factors underlying anxiety changes with age.

Co-operative behaviour in children can be reinforced using appropriate psychological preparation. Communication between dentist and parent is another aspect which has been found to be of concern to many researchers. There was an increase in parents' satisfaction when they received more information from the doctor or dentist. However, in terms of literature on communication between dentist and parent, there are only relatively few studies here and there seems to be little evidence for the hypothesis that written information can help in reducing a child's anxiety. The correlations between coping skills and modelling suggest the importance of the intelligence which additionally contributes to the child's ability to benefit from adjustment.

2.5. Formulating research questions

Several directions for future research can be made after reviewing some of the research and theory on dental anxiety in children. First, compared to adults, not many experimental research projects on children have been conducted. Most research is carried out in clinics and hospitals where the majority of patients are adult. Moreover, relative research on child's dental anxiety mostly rely on the memory of parents. The results of such research have often been inconclusive with respect to the parents' difficulties in recalling events which took place in the past. Although the interview in some studies clearly concentrates on current events, some parents seem to examine their own feelings rather than the child's toward dental procedure. In other words, some parents are not prepared to acknowledge their contribution to the assessment of their child's anxiety, which will emerge in a discussion of their early attitudes on dentistry. Therefore, future research would benefit on concentrating effort on assessing dental anxiety directly from children themselves, rather than relying solely on parents.

A second area for research is highlighted by how little is known about the relationship between a child's intelligence and his/her anxiety. Many studies are directed at illuminating cognitive function of young children. In addition, the investigators seem all too ready to believe that a cognitive deficiency makes one likely to be affected by environmental factors that are known to be central in the genesis of fear. In some instances, children's personal characteristics will reflect that their background has little or nothing to do with intellectual endowment.

A third point is that although there is some evidence that the informative leaflet can reduce dental anxiety in adults, no one has tried to make this approach in children. One approach to this method is to see whether a leaflet can be designed which will change parents' views or inform them about the general anaesthesia procedure which may then in turn have some influence on their management of their child and thereby reassure the children and hence make them less anxious when they have appointments with dentists.

Finally, there is as yet no study on anaesthetic procedure and post-operative dental anxiety in young children. Instead, we have a variety of studies on dental procedures, even on an infection-control barrier (i.e. mask); all of these studies are incomplete or restricted to the parental report, and some of them untestable and without longitudinal observation. At the same time, the implications of anaesthetic agents' psychological effects are beginning to emerge, largely as the result of recommended use of general anaesthesia in young and uncooperative children.

2.6. Conclusion

To conclude: this review has shown that an experimental prospective study is warranted to investigate the factors influencing children's dental anxiety in relation to extraction under general anaesthesia. As commented previously, a leaflet containing information about this treatment may be useful for studying changes in children's dental anxiety. Such research findings could supply valuable data for the improvement of treatment and practice with this patient group. Furthermore, the anaesthetic procedure carried out at the Liverpool Dental Hospital offered a good opportunity to compare the advantages of halothane and sevoflurane as a suitable anaesthetic agent for children, since the Liverpool Dental Hospital was the first dental hospital in the U.K. that administered children with sevoflurane.

However, there were a number of problems that confronted the present investigator including features of parental and children's dental anxiety measurement, children's characteristics and the design of an informative leaflet. Therefore, the guidelines for this present research will be discussed in the following chapter.

CHAPTER 3

AIMS AND CRITERIA OF THE RESEARCH

CONTENTS

CHAPTER 3

AIMS AND CRITERIA OF THE RESEARCH

3.1 Introduction

As indicated previously in Chapter 2, the present investigator is attempting to draw together several points. First, is there any association between the intelligence quotient and child's response to dental treatment? Rud and Kisling (1973) demonstrated that mental development, in terms of mental age, exerted a decisive influence on whether the child could learn to accept dental treatment. They concluded that chronological age does not always agree with mental level of development. They showed that the child who reached a mental development corresponding to 29 months of age was able to cooperate in the dental situation.

A study by Toledano *et al* (1995) showed similarly that children at various equal developmental levels expressed their fear differently in a dental situation. Children with high intelligence quotients showed less dental anxiety at their first dental visit. It therefore seems possible that the differences in children's acceptance of dental treatment is related to the child's ability to cope in the dental situation.

To summarize, there is some evidence indicating a link between dental anxiety in children and their intellectual achievements, with more tentative indications that the mental level may modulate either favourably or unfavourably the learning process (Novakova, 1991). While the causal relationships involved remain uncertain, it is plausible that the learning process would help the child adopt his/her coping style under stress. Since IQ will lead to the intake of information concerned with potential danger from the dental situation, it could well play a part in triggering or maintaining episodes of fear and anxiety.

The second area of concern is the conflicting evidence as to the underlying cause of dental anxiety in children, and the factors which may affect its severity. It is well established that dental anxiety is associated with recall bias favouring negative experience, therefore when a child is anxious he/she is more likely to recall unpleasant dental experiences than when he/she is more relaxed (Vandermaas *et al.*, 1993).

Despite an apparent consensus among researchers that dental fear is acquired in childhood (Lautch, 1971; Kleinknecht *et al.*, 1973; Marks, 1978), efforts to explore its acquisition have presented only retrospective results. For example, in a recent study Ollendick and King (1991) examined 10 types of fear, except dental fear, in a large multi-national sample of children and adolescents (n = 1092). They found the majority of 9-to 14-year-old attributed the onset of their fears to vicarious and instructional factors (56%, 89% respectively) rather than to direct conditioning events (36%). They concluded that fear could result from any one of the sources but often combined with direct experience. It should be noted that these findings relied on the subject's memory and recollection to point to the likely sources of onset.

Milgrom *et al* (1995) also investigated Rachman's theory of fear acquisition in a large sample of children (n = 895) aged 5 to 11 years in order to document the origin of dental fear in childhood. In contrast to the study by Ollendick and King (1991), they used proxy measures to measure direct and modelled effects. However the results were also based on retrospective analysis of self-report and were subject to the limitations of all retrospective studies with children. Both direct conditioning and parent modelling factors were found to be significantly independent predictors of dental fear in children. This study had identified traumatic dental experiences as one primary factor in the acquisition of negative dental attitudes in children. Knowing this, the dentist can recognise anxiety in child-patients and help to prevent the untoward sequelae of frightening clinical episodes.

Other findings suggested that an alternative approach to predicting the child's response during the stressful dental event is by looking at the mother's influence on the child's response, during events where she is present and either anxious or non-anxious on the child's behalf (Shaw & Routh, 1982; Bush *et al.*, 1986). The first experimental study of this issue, by Frankl *et al* (1962) studied children during dental examination and treatment. They found the behaviour of young children (41-49 months) to be significantly less negative when the mother was present than when she was absent. Crying and uncooperative behaviour by these children were observed at the beginning of the first dental visit (i.e. after the initial separation from the mother). Therefore the results of this work can be understood within either mother-child interaction or parent modelling theory frameworks. What is not clear from the data presented is whether the mother's anxiety affected her child's specific response to procedures such as injection or local anaesthetic.

In reviewing the literature, the present investigator has identified the need for parents to support and assist in reducing child's anxiety (section 2.3.1.d). However it is unclear whether parents' emotional well-being suffers from the stressful event. Research in areas (Bevan *et al.*, 1990; Hannallah, 1994) such as paternal participation in the induction of anaesthesia suggests that the experience can be emotionally upsetting. Participation in this procedure, which is inherently frightening (i.e. when the mask is placed over the child's face until a surgical level of anaesthesia or this so-called excitement phase of anaesthesia is reached and the anaesthetised child is unconscious) may be detrimental for some parents.

It has been suggested that anxiety is not quite as bad as we think and is not unusual in individuals experiencing potentially frightening situations. Mild stress helps the individual cope. However, when parents become overtly worried, potential risks seem exaggerated and their fears are often verbally and non-verbally communicated to their children (Bush *et al.*, 1986). Thus, the information preparing parents psychologically for participation in general anaesthesia procedure seems necessary (McGraw, 1994).

General anaesthesia for paediatric dental patients has been used for many years for the removal of teeth. It is recommended especially for children who are handicapped, too young or too anxious to accept treatment with local anaesthesia, or for multiple tooth extraction (Burns *et al.*, 1992). However, the child's fear, apprehensiveness and lack of cooperation are of particular concern to the anaesthetist (Cook, 1989). In reviewing the literature (part 2.3.1.f), it has been found that while many studies have assessed children's reaction to various dental procedures and others have evaluated subsequent anxiety, almost no studies have investigated the relationship between children's anxiety about anaesthesia induction and the development of later anxiety.

For general anaesthesia, most surveys have focused on identifying whether children had received post-operative analgesics or suffered any anaesthetic complications (Morgan *et al.*, 1981; Acs & Moore, 1984; Carpenter *et al.*, 1993; Fung *et al.*, 1993). It has been suggested that the induction of general anaesthesia in children may provoke anxiety no matter what technique is used; children are threatened by frightening environments, masked strangers, pain or discomfort and uncertainty about "going to sleep" (Melamed, 1992). The resulting anxiety and distressed behaviour may lead to later disturbances of behaviour (Meursing, 1989). A decline in the number of general anaesthetics for treatment in the dental hospital was reported (McLaughlin *et al.*, 1987), as there has been increasing awareness of alternative methods using inhalation sedation (Kemp & Broadway, 1986).

Interestingly, it seems that general anaesthesia may also indicate a difference in approach to treatment planning for the child. In other words, more teeth may be extracted. The study by Smallridge and colleagues (1990) of the use of general anaesthesia for tooth extraction in 836 children, showed a larger number of teeth extracted per child compared with a few years earlier. This was explained by the avoiding of any risk of a child needing a second general anaesthetic or a greater use of balancing and compensating extractions. It should be noted that this study overlooked the psychological effects of anaesthesia on children. Greater interest in the early and late psychological negative sequelae of dental treatment and their prevention is warranted.

The psychological effects of general anaesthesia have been initially discussed by Morgan *et al.* (1981). The study was conducted on 5 to 8 year-old children; 36 children anaesthetised with halothane-N_2O undergoing myringotomy and 30 controls. Even though their major aim was to find out whether there was any continued impairment of psychological functioning 24 hours following treatment, they found parents of children in the anaesthesia group rated their children as significantly more anxious ($p < 0.01$) at the presurgical assessment than at 24 hour postsurgery. Additionally, they concluded that physical discomfort could not account for the anaesthesia-control differences in the psychological test at the time of hospital discharge. The results were totally dependent on the parents' point of view and it is likely that the accompanying parent's feeling may influence this information.

Some progress has been made in evaluating the behaviour of children responding to general anaesthesia. Burns and his colleagues (1992) reported 60% of 190 children undergoing dental extraction under general anaesthesia cooperated in the operating theatre. These children presented as dental emergencies which required tooth extraction, therefore the children did not know that treatment awaited them. This may indicate that the children did not have time to develop anxiety towards treatment. It was the authors' opinion, without supporting evidence, that tooth extraction under general anaesthesia for those children who suffered toothache causes psychological trauma and can lead to life - long anxiety about dental treatment.

After an attempt to determine which characteristics of anaesthesia induction were most stressful for most children, Lumley *et al.* (1993) addressed the need for psychological preparation for children undergoing anaesthesia induction, in order to prevent or reduce psychological and possibly subjective fear. The subjects in their study were 50 children, aged 4-to 10-years who had elective surgery for ear, nose or throat dysfunction. The anaesthetic was administered by mask induction. The data from this study found that 36% of children were distressed at mask presentation. Additionally, children were more distressed and uncooperative as anaesthesia induction proceeded from the initial separation from the parent, through the period of waiting in the operating theatre to the presentation of the mask. The child's anxiety was assessed by using heart rate physiological measurement. However, the technique they used is restricted to the special equipment. In other words, the information obtained is limited according to the indirect measure of fear. Nevertheless this study did define the parameters of the event and the risk factors for children that put them under anxiety during the induction of anaesthesia.

Minimizing children's separation from their parents has become an important component of health care. Thus parental presence during a child's anaesthetic induction is receiving increased attention by professional personnel. Among hospitals with major paediatric services most now permit parents to accompany their children through anaesthetic induction (Bevan *et al.*, 1990). It is interesting to note that children are afraid and parents are anxious. Vassey and colleagues (1994) come to the conclusion that parents are disturbed by such factors as witnessing the child's distress prior to induction, watching him/her going limp, having to separate from the child after induction and noticing the child's pain after recovery (Moote, 1994).

The foregoing account on parental and children's anxiety associated with anaesthetic induction, assuming that these results are reliable, has quite intriguing implications.

It suggests that information for parents is very important since it consists of two-parts. First, assisting the parent in making the link between understanding what is going to happen and being able to handle it efficiently (Hannallah, 1994). Second, reducing parental anxiety which may prevent children becoming dentally anxious and therefore lessen the need for psychological interventions with these child dental patients (Melamed, 1986). Hence preparing parents may have merit in assisting their children. Therefore, parental and children's anxiety could be assessed before and after attending tooth extractions under general anaesthesia, comparing the parents who did and did not receive preoperative information. It could be objected that this is nothing new: psychological education of parents is known to be routinely practised by every hospital and general dental practitioner. However, it has been reported that parents do not ask doctors questions even though they want more information about their child's illness (Korsch *et al.*, 1968). Furthermore, they often do not understand and frequently forget what they heard (Ley *et al.*, 1976).

Asking questions prior to surgery may cause anxiety in children. However, there is evidence that young children (5 to 8 years) who are given opportunity to think about disease states feel less vulnerable (Potter & Roberts, 1984). Furthermore, children appreciate being given information about their disease state, as shown by a study involving 50 children, of whom 95% wanted to be told if they were terminally ill (Ellis & Leventhal, 1993). Young children appear not to need radically different explanations of illness compared to adults. Therefore, simple medical or dental explanations of treatment are recommended (Lovius *et al.*, 1973; Eiser, 1984; 1989). It has also been found that children who asked questions about their dental anxiety and expected levels of discomfort prior to a dental procedure do not record higher levels of pain following treatment. In fact, their ratings of dental anxiety decreased (Carlsen *et al.*, 1993). If children are less anxious during the pre-operative period, not only will they often exhibit fewer behavioural disturbances post-operatively, but they may face subsequent medical care more easily (McGraw, 1994).

As indicated previously (section 2.3.3.a), many studies have emphasized the effect of written communication on knowledge and other therapy outcomes (Fleckenstein *et al.*, 1976; Ellis *et al.*, 1979; George *et al.*, 1983). The behaviour of the parent that health professionals call non-compliance is likely attributable to many different factors. However, some aspects of this problem are certainly due to the failure of modes of communication. Written instruction can serve to enhance how important it is that information can be presented, and will be attended to, understood and recalled (Ley, 1982, 1988; Street, 1992). Therefore, the presentation of pre-operative information is designed in a leaflet-form and contains information about anaesthetic procedure and bleeding prevention after extraction.

Before embarking on the fourth area of this present research, the investigator will consider the issue that has recently emerged from studies of post-operative pain in children. It has been pointed out that the literature in paediatric dentistry is notable for its lack of specific information on the experience of pain in children (Fung *et al.*, 1993). The incidence of pain in children recovering from surgery is unknown. Furthermore, there has been a widespread belief that children do not experience pain and therefore seldom need analgesic medication after most surgical procedures. One explanation of this belief relies on the anaesthetic induction required for these operations (Cook, 1989).

The word anaesthesia means without feeling and without pain. It is for the explicit purpose of relieving pain that both anaesthetic agents and the specialty of anaesthesia have been developed (Moote, 1994). The ideal anaesthetic agent for paediatric surgery should provide rapid and smooth induction of anaesthesia, maintain an adequate depth of anaesthesia and prolong analgesia effect. However no anaesthetic agent has yet been discovered that possesses all these properties (Lerman, 1995).

Every anaesthetist's goal is the prevention of pain, which is achieved in the operating theatre. However the same guarantee cannot be made for postoperative pain (Pounder & Steward, 1992). Many anaesthetists allow parents to accompany their children during induction but do not tell those parents that the children may need some post-operative analgesics. They either assume that parents instinctively know what to do, or they are too certain of the analgesia effect from anaesthetic procedure and of what nurses routinely advise the parents.

Mather and Mackie (1983) found that of 170 paediatric surgical patients 40% were in moderate to severe pain during the day of surgery and 27% were similarly uncomfortable on the first post-operative day. Although this data revealed considerable scope to improve pain management in children after surgery, it was based on children undergoing major surgical procedures which needed pre-operative premedication, and post-operative pain was expected.

There is still a mystery of how much pain child-patients feel after their extractions under general anaesthesia. Another evidence in favour of post-operative analgesics comes from a pilot study of pain reported by children after dental extractions under general anaesthesia (Fung *et al.*, 1993). 57.5% of seventy-three children, aged 5.8 to 13.5 years, exhibited pain immediately after treatment, as reported by the child and by the parent of their child. These results indicated the need for urgent post-operative analgesics after dental extractions under general anaesthesia.

It is clear that post-operative pain control is dependent on the parent-child communication, and their interpreting just these details (Mather & Mackie, 1983). However, the study on parent's attitude to treatment of children's pain (Forward *et al.*, 1993) showed that some parents used pain medication as a last resort for fear the child would become addicted to drugs or learn to use them to solve other problems. The object of the present research is the necessary integration of knowledge on extraction under anaesthetic procedure and analgesics. Therefore the informative leaflet designed for this present study will also include post-operative analgesic management apart from the information about general anaesthesia and bleeding prevention after extraction.

In regard to the review discussed so far, it is evident that anaesthetic experience can be painful to the child despite the fact that analgesia effect is universally an important property of anaesthesia. There is some consistency in published reports that painful experience makes a significant contribution to dental anxiety in children (Lautch, 1971; Kleinknecht *et al.*, 1973, Scott *et al.*, 1984). Therefore it is the purpose of the present investigator to pay close attention to the anaesthetic agents which play a major role in this event.

Many laboratory studies have concentrated on the pharmacological and clinical characteristics of halothane (Stern *et al.*, 1990; Ray & Drummond, 1991; Yasuda *et al.*, 1991), the volatile agent mostly used for induction of anaesthesia (Vickers *et al.*, 1984). Meanwhile, a parallel interest has been working to develop a theoretical ideal agent which would have a low solubility in blood to allow for rapid equilibration between delivered concentration and the effect site in the central nervous system, facilitate rapid induction of anaesthesia and permit rapid recovery at the end of anaesthesia. This newly introduced anaesthetic agent is sevoflurane which is the first inhaled agent to rival halothane as the anaesthetic of choice for children (Piat *et al.*, 1994; Lerman, 1995; Smith *et al.*, 1996). Despite this suggestion, it still seems difficult to understand why sevoflurane is recommended for paediatric anaesthesia. The present study therefore will now examine several investigations on anaesthetic in some details.

Halothane is the main drug used for inhaled induction of anaesthesia in children because it allows rapid and smooth induction compared with the other anaesthetics (Piat *et al.*, 1994). However, it is pungent and produces airway irritation which may cause considerable discomfort, especially in children (Cook, 1989). In contrast, sevoflurane, a new inhaled anaesthetic, is pleasant-smelling and relatively non-irritating to the airways and also permits a high inspired concentration to be inhaled without discomfort (Yurino & Kimura, 1993; Doi & Ikeda, 1993; Taivainen *et al.*, 1994; Smith *et al.*, 1996). An absence of pungency recommends the use of sevoflurane for a rapid induction of anaesthesia by inhalation (Eger, 1993). It does not induce the cough reflex and is therefore a good candidate for inhaled induction of anaesthesia in children (Green, 1995).

Several studies have compared sevoflurane with halothane in paediatric patients. In these studies, the lower blood solubility of sevoflurane was reflected in faster induction times (Taivainen *et al.*, 1994; Epstein *et al.*, 1995; Greenspun *et al.*, 1995) and faster recovery (Levine *et al.*, 1993; Piat *et al.*, 1994; Sarner *et al.*, 1995). Naito *et al.* (1991) compared sevoflurane with halothane, in a mixture of nitrous oxide and oxygen, for induction and maintenance anaesthesia of 30 unpremedicated paediatric ambulatory patients aged 1- to 7-years. The anaesthesia was maintained without tracheal intubation. They reported that significantly faster emergence was observed with sevoflurane compared with halothane ($p < 0.01$) and recovery time with sevoflurane was also significantly shorter than with halothane ($p < 0.01$). However, vomiting after recovery was observed in two children in the halothane group and one in the sevoflurane group.

As vomiting is a cause of delayed discharge from the recovery room, the authors suggested it would be an advantage to use sevoflurane in paediatric ambulatory patients. Unfortunately, they did not state the incidence of the use of post-operative analgesics of these patients. Post-operative pain, restlessness and agitation seemed to be greater in the children anaesthetised with sevoflurane.

There has been an increasing interest in the analgesia effect of sevoflurane. Piat *et al.* (1994) compared induction and recovery characteristics of sevoflurane and halothane in 34 paediatric patients under 10 years of age who were scheduled for minor surgery of less than 3 hours. They found no differences in the mean duration of induction between groups but recovery was significantly quicker with sevoflurane than halothane ($p < 0.01$) and was considered by the investigators to be a clinical benefit. As a regional block was used to provide preoperative analgesia in this study, pain might occur rapidly in the recovery room if this technique was not used.

Binstock and colleagues (1994) evaluated the induction and recovery in 525 paediatric ambulatory patients anaesthetised with sevoflurane or halothane in a mixture of nitrous oxide and oxygen. They reported that sevoflurane patients had statistically significant shorter mean times to induction and recovery, compared with halothane patients. Moreover, the authors also found that when sevoflurane was used there was shorter mean time to children's first post-operative analgesic compared with children anaesthetised with halothane.

Although the low blood solubility of sevoflurane facilitates a rapid elimination, sudden recovery may precipitate acute pain. It has been suggested that post-operative analgesic should be administered where pain is anticipated because recovery from sevoflurane is so rapid and complete, otherwise the child may suffer from pain (Lerman *et al.*, 1994; Lerman, 1995). Whereas most findings on the clinical properties of sevoflurane are robust, it has not shown that these findings may apply to the psychological benefit of the child-patient. To the present investigator's knowledge there are no studies which have examined the relationship between children's dental anxiety and anaesthetic agent.

Furthermore, the comparison of post-operative analgesic effect between sevoflurane and halothane has not yet been discussed. Proper selection of anaesthetic agents is considered as the key to the success of general anaesthesia (Pandit & Green, 1994). With these considerations in mind, the fourth purpose of the current experiment is to compare the anxiety changes in children between sevoflurane and halothane administration.

In summary, this experimental study will make a further investigation into the relationships between children's intelligence quotients, previous experiences and their self-reported dental anxiety in relation to treatment under general anaesthesia. Furthermore, it will offer the opportunity to study the benefit of the informative leaflet in terms of reducing anxiety in both parent and child. Another issue is the possibility that the influence of different anaesthetic agents, sevoflurane and halothane, is causally related to the development of anxiety in children. Therefore, this is an important step towards improving our ability to understand such anxiety-provoking anaesthesia situation.

3.2. Aims of the research

Therefore, this research has the following three aims:

3.2.1 To examine the relationships between a child's intellectual level, previous experiences and his/her dental anxiety.

3.2.2 To investigate the effect of the informative leaflet about anaesthetic procedure, bleeding prevention after extraction and pain management on parental and children's anxiety. It is hypothesized by the present investigator that the provision of the leaflet would have the advantage of reducing anxiety in parents. From this result, it is further

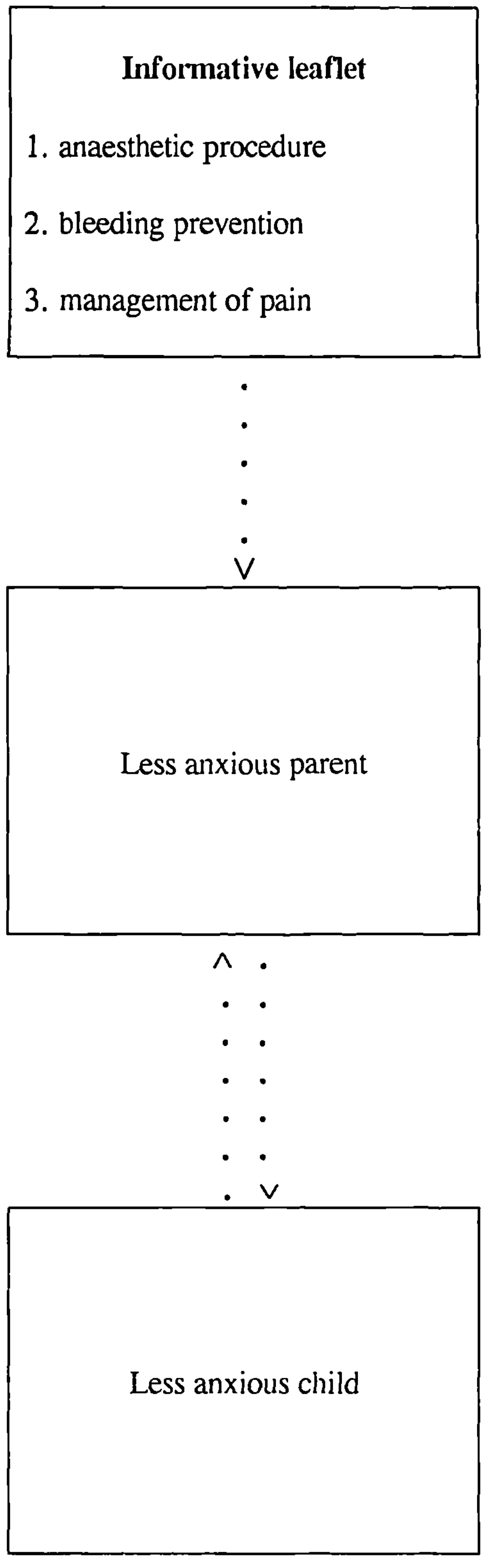

Figure 3.1 Proposed model to explain the effect of informative leaflet on child's dental anxiety

speculated that the child's distress would also be reduced. Such a model should allow the reader to see how the informative leaflet interacts with parent and child. The model is shown in Figure 3.1.

3.2.3 To investigate the influence of sevoflurane on children compared with halothane.

3.3 Criteria for inclusion into the research

Three broad criteria for inclusion in this present research are applied.

First, children aged 5-to 8-years are specifically chosen because Inhelder and Piaget (1958) suggested that during the intuitive period between age four to seven years, children could give reasons for their actions and beliefs, although their thinking depended on immediate perceptions rather than mental representations of the relevant concepts. Furthermore, the highest fear-scores had been reported in younger children (ages six and seven), a trend noted by Johnson and Melamed, and decreased thereafter with nine-to-eleven-year olds levelling off (Johnson & Melamed, 1979). Many studies considered age seven to be a transition point between intuitive stage and the concrete stage of intellectual development (Corkey & Freeman, 1994). White (1970) suggested that the five to seven years of age period is a time of combining maturational development and environmental influences which produces a higher level of function. Melamed *et al.* (1975a, 1975b) found that seven years of age is a primary determinant of when and how to present medical and dental information to children. The younger children benefitted more from immediate preparation at the time of the actual treatment. These studies would appear to support the position that age should be an important consideration in deciding when a child should be prepared for surgery (i.e. immediately before or some days previously).

Secondly, in order to reduce individual variation, children with special needs or severe medical problems are excluded, as their reaction to dentistry might be affected by medical experiences or extra difficulties with treatment.

Thirdly, only children with a referral letter are included in the study. Children who have no referral letter from their general dental practitioner are excluded from the study. This exclusion criterion has two purposes: (a) to prevent children who are being seen as emergency patients and who will therefore have little opportunity of forewarning of treatment procedures being included, and (b) to encourage a more homogeneous sample including children where the parent is aware that their child is about to receive extraction of a tooth or teeth with the aid of general anaesthesia.

One of the most difficult areas of anxiety research on children is the question of which measurement should be used in assessing a child's anxiety. More specifically this is the question of how does assessment differentiate best, or how does assessment reasonably distinguish children between various degrees of dental anxiety?

There are many approaches to the observation and evaluation of clinical research, so that one of the major technical problems of the present investigator is that of choosing the most suitable approach (The literature review on the assessments of dental anxiety in children has been summarized in the Appendix 1, page 282). Therefore, the distinctive quality of the area of investigation has brought us questions of reliability and validity of the measurements. These are terms which as a rule have fairly clear meanings in the scientific research.

It is the purpose of this present research to develop data which is both reliable and valid. For to state that one has validity in the context of the use of that term as a property of a set of data is to assert that one's data is relevant to the process of anxiety which is under this present investigation. Reliability in a set of data implies a relative constancy, precision or repeatability of the measurements and conveys dependability (Armitage & Berry, 1987).

The foregoing account suggests that the precision in successive observations is entirely a matter of the consistency of the assessment in relation to the child and process of dental anxiety which itself remains unchanged throughout the sequence of observations which are made on it. Therefore, the following two pilot studies are designed to draw attention to aspects of reliability and validity testings on certain assessments of a child's dental anxiety, so as to clarify the contribution of these scales to the present study.

To summarise: the proceeding chapter will discuss, in particular, specific measurements of children's behaviour in the operating theatre, the contribution of standardised and quality tests; the validity of test findings; and the stability, as well as the predictive value of these tests.

CHAPTER 4

THE PRELIMINARY STUDY ON THE DEVELOPMENT OF THE ASSESSMENTS OF CHILD'S BEHAVIOUR IN THE OPERATING ROOM

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CHAPTER 4

THE PRELIMINARY STUDY ON THE DEVELOPMENT OF THE ASSESSMENTS OF CHILD'S BEHAVIOUR IN THE OPERATING ROOM

4.1 Introduction

As stated in Chapter 3, the measurements related to children receiving dental treatment such as extraction under general anaesthesia will be mentioned, as the purpose of this chapter is to design and help validate some associated measures of children's reactions to dentistry. Accurate assessment of dental anxiety is necessary not only to determine its prevalence and impact, but also to overcome the problems related to individual diagnosis and treatment (Swallow & Sermet,1972; McGrath, 1986, Stouthard *et al.*, 1995).

In recent years several studies were conducted to determine the prevalence and aetiology of dental fear in children. The methods for assessing child dental anxiety have included measures such as behavioural ratings, physiological measures, and self-report measures (see review in Appendix 1, page 282). However, behaviour observation is a method widely used in research on children's anxiety of dental treatment and its usefulness as a research tool has been demonstrated (Ter Horst & De Witt, 1993). Although dentists can evaluate the children's behaviour or make a consistent assessment of their fear levels (Veerkamp *et al.*, 1995), a study on dental anxiety in children who have tooth extraction under general anaesthesia also requires an evaluation by independent observers such as the anaesthetist and nurse.

The present investigator is interested in observing the child's responses to treatment for the purpose of describing clinical phenomena and monitoring behavioural change. However, one factor in selecting the observers is the accessibility of the observers to the child's behaviour in the operating theatre where the extraction under general anaesthesia is performed. Not only are the anaesthetist and nurse in contact with the child's behaviour as it occurs, but they also have experience and scientific knowledge that make them the appropriate independent observers in this present research.

A question might be raised at this point: what is the importance of behavioural observation on children in the operating room? An initial hypothesis put forward was that this observational data could be used for evaluation on the relationship between anaesthetic procedure and the child's postoperative dental anxiety. For example, in the early study on the child's experience of unconsciousness, Bothe and Galdston (1972) investigated child's anxiety in the immediate perioperative period. They studied 50 children, aged 4 to 14 years of age, who were anaesthetised for elective surgery. They interviewed the children upon admission to the hospital, prior to induction of anaesthesia, and after surgery. In the study, interactive children who appeared at ease experienced no perioperative behavioural difficulties, whereas "quiet" and "anxious" children were more apt to experience difficulties with anaesthetic induction (14%) and/or emergence (10%) from anaesthesia. When asked subsequently what had caused them to go to sleep, about half reported "gas" or "mask", about one quarter indicated the premedication while the other quarter could give no explanation. When asked to relate the events leading up to induction, none of the five children with emergence delirium could recall the pre-induction events in the operating theatre. The authors concluded that in these children, preoperative anxiety precipitated postoperative repression. The results of this study have shown that certain measures for the child's behaviour during and after general anaesthesia procedure are important for the prediction of child's anxiety and postoperative behaviour.

The importance of perioperative observation was also illustrated in the recent study by Lumley *et al.* (1993). In order to predict children's presurgical anxiety, the authors asked the anaesthetists to rate the child's co-operation with the induction procedure. The results from the study have shown that the estimate by the anaesthetist was a significant factor in predicting anxiety in children prior to surgery. To the present investigator's knowledge, however, no behavioural measure has been employed by nurses.

Again, the reader might have a question: why do we need the observations from both the anaesthetist and dental nurse? It is the judgement of the anaesthetist and nurse that the present author regards as the source of valid instrumentation. Their prior experiences seeing a lot of children in the surgery themselves, made them, through training, able to assess children well and in a valid way. In addition, for a comprehensive assessment of anxiety, it is important to have the views of a number of observers such as the anaesthetist and nurse as examples of how to improve the present investigator's assessments and observations of children's behaviours.

Therefore, the main feature of this study is the introduction of ratings of the child's co-operation by the anaesthetist and dental nurse, in order to understand the processes that lead to children acquiring dental anxiety during the extraction under general anaesthesia procedure. Most studies examining child's dental anxiety have used data from either the dentist or psychologist as the observer. Therefore the pilot study I was designed to develop suitable measures, for the anaesthetist and dental nurse, to rate the child's distressed behaviour when he/she was anaesthetised to have tooth extraction, and after awakening. The new measurements included:

1. **Rating of Co-operation by Nursing staff**
2. **The Anaesthetist's Rating of Co-operation**
3. **The Nurse's Rating of Recovery**

However, a number of studies have emphasised in their work on the development of measures that the crucial factors in designing measurements of child's dental anxiety are reliability and validity (Cuthbert & Melamed, 1982; Parkin, 1988; Parkin, 1989; Alwin *et al.*, 1991; Alevasalo *et al.*, 1993; Klingberg & Hwang, 1994; Hosey & Blinkhorn, 1995). A highly reliable method of observation is one which pertains to the degree of agreement between observers whereas its validity can be regarded as the extent to which the observations which it generates are relevant to the purpose of the research to which it is administered (Hersen & Bellack, 1984).

As behavioural assessment in this clinical research is based to a great extent on the conceptual ability and clinical intuitiveness of the assessors, it is questionable whether the assessment procedures focusing on the child's behaviour would differ from study to study and such procedural variations would make a difference. In this regard, the investigation on the reliability and validity of these assessment procedures is clearly needed. Only after such investigation is done can the present author hope to develop standardised measures that, in turn, would allow for clearer evaluation of research findings across outcome studies. Furthermore, these standardised assessments, the Rating of Co-operation by Nursing Staff, Anaesthetist's Rating of Co-operation and Nurse's Rating of Recovery, will provide the present author with the comprehensive data needed to assess clinically meaningful behavioural change in children.

In the first part of the pilot study I, the reliability and validity of instrumentations for assessing children's behaviour during perioperative period, the Rating of Co-operation by Nursing Staff and the Anaesthetist's Rating of Co-operation, are described. In the second part, after the children recovered from being anaesthetised, the process of development of the Nurse's Rating of Recovery and testing are demonstrated. The results from these children in the pilot study I are excluded from the proceeding investigation in Chapter 6.

PILOT STUDY I

All children who took part in this pilot study had the same criteria as described in Chapter 3.

4.2 Part 1

4.2.1 Aim

To design, and assess the reliability and some evidence for validity of the ratings of child's behaviour during the perioperative period by the nurse and anaesthetist:

Rating of Co-operation by Nursing Staff and Anaesthetist's Rating of Co-operation.

4.2.2 Participants

The subjects were 225 children. The sample characteristics for this group of children are presented in Table 4.1.

4.2.3 Measures

The following measures were designed to observe distressed behaviour in children while they attended to have treatment.

1. The Rating of Co-operation by Nursing Staff (Figure 4.1)

   This scale was to be completed by dental nurses. It consisted of three criteria referenced ratings focusing on the preparatory process leading to the gas induction procedure, when the child (a) met the nurse in the examination room, (b) entered the operating room and (c) waited on the chair for the mask presentation.

2. The Anaesthetist's Rating of Co-operation (Figure 4.2)

   This measure used a single seven category Likert rating which focused on the child's reaction to the induction procedure. This scale was modified from a scale by Lumley *et al.* (1993). The anaesthetist rated the child's overall

Table 4.1 Sample characteristics for total subjects

	Boys	Girls	Overall
N	114	111	225
%	50.7	49.3	100
Age mean	6.20	6.11	6.16
Standard deviation	1.13	1.13	1.13
	Age years	**Number**	**%**
	5	90	40
	6	48	21.8
	7	49	21.8
	8	38	16.4
	Total	**225**	**100**

Figure 4.1. Rating of Cooperation by Nursing Staff

very uncooperative **very cooperative**

-3	-2	-1	0	1	2	3
Uncontrollable crying	Crying	Slightly tearful	Looks worried	Looks slightly worried	Occasional smile	Smiling
-3	-2	-1	0	1	2	3
Needs to be carried in. Verbal and physical protesting	Needs to be carried in but without protest	Requires considerable persuasion to enter GA room which he/she does eventually	Needs gentle persuasion to enter GA	Needs to be led into GA room	Willingly goes into GA room	Eager to go into GA room
-3	-2	-1	0	1	2	3
Will not sit in chair while unanaesthetised	Sits in chair with much persuasion and physical restraint	Sits in chair with some persuasion and minimal restraint	Sits in chair with parent holding hand and constant verbal reassurance	Sits in chair but requires parent to hold hand	Sits in chair unaided but insists on parent being present in room	Sits in chair unaided and happy for parent to leave the room

Figure 4.2 The Anaesthetist's Rating of Co-operation

		Very Uncooperative		**Neutral**		**Very Cooperative**		
EXTREMELY UNCOOPERATIVE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**EXTREMELY COOPERATIVE**
			Fairly Uncooperative		**Fairly Cooperative**			

co-operation with the induction procedure on a 7-point scale (extremely unco-operative to extremely co-operative).

4.2.4 Instructions to anaesthetist and nurse before observation

All anaesthetists (n = 5) and nurses (n = 5) were invited to take part in this present research and the purpose of the measures was explained. The conditions under which the observations are made with respect to the items on the measures and the corresponding set of definitions were given to each anaesthetist and dental nurse.

4.2.5 Procedure

Data collection for children was conducted by the anaesthetists and nurses. On the day of treatment, parent and child presented to the examination room where a nurse interviewed them about the child's medical and dental history, and observed the child's reaction. Following the examination, the parent and child entered the operating room together. No child in this study was separated from his/her parent where he/she was given general anaesthesia via mask induction.

Assessment by nursing staff occurred in three phases. Phase 1 started when the child was in the examination room. Phase 2 began when the child entered the operating room until the child reached the dental chair. Phase 3 began when the child was on the chair. A child's distress score in each phase was the sum of the ratings for observed behaviours.

Examination Room		**Operating Room**		**Recovery Room**
• Rating of Co-operation by Nursing Staff (Phase 1)	→	• Rating of Co-operation by Nursing Staff (Phase 2 and 3) • Anaesthetist' s Rating of Co-operation	→	• Nurse's Rating of Recovery

Figure 4.3 Model of behavioural measures administration

For the anaesthetist, behaviour assessment began when the mask was brought into the child's view for induction and the child began to inhale the anaesthetic. The observation ended when the child was unconscious. The anaesthetic used was nitrous oxide and halothane mixture. The anaesthetist rated the child's co-operation with the foregoing procedures after the child was induced. The researcher also assessed the child's behaviour using the same measures used by the anaesthetist and the nurse. The model of assessments administration is shown in Figure 4.3.

4.2.6 Data analysis

The Spearman's correlation coefficient was used to assess validity, and the inter-rater agreement was chosen as a measure of reliability of the three newly designed assessments. The correlations were 2-tailed significance unless otherwise stated. The data was analysed using SPSS for Windows version 6.0.

4.2.7 Results

Correlations between the present investigator and anaesthetists and nurses are presented in Table 4.2. The correlational analysis showed a strong relation between the present investigator and each anaesthetist and each nurse. Subsequent analysis indicated that the anaesthetists' and nurses' scores were all significantly correlated to the present investigator ($r_s = 0.82$ and 0.8 respectively). However, the correlation between the Rating of Co-operation by Nursing Staff and the Anaesthetist's Rating of Co-operation was not as high as the correlations found between the investigator and both the anaesthetist and nurse. (r_s = 0.42).

The inter-rater agreement of the anaesthetist's and nurses's scales to the investigator was quite high: 0.76. For most other studies, internal consistency (Cronbach's alpha between 0.70 and 0.80) has been considered as being satisfactory (Stouthard *et al.*, 1995).

4.2.8 Discussion

In this study, the observational measures, the Rating of Co-operation by Nursing Staff and the Anaesthetist's Rating of Co-operation, assessing dental anxiety in 5-to 8-year-old children have been described. Before accepting a straightforward interpretation of these results, it is appropriate to consider the statistical definitions of reliability and validity.

For reliability, the statistical coefficient is calculated directly by means of a Pearson Product-Moment correlation/Spearman's correlation. The resulting correlation can be interpreted as the proportion of variance in the measure that is reliable (Sechrest, 1984). In this study, Spearman's correlation is preferred. The correlations calculated indicate that both measures appeared to be reliable for measuring child's dental fear.

Calculated interexaminer agreement also indicated that the newly designed measures are reliable. In other words, the finding of high inter-rater agreement between the present investigator and observers suggested that the Rating of Co-operation by

Table 4.2 Spearman's correlations between the investigator and anaesthetists and nurses

		Investigator r_s	n
Anaesthetist	1	0.92	34
	2	0.86	65
	3	0.83	43
	4	0.77	53
	5	0.81	30
Total for all anaesthetists		**0.82**	
Nurse	1	0.84	58
	2	0.82	39
	3	0.77	40
	4	0.79	46
	5	0.68	42
Total for all nurses		**0.80**	

Note: All correlations statistically significant at $p < 0.001$

Nursing Staff and the Anaesthetist's Rating of Co-operation can easily be administered with similar results by different nurses and anaesthetists, provided they have been trained.

Although a reliability coefficient represents the limitation on the validity of a measure because the maximum validity of the measure is the square root of the reliability, this does not mean that it will have validity that high, only that it could (Sechrest, 1984). All of the correlations are positive and high (all but one of the correlations were above 0.75) showing that there is good agreement between the investigator, anaesthetists and nurses which demonstrates one aspect of validity.

4.3 Part 2

4.3.1 Aim

This part of the pilot study I will concentrate on assessing the reliability of the Nurse's Rating of Recovery assessment.

4.3.2 Participants

The subjects were a new group of 53 children.

4.3.3 Measure

The Nurse's Rating of Recovery (Figure 4.4) was a 7 point Likert scale (1 = bad, 7 = good) designed for assessing the degree of emergence from anaesthesia in children.

4.3.4 Instructions to nurse before observation in the recovery room

The purpose of this assessment was explained to the nurses (n = 5) before they conducted their observations on children's behaviour in the recovery room. The list of reasonable length, accompanied by some examples of the processes involved at specified level 1 to level 7 was given to secure a meaningful validity and reliability in the measure of this present study (Figure 4.4). The nurse rated the child's overall recovery for post-operative restlessness, agitation, and responding to comfort.

4.3.5 Procedure

After awakening, the child was transferred to the post-operative recovery room and cared for by the nurse with the parent present. The recovery score was given by the nurse when the child was ready to be discharged. The observation was also conducted by the researcher who employed the same behavioural scale.

4.3.6 Data analysis

The same strategy of analysis was adopted for the investigation on the reliability and validity of the assessment of the child's recovery, as in part 1 of the present pilot study.

4.3.7 Results

The correlations between the present investigator and each nurse are presented in Table 4.3. Further analysis also indicated that the rater-agreement between the investigator's and nurse's ratings of child's recovery was quite high ($r_s = 0.82$, $p < 0.001$).

4.3.8 Discussion

The correlation between the investigator's and nurses' ratings of the child's recovery was strong, which suggests that the present study offers reliability support to this measure. Ideally, the process of recovery from anaesthesia involves many factors, including the restoration of normal body temperature, the return of reflexes and of neuromuscular function, the ability to maintain a patent airway without dependence or any mechanical device and the re-establishment of adequate spontaneous ventilation, in addition to the regaining of consciousness, as described by Cook (1989). However, the children undergoing dental extraction under general anaesthesia do not need tracheal intubation. Therefore, several issues, as the results from intubation procedure (i.e. patent airway), are not included in the criteria of recovery

Figure 4.4 The Nurse's Rating of Recovery

BAD	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**GOOD**

Score	Description
7	Calm, Not crying
6	Drowsy, Not crying
5	Drowsy, Crying a little but responding to comfort
4	Drowsy, Crying a little, Not responding to comfort
3	Crying a lot, Mild agitation but responding to comfort
2	Restless, Moderate agitation, Not responding to comfort
1	Thrashing, Severe agitation, Not responding to comfort

Table 4.3 Spearman's correlations between the investigator and nurses

	Investigator	
	r_s	**n**
Nurse 1	0.70	9
2	0.80	11
3	0.79	11
4	0.80	10
5	0.81	12

Note: All correlations statistically significant at $p < 0.05$

in the present study. The result seems to indicate that the recovery score rated by nurse is not an artifact of the assessment but it shows how the scale adequately represents the domain of the situation to which the approach on child's behaviour is to be generalized, even its lack of relation with unrelated scales.

It seems that the present investigator's contributions to progress in the study of child's dental anxiety, in a general anaesthesia situation, depend to a great extent on the data from observational measurements assessed by the anaesthetist and nurse. Nevertheless, it is possible that such data might reveal new hypotheses to the dentist; and what is more important, it is likely that these measurements might provide the dentist with the means of evaluating the influence of the anaesthetic process.

Over the years, those who have conducted research in a surgical setting have been fully aware of the problems involved such as the accuracy of the measures, and limitation of time for observation. However, it has been shown in the present study that the observation measured by anaesthetist and nurse have many advantages including clear-meaning and short-time assessing. Furthermore, the Anaesthetist's rating of Co-operation can be used to predict children's behavioural distress at perioperative period, as reported by Burns *et al.* (1992) and Lumley *et al.* (1993). However, the research literature on the topic of observation by operating-room staff contains few studies and to the present investigator's knowledge, none has offered any evidence on behavioural assessment by nurse.

In summary, the present research has found that the ratings of child's behaviour by the nurse and anaesthetist: Rating of Co-operation by Nursing Staff, Anaesthetist's Rating of Co-operation and Nurse's Rating of Recovery, are reliable and valid measures to assess the child's response to extraction under general anaesthesia. In the literature review, the perioperative behavioural studies of children consistently demonstrate that children are at great risk of experiencing turbulent anaesthetic procedure and adverse behavioural sequelae (Bothe & Galdston, 1972; Morgan *et al.*, 1981). Little is known about the course and duration of adverse behaviour following general anaesthesia. In other words, no research has demonstrated that traumatic anaesthetic procedure in children causes long-term psychological anxiety.

Another issue, however, pertains to the goal of testing the reliability of the measures. If the undesired influence of general anaesthesia is disruptive behaviour from the child before and during anaesthetic induction, then the pilot study suggests that self-report measure is needed in order to assess the nature and degree of this behavioural problem. For purposes of basic research, direct measurements of behavioural phenomena taken independently of child's self-report would also be required for an application of the present investigation on dental anxiety in children (Tasto, 1977). Therefore, the next chapter will be examining the reliability and validity aspects of some self-report measurements pertaining specifically to children, as it is important to study the child's responses for the assessments selected in order to improve the quality of the data obtained.

CHAPTER 5

THE PRELIMINARY STUDY ON CHILD'S AND PARENT'S SELF-REPORT MEASURES

CONTENTS

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CHAPTER 5

THE PRELIMINARY STUDY ON CHILD'S AND PARENT'S SELF-REPORT MEASURES

5.1 Introduction

As reviewed in Chapter 2, it is the purpose of the present investigator to develop assessments of child's dental anxiety which may represent the influence of a variety of factors in addition to the level of anxiety. In the previous pilot study I, the behavioural measures assessed by anaesthetist and nurse have been demonstrated to be valid and reliable for the present research. Since behavioural measures do not reveal how children feel in the stressful settings, it has been suggested that a better way to assess child's anxiety is to combine self-report measures with the behavioural observations (Campbell, 1984).

For example, a combination of observational and self-report measures was taken by Alwin, Murray and Britton (1991) when they investigated children's behaviours in a dental surgery. Observations were made from a videotape taken while the children were undergoing treatment. Children completed the Child Manifest Anxiety Scale and Venham Picture Scale for ratings of trait and situational fear respectively. The video and self-report data showed that anxious children not only felt more fear, but tended to express disruptive behaviours compared with less-anxious children in the study. The children in the study were aged between 6 and 18 years and positive correlation across these different types of measurements was demonstrated. The authors do draw attention to the fact that taking child's anxiety measures from self-report and behavioural assessments can reflect both the cognitive component and overt signs of child's anxiety.

For the present research, in addition to obtaining information on the behavioural observations by anaesthetist and nurse, it is useful to discover how the child views himself/herself. There are two major types of information on dental anxiety one wishes to obtain from an interview with a child: (1) degree of **trait anxiety** that the child experienced during recent exposure to a variety of dental situations and (2) degree of **state anxiety** that the child feels in response to the specific situation. Therefore, a number of anxiety assessments currently available is a reflection of the ways in which child's dental anxiety has been operationally defined. These self-report clinical measures have taken the form of picture tests and, more commonly, anxiety rating-scales (Borkovec *et al.*, 1977).

Therefore, the pilot study II was designed and conducted in order to select appropriate assessments to obtain the child's description of his/her feeling regarding to the dental situation and specific situation such as extraction under general anaesthesia. Three different measures were selected: (1) the Modified Children's Dental Anxiety Scale (MCDAS: Humphris *et al.*, 1991), (2) the Venham Picture Scale (VP: Venham *et al.*, 1977; 1980) and (3) the State-Trait Anxiety Inventory for Children (STAIC: Speilberger, 1975).

Although the progress which has been made with these scales appears to show good reliability and validity relative to other assessment approaches, these child self-report measures do not provide clear age norms. In short, it is unlikely that questions appropriate for a 18 year-old are also appropriate for a 5 or 6-year-old or that very young children can reliably report much of the information sought on these assessments.

To summarise, it is the point of interest whether the MCDAS, the VP and the STAIC could be used with children aged 5 to 8 years in the present study. The information about reliability and validity of the three scales will be described further in the following subsection of assessments of child's anxiety. As children are always accompanied by parents and it is often necessary to obtain from parents detail regarding anxiety problems as well as the medical and dental history of the child, so the pilot study II investigated the issue of interviewing parents as well.

The parental interview has a number of purposes, primarily the identification of dental anxiety in children and also the assessment of parent's anxiety in the dental situations. Regarding the second point, bringing a child in for dental treatment is likely to be stressful for most parents (Milgrom *et al.*, 1992). In the present study, this stress was expected to be even more pronounced. First, some parents still expressed concern about the child's failing to wake up or developing systematic complications after anaesthesia induction (Watcha & White, 1995), and second, as the child was not allowed to have any fluid or food intake for several hours before treatment, parents might also refrain from eating (Vassey *et al.*, 1994). The physiological consequence of fasting might amplify the stress experienced by parents. The researcher was concerned about the impact of brief encounter from many questions on parental stress level and, therefore, conducted this pilot study in order to develop the detail of quickly administering the questionnaire.

As discussed in the second chapter, section 2.3.1.d, one may understand and predict a child's dental behaviour through the parental attitudes towards dentistry. However, the question of the validity of the parent's report on the child's behaviour and anxiety was acknowledged and a number of researches have referred to this problem (Shaw, 1975; Dasanayake *et al.*, 1995). Despite this, the memory of parents has been accepted as reliable because of their great amount of contact and influence with their child (Milgrom *et al.*, 1994).

Therefore, the baseline data in the pilot study II came from the assessments of parents that used the Corah's Dental Anxiety Scale (CDAS: Corah, 1969) and the Modified Dental Anxiety Scale (MDAS: Humphris, 1981; 1984). Both scales have been acknowledged as useful for assessing adults' anxiety. The reliability and validity of these scales will be described further in the following subsection of assessments of parental anxiety.

In this pilot study, the primary purpose was to investigate the reliability.and validity of the state and trait anxiety measures in children aged 5 to 8 years by means of self-report. A secondary purpose was to develop a method of assessing parents which measured their dental anxiety as well as their view of their child's dental anxiety.

PILOT STUDY II

5.2 Aims

To develop a method of assessment and assess the reliability and some evidence for validity of the self-report measures for child and parent: Modified Children's Dental Anxiety Scale, Venham Picture Scale, State-Trait Anxiety Inventory for Children, Corah's Dental Anxiety Scale and Modified Dental Anxiety Scale.

5.3 Participants

The participants in this pilot study consisted of 50 children and their parent/guardians. The children met the criteria as described in Chapter 3. The distribution by gender and age is presented in Table 5.1.

5.4 Assessments

5.4.1 Assessments of Child's Anxiety

Three self-report measures were administered to the children to assess anxiety: the Modified Children's Dental Anxiety Scale, the Venham Picture Scale and the State-Trait Anxiety Inventory for Children.

Table 5.1 Children involved in the study broken down by gender and age.

	Boys	Girls	Overall
N	26	24	50
%	52	48	100
Age Mean	5.9	6.3	6.1
SD	1.13	1.13	1.13

	Years	N	%
Age Group	5	20	40
	6	14	28
	7	7	14
	8	9	18
	Total	**50**	**100**

5.4.1.a The Modified Children's Dental Anxiety Scale (MCDAS: Appendix 2, page 289)

This scale has been developed for children and well tested (Humphris *et al.*, 1991). The reliability of the scale has been reported for 9-,12-and 15-year-old children with substantial sample sizes (n=840): internal consistency = 0.70, 0.77 and 0.84 for the age groups, 9,12 and 15 years respectively and test-retest =0.84 (n=42), 0.76 (n=32) for age groups 9 and 12 years. It is an assessment of 7-item rating scale with 5 categories with verbal anchors at each end, namely: 1= relaxed and 5= very worried. Results from previous work on a group of 6- to 15-year-old children have been reported to support the scale's construct validity and reliability (Phinainitisatra, 1993). The scale consists of questions about child's general attitudes (trait anxiety) to a dental visit and to dental care such as examination, scale and polish, injection, restoration, extraction and general anaesthesia.

5.4.1.b The Venham Picture Scale (VP: Appendix 2, page 290)

The scale is easy to administer, and has been well tried and tested on young children, 2- to 5-years of age (Venham, 1979). It provides a measure of situational anxiety (state anxiety) and is composed of eight pairs of cartoon style drawings of a child attending the dentist. The child was asked to choose one figure from each pair that best expressed how he/she felt about going to the dentist. A score of 1 is recorded each time the child chose the "more anxious" of the figures in any pain. This scale has a range of 0 (no fear) to 8 (high fear).

5.4.1.c The State-Trait Anxiety Inventory for Children (STAIC: Appendix 2, page 291-292)

It consists of two parts which measure state anxiety and trait anxiety (Spielberger, 1975). This assessment of known validity and reliability has been used in previous investigations of dental anxiety (Parkin, 1988; Moore *et al.*, 1991; Toledano *et al.*, 1995).

- The State version of the STAIC (page 291) consists of 20 questions designed to ascertain how the child feels at a particular moment. For example, the child is asked whether he/she feels "very jittery", "jittery", or "not jittery". Each response receives a weighted score from 1 to 3, with 3 representing the highest level of anxiety. Total scores are calculated by summing the weighted score for each of the 20 items.

- The Trait version of the STAIC (page 292) is a 20-item scale that asks the child to describe how he/she generally feels by choosing "hardly-ever", "sometimes", or "often" to statements such as "I feel unhappy". Each item is given a weighted score from 1 to 3. For items that reflect the absence of anxiety, scoring weights are in the reverse order. The scale ranges from 20 to 60 where 60 indicates maximal anxiety. The mean STAIC score was 16.8 (SD = 6.9).

5.4.2 <u>Assessments of parental anxiety</u>

Two measures were administered to the parents to assess their dental anxiety, child's previous dental experiences and their view of child's dental anxiety: the Corah's Dental Anxiety Scale and the Modified Dental Anxiety Scale.

5.4.2.a The Corah's Dental Anxiety Scale (CDAS: Appendix 2, page 293)

It comprises four multiple-choice questions dealing with the individual's subjective reactions about (1) going to the dentist, (2) waiting in the dentist's office for treatment, (3) having teeth drilled, and (4) having teeth scaled. Five possible answers that are rated in ascending order from "1 = relaxed" to "5 = so anxious that I sometimes break out in a sweat or almost feel physically sick" are provided. The scale ranges from 4 (no fear) to 20 (high fear). The CDAS is widely used for measuring dental anxiety and has proved to possess good validity and reliability (Corah *et al.*, 1978; Corah, 1986; Berggren & Carlsen, 1986). The internal consistency of the CDAS was 0.90 (n = 284; De Jongh *et al.*, 1995).

5.4.2.b The Modified Dental Anxiety Scale (MDAS: Appendix 2, page 294)

The scale which consists of five questions is a modification of the Corah's Dental Anxiety Scale (Humphris *et al.*, 1995). The items are very similar to the CDAS except that an extra item was included to require the respondent to give a rating of anxiety to a local injection, a major focus of anxiety for many,and a new and simplified answering scheme was devised for use with each question. The five category rating was simplified by choosing verbal anchors at each extreme of the scale: namely "not anxious" and "extremely anxious" with three intermediate positions "slightly anxious", "fairly anxious" and "very anxious". The five questions (MDAS (PANX): Q. 1-5) were administered to assess parent's dental anxiety. The reliability of this scale was found to be reasonable: internal consistency about 0.70 (n = 2,578; Humphris *et al.*, 1995).

- One question (Q.6) was asked of the parent to indicate how difficult it was bringing the child to have dental extraction with gas (Appendix 2, page 294) by using a single item category rating scale, with simplified verbal anchors at each extreme of the scale: namely "not difficult at all" and "extremely difficult" with three intermediate positions "slightly difficult", "fairly difficult" and "very difficult" as developed by Humphris *et al.* (1991).

- To assess the child's expectation of pain before the treatment (Appendix 2, page 294), the parent was asked "How much pain do you think your child will feel on this visit?" (Q.7) with five category ratings. The scale was with verbal anchors, "no pain", and "pain as bad as it could be", at the extremes (as used by Scott & Huskisson, 1976; Kent, 1984).

- Seven questions (MDAS (PCANX) : Q.8 - 14) were asked to ascertain parental view of their child's dental anxiety (Appendix 2, page 294).

- One question (Q.15) was asked of the parent to indicate the child's previous dental experience, i.e. filling, tooth extraction, scale and polish, injection, examination and being put to sleep (Appendix 2, page 294).

5.5 Overview of the study

All children (n = 50) completed the Venham Picture Scale and the Modified Children's Dental Anxiety Scale while they were in the waiting area, prior to treatment.

Of fifty parents, twenty were asked to complete the Corah's Dental Anxiety Scale and the Modified Dental Anxiety Scale (Table 5.2). The summary of measurement specifications used for dental anxiety scales for children and parent are presented in Table 5.3.

5.6 Procedure

When the child and parent/guardian attended for having tooth extraction at the Liverpool Dental Hospital, the parent gave his/her consent (Appendix 3, page 295)after a full explanation of the study. The parent was then asked to complete the CDAS and the MDAS to collect data of parent's dental anxiety, child's previous dental experiences and child's dental anxiety (from parent's view).

Table 5.2 Assessments

Subject	Number	Assessments
Children	50	* Modified Children's Dental Anxiety Scale * Venham Picture Scale
Parent +	20	* Corah's Dental Anxiety Scale. * Modified Dental Anxiety Scale.

Note: + The 20 parents were drawn from the child (n=50) sample.

Table 5.3 Summary of measurement specifications used for dental anxiety scales for child and parent

Description	Variable Name	No. of Questions	Question number in questionnaire
Child's assessments			
Modified Children's Dental Anxiety Scale	MCDAS	7	Q1-7
Venham Picture Scale	VP	7	Q1-8
Parent's assessments			
Corah's Dental Anxiety Scale	CDAS	4	Q1-4
Modified Dental Anxiety Scale (For parental dental anxiety)	MDAS(PANX)	5	Q1-5
Modified Dental Anxiety Scale (For parent's view of their child's dental anxiety)	MDAS(PCANX)	7	Q8-14

During completion of the questionnaires, the present investigator showed the child the VP, which was a series of pictures, and asked the child to point to the picture that "looks most like the way you feel now". The child was also asked to complete the MCDAS. Both the VP and the MCDAS were presented to the child on the flip charts. It was attempted to give the STAIC to the children. It was emphasised that should any problem occur the children should feel free to ask for help.

In all cases, the administration of assessments was conducted preoperatively in the clinical waiting room. It took up to 10 minutes for parent and child to complete the questionnaires.

5.7 Statistical analysis

Simple description statistics were obtained using SPSS for Windows version 6.0. The internal consistency was chosen as the measure of reliability of the Modified Children's Dental Anxiety Scale, the Corah's Dental Anxiety Scale and the Modified Dental Anxiety Scale. The alpha coefficient, a measure of the extent of internal consistency with a range from 0 to 1 was used to determine the feasibility of scales (Streiner & Norman, 1989). The correlation coefficient between measures was used as a basis for determining validity.

5.8 Results

5.8.1 General results

Before addressing the main questions of the present investigation, some general results are presented. First, the STAIC was not answered properly by the children as it was clear that after 4 children had attempted to answer the STAIC they found it very difficult to complete. It was noted when the scale was given to the child, it had to be translated. This was because many items have wording such as: "I feel upset", "I feel pleasant" and "I am content"; and it was considered inexact and as a result raised the question as to whether the two forms of the STAIC distinguish between "state" and "trait" (Keedwell & Snaith, 1996). It was concluded that items with vague meaning would inevitably lead to further imprecision and inaccuracy of assessment of anxiety in young children. Therefore, the STAIC was withdrawn from the study.

Second, the participants in this pilot study, parent and child, showed similar patterns of self-report responses to those of earlier study. The total mean scores and standard deviations (Table 5.4) of the MDAS (PANX), MDAS(PCANX) and MCDAS were 10.70 $\pm$ 3.25, n = 20; 14.95 $\pm$ 5.70, n = 20; 13.90 $\pm$ 6.60, n = 50, respectively. These results were consistent with the previous report (Phinainitisatra, 1993) on the same scales [MDAS (PANX): 14.60 $\pm$ 4.89, n = 51; MDAS (PCANX): 17.26 $\pm$ 7.02, n = 51; MCDAS: 13.37 $\pm$ 5.64, n = 51].

Third, to examine whether there is any relationship between dental anxiety measures, the Spearman's rank correlation was computed. The intercorrelations between scores on the different scales (Table 5.5) showed that the CDAS and the MDAS (PANX) correlated highly ($r_s = 0.87$, $p < 0.001$) and that the VP correlated significantly with the MCDAS ($r_s = 0.54$, $p < 0.001$). The analysis showed that the parent's view of their child's dental anxiety [MDAS(PCANX)] was closely related to the child's own fear (MCDAS).

Fourth, a further analysis was undertaken to examine in more detail the scale's items. The child's report of anxiety (MCDAS) on going to the dentist generally, examination, scale and polish, injection, restoration, extraction and general anaesthesia were poorly correlated with the child's VP scores (Table 5.6) except for extraction and general anaesthesia which were correlated significantly ($r_s = 0.51$, $p < 0.001$; $r_s = 0.44$, $p < 0.05$, respectively).

Correlations were also computed separately by age, and no significant correlations were found between VP score and the total MCDAS score (5 yrs r_s=0.43 n=20; 6 yrs r_s = 0.33 n=14; 7 yrs r_s = 0.84 n=7; 8 yrs r_s = 0.64 n=9).

5.8.2 Reliability and validity

The main element of reliability was investigated; internal consistency. The estimates of internal consistency as calculated by the use of Cronbach's alpha formula demonstrated high levels of reliability (Table 5.4). For comparative purposes, where

Table 5.4 Means and standard deviations of data

Scale	n	Mean	SD	Cronbach's Alpha
MCDAS	50	13.90	6.60	.79
VP	50	3.14	3.43	
CDAS	20	8.05	2.09	.67
MDAS (PANX)	20	10.70	3.25	.73
MDAS (PCANX)	20	14.95	5.70	.82

Table 5.5 Spearman's correlations between dental anxiety measures for child and parent

Assessments	MCDAS	VP	CDAS	MDAS (PANX)	MDAS (PCANX)
Child's Assessments					
MCDAS	1.00	0.54**@	-0.25	-0.07	0.32**
VP		1.00	-0.05	-0.06	0.27
Parent's Assessments					
CDAS			1.00	0.87**	-0.26
MDAS (PANX)				1.00	-0.20
MDAS (PCANX)					1.00

Note: n = 20, except @ where n = 50

** $p < 0.001$

MCDAS Modified Children's Dental Anxiety Scale

VP Venham Picture Scale

CDAS Corah's Dental Anxiety Scale

MDAS (PANX) Modified Dental Anxiety Scale (Q1-5: for parent's dental anxiety)

MDAS (PCANX) Modified Dental Anxiety Scale (Q8-14: for parent's view of their child's dental anxiety)

Table 5.6 Spearman's correlations of the child's scores between question 1-7 of the MCDAS and the VP

	VP
MCDAS	
Question 1 (How do you feel about *going to the dentist generally?)*	0.32
Question 2 (How do you feel about *having your teeth looked at?)*	0.15
Question 3 (How do you feel about *having your teeth scraped and polished?)*	0.38
Question 4 (How do you feel about *having an injection in the gum?)*	0.44*
Question 5 (How do you feel about *having a filling?)*	0.28
Question 6 (How do you feel about *having a tooth taken out?)*	0.51**
Question 7 (How do you feel about *being put to sleep to have treatment?)*	0.44*

Notes: ** $p < 0.001$

*$p < 0.05$

$n=50$

the MDAS was used as well as the CDAS in parent, it was found that the MDAS alpha coefficient was similar to if not higher than the CDAS coefficient. However, it should be noted that the sample sizes were very small (n=20), giving wide confidence intervals to the estimates derived. The concurrent validity was demonstrated, with correlation coefficient of 0.87 ($p < 0.001$) between the CDAS and the MDAS (part of the parental anxiety) and 0.54 ($p < 0.001$) between the VP and the MCDAS.

5.9 Discussion

Compared to adults, very few studies have been performed to clarify the reliability and validity of self-report measures in children. In spite of the small number of children in this present pilot study, the overall results indicated that evaluation with these self-report anxiety scales can be reliable as well as clinically useful in revealing the intensity and the development of child's dental fear.

In this study, the Modified Children's Dental Anxiety Scale (MCDAS) and the Venham Picture Scale (VP) were administered to children. The MCDAS showed high internal consistency (Table 5.4) for the sample whereas Cronbach's alpha cannot be calculated for the VP. The results suggested that the MCDAS was suitable for young children (aged 5 to 8 years) as well as for older children in the study by Humphris *et al.* (1991) and Phinainitisatra, (1993).

The low but statistically significant correlations between the MCDAS and the VP for children (see Table 5.5) provided some additional evidence for the validity of the MCDAS. The MCDAS scores were not expected to relate strongly to the VP measure but were predicted to relate to some degree (Table 5.6). This was because the MCDAS does not assess the level of anxiety to a specific dental situation, but rather a predisposition to be anxious at the dental treatment visit. Therefore, the correspondence between the child's own report of his/her anxiety at the moment while waiting for extraction treatment (VP)and the child's report of his/her general dental anxiety (MCDAS) was not great. Some children did not show their fear when they were asked how they felt about going to the dentist generally (Q.1, Appendix 2, page 289) but they expressed their anxiety by choosing the anxious child figure (Appendix 2, page 290) when they were asked how they were feeling at that time.

The concepts of state and trait dental anxiety appear to be important in discussion of dental fear measurements. State anxiety is affected by situation and does not necessarily repeat over a long period of time while trait anxiety refers to stable individual characteristics in stress proneness (Spielberger, 1975). Although the Venham Picture Scale appears to have a quality, that none of the other scales attempted to capture, for measuring state dental anxiety in children, there are also elements of trait anxiety in children's interactions with dental treatment as indicated by the present results. The Modified Children's Dental Anxiety Scale can be used to assess the child's general attitudes towards dentistry and particular dental procedures. This is an important finding, indicating that these two scales are needed for the child dental anxiety assessment.

As commented earlier, parental anxiety and report appeared important for the background history of the child. The Modified Dental Anxiety Scale (MDAS) appears to have a unique quality in assessing both parent's dental anxiety and his/her view of child's dental anxiety which, therefore, fits to the purpose of this pilot study. According to results in Table 5.5, the significant correlation between the Corah's Dental Anxiety Scale (CDAS) and the MDAS confirmed the reliability of the MDAS to assess parental anxiety, as shown previously by Humphris *et al.* (1995).

Although there were no associations between parent's dental fear [MDAS (PANX)] and the child's (MCDAS, VP) in this study (Table 5.5), the parent does have an influence on the child's dental fear for some (see review part 2.3.1.d). The MDAS was an especially useful measure of parent's dental fear due to its high internal consistency (Table 5.4) and specific item of rating of anxiety toward a local anaesthetic.

The relationship between parental view of their child's anxiety and the child's own report of dental anxiety (Table 5.5) showed that the parents were perceptive of their child's anxiety. The correlation between the parent's view of their child's anxiety and the child's own report of dental fear indicated there was some parental awareness of the child's state of mind in this situation. This finding illustrated the importance of assessment on parental view of child's dental anxiety, as the present investigator considered the possibility that the child might try to please the investigator by giving the answer he/she assumed the investigator wanted.

In summary, the Modified Children's Dental Anxiety Scale and the Venham Picture Scale have been shown to be reliable and valid self-report measures for predicting child's general attitude of dentistry and situation-specific dental fear. The combination of these properties is important for collecting data in the main study, which will be discussed further in the following chapter. Also, the Modified Dental Anxiety Scale reflects the relationship between parent's and child's dental fear.

CHAPTER 6

MAIN STUDY

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CHAPTER 6

MAIN STUDY

6.1 Introduction

As stated in the aims in Chapter 3, the purpose of this present study was to investigate the effect of parent's informative leaflet and the effect of sevoflurane/halothane administration on child's dental anxiety. The factors such as child's intellectual level and previous experiences were also examined. In Chapter 4 and 5, the preliminary studies were conducted in order to test and validate observational and self-report measures respectively before these measures were used in the present main study.

6.2 Method

6.2.1 Overview of design

The criteria of children (n = 313) were as specified in Chapter 3 (page 104). After the consent form was completed, the child and accompanying parent were asked to complete pre-extraction assessments before the treatment started. They were selected at random with respect to the provision of informative leaflet into two groups: LEAFLET group and NO LEAFLET group. Then the parent was asked to fill in another questionnaire 3 days after treatment, and post it back to the investigator.

After 1 month, the parents and children were requested to make another visit to see the dentist and to complete post-extraction assessments. The child's intellectual level was also assessed in this visit. The parents' assessment of the children's dental anxiety was noted after a further 3 months by telephone interview.

Of all the children who were anaesthetised with either sevoflurane or halothane, 126 children were allocated for the comparative study between these two anaesthetic agents. Because the administration of general anaesthetic could not be changed from one child to the next, children were processed in batches of up to half a dozen-children per anaesthetic agent, in other words, the anaesthetic agent was supplied for a session. This explains why the present research has somewhat unequal size groups of children anaesthetised with sevoflurane (SEVO group) and those anaesthetised with halothane (HALO group). It is unlikely that there could be equal numbers of children in each of the groups for sevoflurane and halothane and this is because it is difficult to predict how many children would attend every session. The child's response to general anaesthesia was assessed by the nurse and anaesthetist. The rate of emergence from anaesthesia was also scored by the nurse in the recovery room. The investigator and nurse were unaware of which anaesthetic was used during surgery.

6.2.2 Participants

Three hundred and thirteen children (Boys = 181 (57.8%), Girls = 132 (42.2%), aged 5 to 8 years (M = 6.23, SD = 1.11; age 5, n = 108 (34.5%); age 6, n = 83 (26.5%); age 7, n = 64 (20.5%); age 8, n = 58 (18.5%). The children were accompanied by 248 mothers (79.2%), 59 fathers (18.9%) and 6 guardians (1.9%).

6.2.3 Material and Measures

The following instruments were used in the present research.

6.2.3.a Informative leaflet

This leaflet (see Appendix 3, page 296) was approved by the Department of Clinical Dental Sciences and the Board of the Liverpool Dental Hospital. It was given to the parent and followed guidelines produced by Ley (1976, 1982) in that it was brief and clear. It included information about anaesthetic procedure, bleeding prevention after extraction and pain management in children (i.e. paracetamol).

The leaflet was 247 words long and spread across three columns on horizontal A4 paper. The Flesch Formula was used to calculate the readability score and it was found to be 85.86. According to the interpretation of Flesch Reading Scores, this leaflet had been described as easy to read (Ley, 1988).

6.2.3.b Measures

Each child and each parent were given measures which investigated their dental anxiety. The parent was also asked to rate the child's fear of the dentist and reported previous dental/general anaesthetic experiences of the child. Prior to conducting this study, the self-report scales were tested in the pilot study II (Chapter 5). The previous analyses supported the validity of the Modified Dental Anxiety Scale for parent (MDAS) and Modified Children's Dental Anxiety Scale (MCDAS) for child. However, the findings resulted in further minor modifications to the parental questionnaires.

(a) *Parental questionnaires*

The following scales were included in the parental assessment: the Modified Dental Anxiety Scale, the Dental Subscale of the Children's Fear Survey Schedule and the Three Days Post-Treatment Questionnaire.

(a.1) The Modified Dental Anxiety Scale for Parent (MDAS)

The assessments of difficulty in bringing the child to have a dental extraction with gas ("How difficult was it bringing your child for extraction with gas?") and the child's expectation of pain ("How much pain do you think your child will feel on this visit?") are not included in the questionnaire for this present study. It now consists of four sections (Appendix 3, page 297-298). The first is concerned with the child's dental anxiety for the treatment. The parents were asked "How worried do you think your child is about this dental visit?". As reviewed in Chapter 5, the other three parts concern parental opinion about their child's attitudes towards dental treatments, parent's dental anxiety and child's previous dental/general anaesthetic experiences.

(a.2) The Dental Subscale of the Children's Fear Survey Schedule (DS-CFSS)

Although the DS-CFSS was not piloted in the preliminary study, this scale is well known for its reliability and validation. To support the findings of the MDAS on parental view of child's dental anxiety and to relate the results to other studies reported in the literature that used the DS-CFSS, the present author elected to include this scale in the present main study.

The DS-CFSS (Appendix 3, page 298) was adapted by Cuthbert and Melamed (1982) from the Fear Survey Schedule for Children (FSS-FC; Scherer & Nakamura, 1968) in order to assess the child's fear of the dentist. It was found to be highly correlated with the FSS-FC scores ($r = 0.82, 0.87, p < 0.001$) and also with other rating scales. The parent predicted the child's responses to 15 items with 5 choices from "not afraid at all" (score 1) to "very afraid" (score 5) and an average score was obtained by dividing the aggregated score by the number of items.

(a.3) Three Days Post-Treatment Questionnaire

Each parent was handed the questionnaire (Appendix 3, page 299) and was asked to complete it 3 days after arriving home and to return it in a self-addressed, stamped envelope. It is concerned with child's reactions on the way home from the hospital (i.e. **negative** reactions: in pain, crying, distressed, vomiting, nausea and bleeding; **positive** reactions: content and drowsy), child's reactions at home (i.e. **negative** reactions: crying, sleeping, nausea, vomiting, in pain, bleeding and distressed; **positive** reactions: content, watching television, reading and playing) and use of analgesics.

(b) *Child assessments*

The following measures:

(b.1) The Modified Children's Dental Anxiety Scale (MCDAS) and,

(b.2) The Venham Picture Scale (VP)

These have been previously reviewed in Chapter 5 (page 134).

(b.3) **The Coloured Progressive Raven's Matrices (CPM; Raven et al., 1990)**

This assessment was used to assess the intellectual level of the child at the one month post-treatment collection of data. The CPM (Appendix 3, page 303) consists of 3 sets of geometrical shapes which were presented to the child. The child was asked to recognise, from a selection, the correct shape to complete the series. It is internationally recognised as a powerful clinical tool as well as a reputable research instrument (Kendall & Norton-Ford, 1982). It is the major test of the choice for child psychologists, clinical psychologists and paediatricians. The norms are well accepted and based on hundreds of children (n = 598) who were assessed in the construction of the test (Raven *et al.*, 1990). It was presented to the child in the form of a game and took just under 10 minutes to complete.

(c) ***Behavioural assessments***

The following three measurements of children's behaviours were modified and constructed by the investigator and have been tested for reliability and validity in the pilot study I (Chapter 4). The scales were assessed before, during, and after the induction of anaesthesia by the nurse and anaesthetist.

(c.1) **Rating of Co-operation by Nursing Staff** (page 112)

(c.2) **The Anaesthetist's Rating of Co-operation** (page 112)

(c.3) **The Nurse's Rating of Recovery** (page 122)

Note: The extra support for the validation of the Rating of Co-operation by Nursing Staff and the Anaesthetist's Rating of Co-operation was confirmed in the present study (Results: part 6.5.4, Table 6.22). The pre-treatment child's dental anxiety (see Table 6.2 for measurement specifications) from the self-report MCDAS (CANXA) and VP (VA) were correlated significantly with the three phase-scores (N1, N2, N3) rated by nurse (see Table 6.20 for measurement specifications): (CANXA and N1, N2, N3: $r = -0.31, -0.31, -0.32$ respectively, $p < 0.001$; VA and N1, N2, N3: $r = -0.20^{*}$, $-0.25, -0.26$ respectively, $p < 0.001$ except $* = p < 0.05$. The overall child's cooperation rated by anaesthetist (ANAES) was also correlated significantly with CANXA and VA: $r = -0.30$, $p < 0.001$, $r = -0.20$, $p < 0.05$ respectively).

6.3 Procedures

This randomized, prospective, longitudinal study was conducted at the Liverpool Dental Hospital, University of Liverpool, and was approved by the Local Research Ethical Committee on 26 June 1995 (see Appendix 3, page 295).

6.3.1 Pre-operative

The procedures described here provided a partial replication of the former pilot studies. The parent and child were approached in the waiting area and informed about the study, and written consent was obtained. The parent was interviewed and information about child's age, sex, residential area and contact telephone number was collected. The parent completed the MDAS and DS-CFSS while the investigator administered the MCDAS and VP to the child in the form of flip charts. Following pre-extraction assessment which took less than 10 minutes, the parent was randomly given the **informative leaflet** together with verbal explanation. The present investigator also asked the parent to complete the Three Days Post-Treatment Questionnaire and send it back in the stamped addressed envelope.

Parent and child then went to the examination room, where the nurse obtained the child's medical history and informed consent for induction of anaesthesia. During the examination, the nurse completed the first phase of the Rating of Co-operation by Nursing Staff. Parent and child then left the examination room to await treatment in the waiting area.

6.3.2 Perioperative

The parent and child entered the operating room where extractions were carried out under general anaesthesia via mask induction. No child in this present study received a sedation or hypnotic prior to treatment. The nurse ended observation on the child's behaviour after the child was seated in the dental chair. While the child was anaesthetised, his/her response was rated by anaesthetist on the Anaesthetist's Rating of Co-operation.

All children were assigned to receive either sevoflurane or halothane. A total of one hundred and twenty six of them were randomly anaesthetised by sessions: **sevoflurane** (SEVO group, n = 77) and **halothane** (HALO group, n = 49). The nurse and the investigator were unaware of which anaesthetic was used during treatment for these 126 children.

The inhalational agent was administered with 60% nitrous oxide /40% oxygen via Boyle's type machine. Inspired concentrations were steadily increased, in increments of 1.5 - 2% for sevoflurane or 0.5 - 1% for halothane. All children received face mask application and no other drugs were administered. As soon as the child lost consciousness, the parent left the operating room with the nurse to wait for the child in the recovery room. The maintenance of anaesthesia was kept constant until the extraction ended and only then were the anaesthetic agent and nitrous oxide turned off and changed to 100% oxygen.

6.3.3 Post-operative

In the recovery room, the same nurse scored the child's rate of recovery and emergence from anaesthesia. It was the overall score for post-operative restlessness, agitation, and responding to comfort. The child was considered ready to return home when he/she was fully awake and mobile.

After 1 month, parent and child were invited and offered travel expenses (£5) in order to make another visit to the investigator. The parent was asked to complete the MDAS and DS-CFSS (Appendix 3, page 300), and the child to complete the MCDAS

(Appendix 3, page 302) and VP (Appendix 2, page 290) again. The child also completed the intellectual level scale, CPM.

The final assessment of the present study was performed 3 months after extractions, through the telephone interview with the parent (Appendix 3, page 301) by the investigator. In all cases the interviewee was the same parent who brought the child to the dental hospital at the first and one month-follow up visits. The parent was asked to rate the child's fear on the DS-CFSS. The questions about child's general attitude to a dental visit and change in dental anxiety were also included in this interview.

It was the purpose of the investigator to create a friendly interview atmosphere in which the parents would feel free to answer. All those parents that refused to bring the child back for further interview were contacted by telephone. Those that had unlisted telephone numbers received a reminder letter in which they were asked to get in touch with the investigator.

The foregoing review of the present researcher's plan of data collection has been summarised in Figure 6.1. Finally, it should be noted that the number of anaesthetists (n = 5) and nurses (n = 5) involved in this study might have produced a more varied presentational approach to the children, as some anaesthetists were more successful in producing a smoother induction and some nurses were more able in making conversation with these young patients. Although the presence of only one anaesthetist and one nurse could have eliminated this variability, it was not logistically possible. It should be noted that the anaesthetic administration in the comparative study between sevoflurane and halothane was conducted by the same anaesthetist.

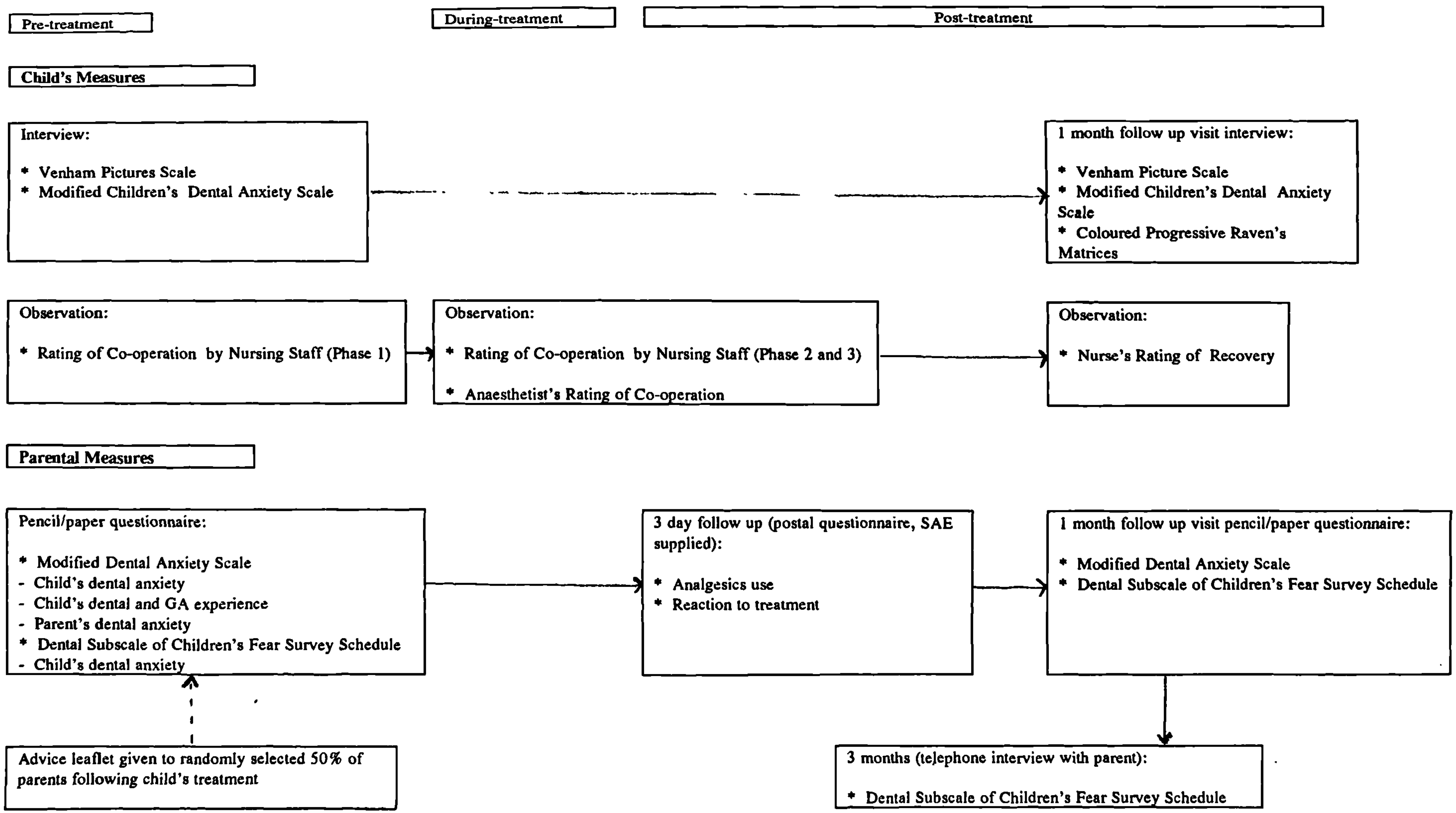


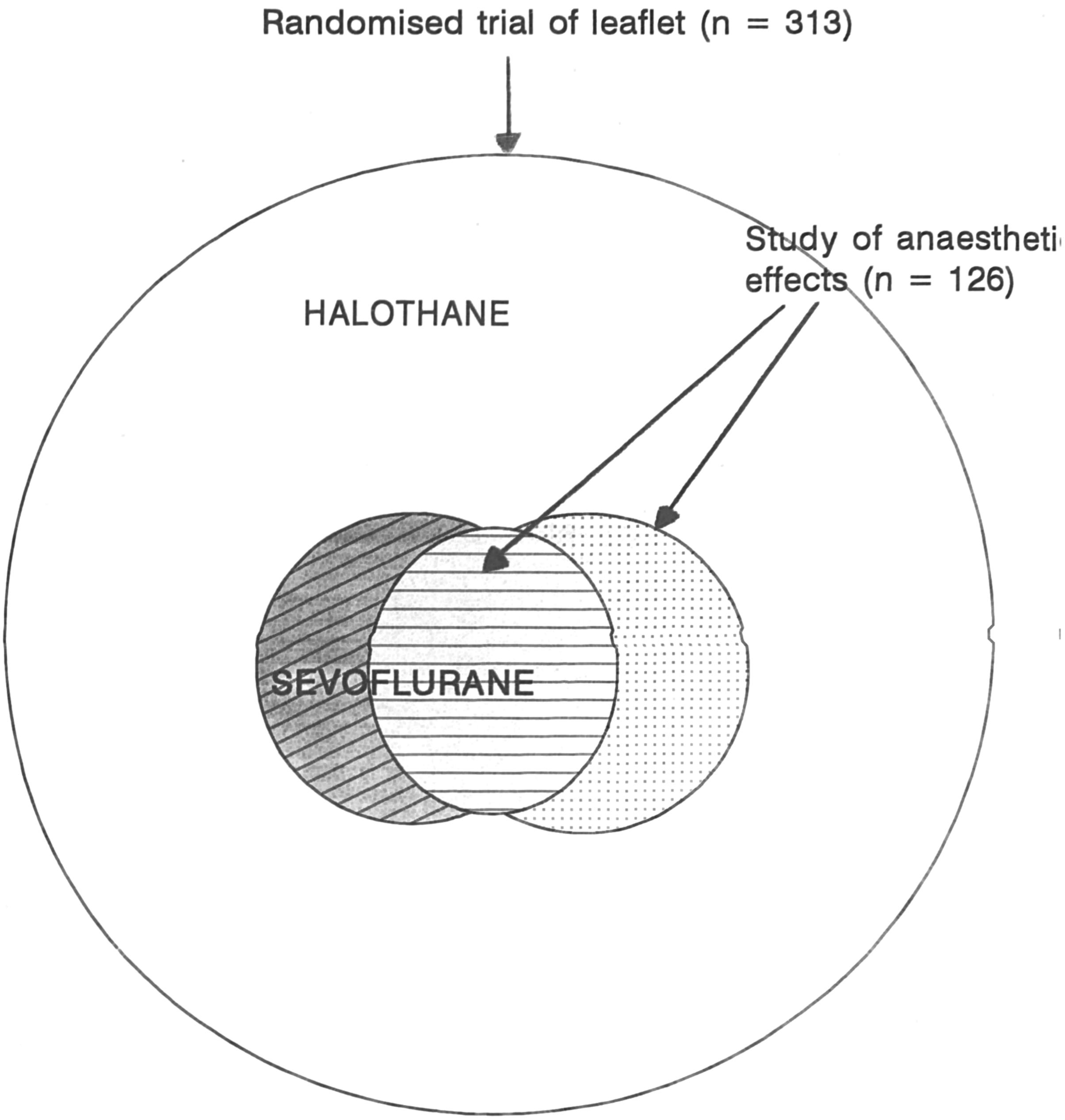
Figure 6.1: Plan of data collection

6.4 Statistical analysis

Analyses for all results were carried out using the statistical package SPSS for Windows version 6.0 (Norusis, 1993). The statistical procedures used will be further discussed for each section of the results.

6.5 Results

As mentioned previously in the section on procedure, the children participating in the present study were anaesthetised with either sevoflurane or halothane and an influence of the anaesthetic agent was predicted. In order to present the results without the influence of sevoflurane the present researcher chose to analyse the results of intellectual level, of previous experience and the results of the informative leaflet without entering children anaesthetised with sevoflurane. In short (see Figure 6.2), only 203 children anaesthetised with halothane were selected from the randomised trial of the informative leaflet (children received halothane from part of the randomised trial of anaesthetic agents = 49, and children received halothane who did not participate in the randomised trial of anaesthetic agents = 154). These 203 children would be used for analysing the data on children's dental anxiety over time in the investigation of the effects of child's intellectual level, child's previous experience and parental informative leaflet. The number of 126 children from the randomised trial of anaesthetic agents (SEVO = 77, HALO = 49) would be used for analysing the data in the comparison between sevoflurane and halothane.



Child received sevoflurane but **not** part of the randomised trial by anaesthetic agents (n = 33)

Child received sevoflurane and part of the randomised trial of anaesthetic agents (n = 77)

Child received halothane and part of the randomised trial of anaesthetic agents (n = 49)

Child received halothane and **not** part of the randomised trial of anaesthetic agents (n = 154)

Figure 6.2: Model to represent sample size of children participated in the study of informative leaflet and the study of anaesthetic effec

According to Table 6.1, the gender of participants (n = 203) was reasonably balanced with respect to age. The mean age of the children was 6.16 (SD = 1.09).

Before presenting the data to address each of the aims outlined in the introduction, the present investigator will first demonstrate that the children and parents who participated in the study are not statistically different in their background and pre-treatment anxiety.

The research was designed so that all children and their parents would return after their first visit for a 1 month post-extraction follow-up, and a telephone interview would be performed 3 months after extraction.

<u>Analysis of non-responders</u>

Children and parents were interviewed on the 1 *month* (*n* = *128*) *and* 3 *month* follow-up (n = 120). They comprised 5 groups:- Group 1, the children and their parents (n = 21) who completed the pre-extraction assessments and sent the three days post-treatment questionnaire back; Group 2, those who completed only pre-extraction assessments (n = 18); Group 3, those who completed the pre-extraction assessments and returned later to answer only the 1 month post-extraction scales (n = 8); Group 4, those who completed all the assessments (n = 120); and finally, Group 5, those who did not come back but whose parents were interviewed by telephone for 1 month and 3 month post-extraction follow-up (n = 36). The measurement specifications of dental anxiety assessments used for parent and child

Table 6.1. Sex and age distribution of research participants with **halothane used**.

Age	No. of Boys	No. of Girls	N
5	43	31	74
6	30	25	55
7	23	19	42
8	15	17	32
Total sample	**111**	**92**	**203**

Table 6.2. Measurement Specifications used for dental anxiety scales for children and parent.

Participants	Description	Variable Name		
		Before Extraction	After Extraction	
			1 month	3 month
Children	Modified Children's Dental Anxiety Scale	CANXA	CANXB	
	Venham Picture Scale	VA	VB	
Parent	Modified Dental Anxiety Scale for parent's dental anxiety.	PANXA	PANXB	
	Modified Dental Anxiety Questionnaire for parental view of their child's dental anxiety.	PCANXA	PCANXB	
	Dental Subscale of the Children's Fear Survey Schedule for parental view of their child's anxiety.	CFSA	CFSB	CFSC

are presented in Table 6.2.

To check for group equivalence (Table 6.3), a number of demographic and substantive variables were examined: age, dental and general anaesthesia experiences of the child, number of teeth extracted, number of dental quadrants from which teeth were extracted in each mouth and pre-extraction dental anxiety of parents and of child (as reported by parent of their child and as reported by the child). The means and standard deviations of these variables were calculated for each group. Statistical testing demonstrated there to be no significant effects between these groups ($p > 0.05$), although high scores for state (VA) and trait (CANXA, PCANXA, CFSA) children's dental anxiety were reported by the child and parent of the child in the group of those who completed only pre-extraction assessments (Group 2), which resulted in relatively high mean levels and standard deviations for the group (VA: $M = 2.72$, $SD = 3.08$; CANXA: $M = 14.83$, $SD = 7.10$; PCANXA: $M = 17.39$, $SD = 7.82$; CFSA: $M = 37.39$, $SD = 14.00$).

In addition, the parents in the group of those who completed all assessments (Group 4) had the lowest mean level of pre-treatment dental anxiety compared with the other four groups ($M = 11.53$, $SD = 5.17$, $p > 0.05$).

After this analysis, the results are now divided into four sections with regard to each of the aims stated in Chapter 3. First, data to demonstrate if intellectual level has an influence on children's dental anxiety levels will be presented. Second, the association between their previous dental and general anaesthesia experiences and

Table 6.3 Group comparisons of demographic and dentally related factors, child's and parent's reported dental anxiety, and parental view of their child's anxiety at pre-treatment session

Variables	Group 1 (n = 21)		Group 2 (n = 18)		Group 3 (n = 8)		Group 4 (n = 120)		Group 5 (n = 36)		Total (N= 203)	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Age	6.10	(1.09)	6.22	(1.17)	6.38	(1.19)	6.10	(1.07)	6.31	(1.12)	6.16	(1.09)
Experience	1.29	(1.35)	1.39	(0.85)	1.75	(1.28)	1.21	(1.06)	1.50	(1.21)	1.31	(1.11)
No. of extractions	3.62	(2.94)	3.39	(1.91)	3.00	(1.20)	3.24	(2.33)	2.75	(1.76)	3.20	(2.24)
No. of quadrants	2.19	(0.98)	2.56	(0.98)	2.38	(0.92)	2.29	(1.03)	2.06	(1.04)	2.27	(1.02)
Pre-treatment child's dental anxiety												
CANXA	12.76	(4.96)	14.83	(7.10)	12.88	(5.00)	13.67	(5.57)	14.14	(7.04)	13.73	(5.89)
VA	1.62	(2.84)	2.72	(3.08)	1.38	(1.85)	1.44	(2.69)	1.86	(2.84)	1.65	(2.74)
Pre-treatment parent's dental anxiety												
PANXA	13.19	(5.60)	12.06	(5.56)	13.00	(7.07)	11.53	(5.17)	13.58	(6.01)	12.17	(5.49)
Pre-treatment parental view of child's anxiety												
PCANXA	16.57	(6.75)	17.39	(7.82)	13.75	(5.68)	15.62	(6.46)	16.81	(6.17)	16.01	(6.52)
CFSA	35.19	(9.45)	37.39	(14.00)	29.38	(12.76)	35.11	(10.98)	36.81	(10.68)	35.39	(11.13)

Note: Group 1 = Pre-extraction assessments and Three Days Post-Treatment Questionnaire.
Group 2 = Pre-extraction assessments only.
Group 3 = Pre-extraction assessments, Three Days Post-Treatment Questionnaire and 1 month post-extraction questionnaire.
Group 4 = Pre- and 1 month, 3 month post-extraction assessments, and Three Days Post-Treatment Questionnaire.
Group 5 = Likewise those in group 4 except 1 month-assessment data was collected by telephone.

dental anxiety will be explored. Third, data to demonstrate whether the provision of a short informative leaflet received by the parent has an influence on the child's dental anxiety will be presented. The comparison between the influence of sevoflurane and halothane on children's dental anxiety and reactions after treatment will be shown in the final part.

6.5.1 <u>The effect of intellectual level on child's dental anxiety</u>

The data analysis in this part of the results is discussed in the following section.

6.5.1.a Statistical analysis

There are two common correlation coefficients which may be used; Spearman's rank correlation and Pearson product-moment correlation. Spearman's rank correlation is suggested for measuring association between variables with values that have been ordered into ranks on a case-by-case basis; whereas Pearson product-moment correlation will produce relatively accurate results if there are more than two responses alternatives (Armitage & Berry, 1987: Chapter 5 and 13). The present investigator used Pearson correlation coefficient to examine the relationship between intellectual level, age, parental and child's dental anxiety as there was at least one variable in the study which demonstrated a normal distribution curve on inspection of the variables frequency histogram and the use of Pearson correlation is indicated when one of the variables is normally distributed (Armitage & Berry, 1987). The intellectual level of each child was calculated from the sum of raw scores from the three sets of intellectual assessments in the CPM.

6.5.1.b Results

The histograms (Figure 6.3) show the frequency of Raven scores. It can be seen that the highest Raven score of children in this part of the present study is 31 and the lowest score is 14. The comparison between the raw score means for the intellectual level of the children who participated in the present study (only children who were anaesthetised with halothane) and the standard score means of 598 Dumfries children from Raven's manual are presented in Table 6.4. The results demonstrated that the children were similar in intelligence to the expected level of each age, although the children aged 5 years seemed to be less bright compared with the standard ($M = 14$, standard mean $= 15$).

The data in Table 6.5 showed the Pearson product-moment correlation coefficients between the child's intellectual level and age, both child's and parent's dental anxiety, and the parental view of their child's anxiety; there was no statistically significant effect with the exception of age ($r = 0.18$, $p < 0.05$). However, there was a negative relationship between the intellectual level and the child's state (dental) anxiety when the data on children with no previous dental and general anaesthesia experiences was analysed separately ($n = 84$). Naive children with higher intellectual levels showed less anxiety, as assessed by the Venham Picture Scale, before they received extraction under general anaesthesia ($r = 0.38$, $p < 0.05$).

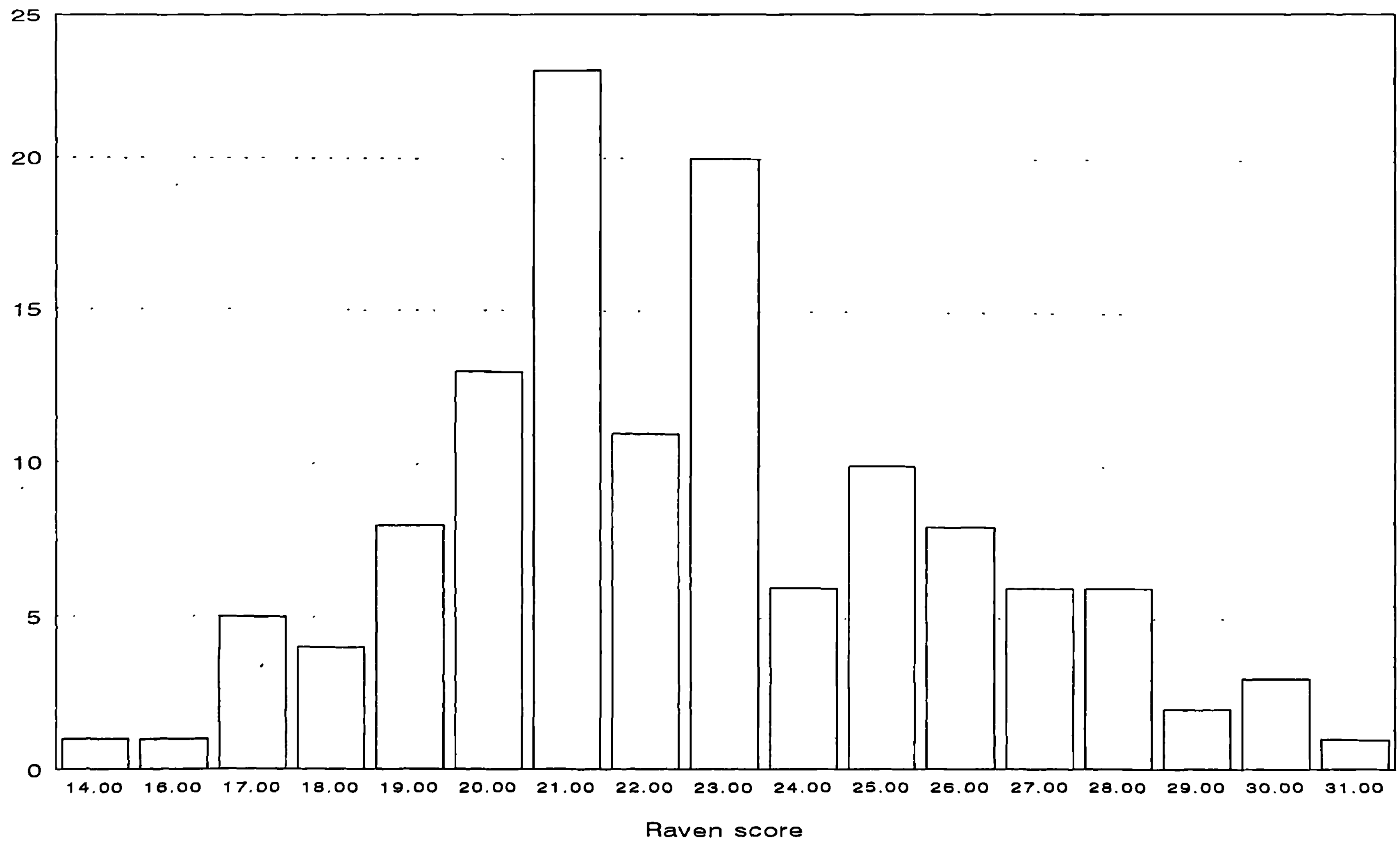


Figure 6.3: <u>Histograms of the frequency of Raven score (the frequency represent the number of children who had the scores, Total N=203)</u>

Table 6.4 Comparison between child's Raven score by ages and 50th percentile score from Raven's Manual

Raven Score	**Age (in years)**			
	5 (n = 48)	**6 (n = 36)**	**7 (n = 25)**	**8 (n = 19)**
Mean	22.10	22.00	24.12	23.11
SD	3.56	2.99	2.71	3.45
Minimum	14	17	20	17
Maximum	30	31	30	29
50th percentile score from Raven's Manual: n = 598, Dumfries children 1982	**15**	**17**	**20**	**24**

Table 6.5 Pearson product-moment correlation coefficients (r) between intellectual level, age, child's dental anxiety, parent's dental anxiety and parental view of their child's anxiety

Variables	r	p
Age	**0.18**	**0.04**
Child's dental anxiety		
CANXA	0.07	0.41
CANXB	-0.09	0.32
VA	0.12	0.16
VB	- 0.07	0.44
Parent's dental anxiety		
PANXA	- 0.09	0.29
PANXB	- 0.14	0.11
Parental view of child's anxiety		
PCANXA	0.06	0.52
PCANXB	0.02	0.80
CFSA	0.07	0.42
CFSB	- 0.02	0.86
CFSC *	- 0.08	0.40

Note: $n = 128$ where * $n = 120$
(bold types in print shows statistical significance $p < 0.05$)

6.5.1.c Discussion

The first aim of the present research is to examine whether intellectual level can be used to predict dental anxiety in children. The result clearly supported this prediction and is consistent with previous studies (Schor, 1983; Novakova, 1991). It is consistent with the Toledano *et al.* (1995) study, which found that children with no previous dental experiences and high intelligence showed less anxiety at their first dental visit. However, it was observed that there was no relationship between a child's dental anxiety and intellectual level when the child had experience with either dental visit or general anaesthesia. It may be possible that previous experience has more influence on child's dental anxiety than the intellectual level does.

Also, the statistically significant effect of age on intellectual level is not surprising. There is an increase in intelligence with increasing chronological age with the normative sample (Raven *et al.*, 1990).

Of theoretical interest is the suggestion that intelligence rather than age influences child's anxiety (Corkey & Freeman, 1994). Research has shown that the difference in children's intellectual levels has an influence on their ability to cope with dental treatment (Rud & Kisling, 1973). However, in the present study, the results imply that intellectual level seems to be important in determining a child's dental anxiety with respect to his/her lack of experience when the child attends the hospital in pain/distress and needs dental extractions under general anaesthesia.

Although there have been few studies correlating intellectual level with children's anxiety, the present study has many advantages compared with them. It should be noted that the present findings based on a prospective analysis of the children's self-report are in contrast to the study by Corkey & Freeman (1994) which relied on maternal report of the child's psychological development. Furthermore, the authors did not report on the child's state (dental) anxiety since the child was with his/her mother who attended the hospital for routine medical inspection.

Another advantage of the present study is the assessments of children's dental anxiety. The present investigator used the Venham Picture Scale and the Modified Children's Dental Anxiety Scale to measure the child's state and trait (dental) anxiety. One of the items in the MCDAS assessed the child's anxiety about extraction under general anaesthesia treatment whereas Toledano *et al.* (1995) used anxiety ratings (STAIC, page 135) as dental anxiety ratings.

The limitation of the present study is the assessment of the child's intellectual level conducted in the post-operative second visit due to the lack of time in the first visit. It would have been more appropriate to employ the Coloured Progressive Raven's Matrices preoperatively, and a stronger effect of intellectual level on child's anxiety than that reported on children with previous experiences, in the present study may have been shown. However, the present researcher was advised by the ethical committee not to test children prior to their treatment, hence this design was not possible.

In conclusion, this study supports previous work showing that intellectual level has a moderate influence on a child's dental anxiety where they have no previous experience. In addition, children are affected by previous experiences which may reduce or promote their anxious feelings towards dentistry. The results of this effect will be explored in the next section.

6.5.2 The influence of previous experience

The data analysis of this result is demonstrated in the following paragraph.

6.5.2.a Statistical analysis

The present investigator was interested in determining the effects of the child's previous experience on the dependent measures of anxiety; therefore one way analysis of variance (ANOVA) was conducted (Armitage & Berry, 1987) for each of the dependent measures for comparisons: Modified Dental Anxiety Questionnaire for children, Venham Picture Scale, Modified Dental Anxiety Questionnaire for parent's dental anxiety, Modified Dental Anxiety Questionnaire for parental view of their child's dental anxiety and the Dental Subscale of the Children's Fear Survey Schedule. The Least Significant Difference test was computed to do multiple comparisons between all pairs of experimental groups (Streiner & Norman, 1989). Pearson product-moment correlations were calculated among variables.

6.5.2.b **Results**

From the retrospective studies reviewed in Chapter 2 (section 2.3.1.a), there was evidence that previous dental and medical experiences can cause dental anxiety in children. In this present study, dental anxiety was found to vary according to child's previous experience for both before and after treatment. The findings are further described in more detail in the following sections. The present investigator wishes to remind the reader that only children anaesthetised with halothane (n = 203) were used for the data analysis in this part in order to prevent the influence of sevoflurane which is the new anaesthetic agent.

(a) *The effects of previous experience on child's dental anxiety*

To investigate the relationship of dental fear to previous experience in children, this study analysed the data collected of the child's previous experience of general anaesthesia and/or extraction. The age and gender distribution by experimental groups are presented in Table 6.6. A total of 203 children comprised 4 groups: NO EXP group (n = 122), the children who had no experience with either general anaesthesia or extraction, GA group (n = 12), those who had experience with general anaesthesia procedure (i.e. tonsillectomy, appendectomy) but not with extraction, LA group (n = 19), those who had had extraction with local anaesthetic and finally, EXT group (n = 50), those who had experience with extraction under general anaesthesia.

The results of child's dental anxiety, parental view of child's anxiety and other variables associated with child's previous experience are demonstrated in Table 6.7. It was found that regardless of the child's previous experience it has no statistically significant effect ($p > 0.05$) on either pre- and post-extraction self-report of child's dental anxiety (CANXA, CANXB) or change scores (CANXB-CANXA). However, the parent seemed to think differently.

The results show a significant difference in pre-treatment parental view of child's anxiety with respect to the child's previous experience (PCANXA: $F = 2.63$, $p = 0.05$). The parents reported highest levels of dental anxiety in children of LA group ($M = 19.16$, $SD = 7.20$) and of GA group ($M = 18.50$, $SD = 5.58$) whereas those of NO EXP group reported their children's dental anxiety to be lowest ($M = 15.28$, $SD = 6.27$). Consistently, the children in GA group ($M = 41.00$, $SD = 8.47$) and in LA group ($M = 36.31$, $SD = 14.54$) were found to be significantly more anxious than those in the EXT group ($M = 34.08$, $SD = 10.83$) and the NO EXP group ($M = 31.04$, $SD = 10.65$) as reported by their parents, 3 months after treatment (CFSC: $F = 3.13$, $p < 0.05$). In order to show how the predictions of child's dental anxiety made by parent change in relation with previous experience of the child at pre-operative assessment, 1 month post-operative assessment and finally 3 months post-operative telephone interview, the data for the NO EXP group, GA group, LA group and EXT group was summarised in Figure 6.4.

Interestingly, it was also found that the NO EXP group had a statistically significant high number of extractions ($M = 3.55$, $SD = 2.40$) while the GA group had the lowest number of extractions (M = 2.50, SD = 1.68, $p = 0.05$). The results are partly in accordance with the finding on number of quadrants that the NO EXP group had more quadrants with at least one extraction (M = 2.46, SD = 1.02) than those of the EXT Group (M = 1.92, SD = 0.92, $p < 0.05$).

(b) ***Child's report of change in anxiety towards dental procedures***

To continue the analysis of the results, this study was conducted to investigate whether children changed their dental anxiety towards dental procedures including general anaesthesia in relation with their previous experience.

The self-report anxiety levels for individual dental treatments are presented in Table 6.8. There was a significant difference between the levels before and after the treatment session for the scale and polish procedure in the LA group ($p < 0.05$). Also, the NO EXP group were found to have higher levels of anxiety treatment for the filling procedure. However, the reader is reminded that these significant findings could happen by chance from a large number of t-test comparisons ($n = 28$).

(c) ***The change in child's dental anxiety after extraction under general anaesthesia***

It was the present investigator's prediction that children who had to undergo a mask procedure for anaesthesia induction would be affected by the stressfulness of this unpleasant event. In order to make the analysis of changes in child's dental anxiety,

Table 6.6 Sex and age distribution of experimental design indicating child's previous experience.

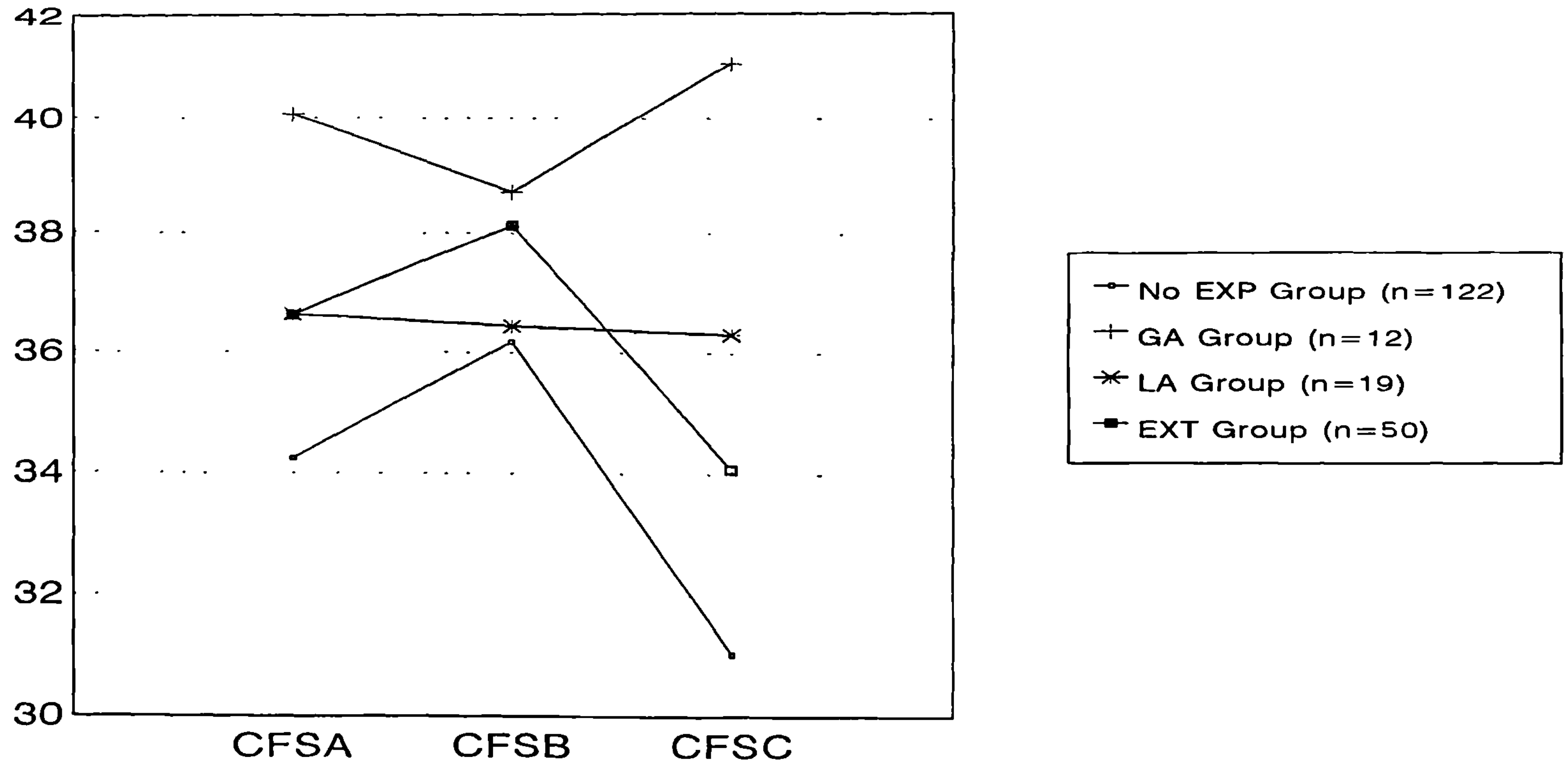
Group	Experience	Age	No. of boys	No. of girls	N
NO EXP group	No experience with either GA nor extraction	5 6 7 8	34 21 11 5	21 15 8 7	55 36 19 12 **Total 122**
GA group	Had experience with GA	5 6 7 8	0 1 3 1	2 0 3 2	2 1 6 3 **Total 12**
LA group	Had experience of extraction with local anaesthetic	5 6 7 8	4 3 2 2	3 1 2 2	7 4 4 4 **Total 19**
EXT group	Had experience with extraction under GA	5 6 7 8	5 5 7 7	5 9 6 6	10 14 13 13 **Total 50**
Total Sample			**111**	**92**	**203**

Table 6.7 Comparison of demographic and dentally related variables, child's dental anxiety, and parental view of child's anxiety at pre-and post-treatment sessions by experimental groups.

Variables	No EXP group (n = 122) M	SD	G A group (n = 12) M	SD	LA group (n = 19) M	SD	EXT group (n = 50) M	SD	Total (n = 203) M	SD	F	p
Age	5.90	(1.00)	6.83	(1.03)	6.26	(1.19)	6.58	(1.09)	6.16	(1.09)	6.93	0.00
No. of extractions	3.55	(2.40)	2.50	(1.68)	2.84	(2.01)	2.64	(1.90)	3.20	(2.24)	2.64	0.05
No. of quadrants	2.46	(1.02)	2.00	(0.95)	2.11	(1.05)	1.92	(0.92)	2.27	(1.02)	3.98	0.01
Pre-treatment dental anxiety												
CANXA	13.13	(5.74)	15.33	(6.18)	14.63	(5.96)	14.46	(6.13)	13.73	(5.89)	1.12	0.34
VA	1.48	(2.69)	3.00	(3.41)	2.37	(2.85)	1.44	(2.60)	1.65	(2.74)	1.67	0.18
PCANXA	15.28	(6.27)	18.50	(5.58)	19.16	(7.20)	16.00	(6.76)	16.01	(6.52)	2.63	0.05
CFSA	34.24	(10.97)	40.08	(10.52)	36.63	(9.89)	36.62	(11.92)	35.39	(11.13)	1.44	0.23
Post-treatment dental anxiety												
CANXB •	14.24	(5.69)	18.33	(10.13)	14.09	(5.22)	16.81	(7.43)	14.96	(6.35)	1.80	0.15
VB •	0.45	(1.42)	1.33	(3.27)	0.45	(1.51)	0.48	(1.58)	0.50	(1.57)	0.59	0.62
PCANXB *	15.45	(6.12)	18.10	(6.57)	16.38	(6.54)	16.03	(6.03)	15.84	(6.15)	0.63	0.60
CFSB *	36.18	(12.24)	38.70	(9.75)	36.44	(13.80)	38.13	(13.00)	36.82	(12.38)	0.31	0.82
CFSC **	31.04	(10.65)	41.00	(8.47)	36.31	(14.54)	34.08	(10.83)	32.79	(11.17)	3.13	0.03
Child's behaviour after treatment												
HOSPOS +	0.76	(0.60)	1.00	(0.47)	0.89	(0.58)	0.82	(0.39)	0.80	(0.55)	0.80	0.50
HOSNEG +	1.05	(1.14)	1.70	(1.95)	1.11	(1.45)	1.16	(1.26)	1.12	(1.25)	0.84	0.47
HOMEPOS +	0.67	(0.82)	0.60	(0.84)	1.11	(1.13)	0.77	(0.71)	0.74	(0.83)	1.56	0.20
HOMENEG +	1.07	(1.13)	2.00	(1.83)	1.11	(1.53)	1.25	(1.66)	1.17	(1.36)	1.52	0.21
Change in child's dental anxiety												
CANXB- CANXA •	1.23	(6.29)	2.50	(6.53)	0.73	(5.14)	1.70	(6.64)	1.34	(6.23)	0.14	0.94
VB-VA •	-0.80	(2.77)	-2.33	(3.39)	-1.27	(3.58)	-0.93	(3.17)	-0.94	(2.94)	0.56	0.65
Change in parental view of child's anxiety												
PCANXB- PCANXA*	0.08	(4.30)	0.20	(4.76)	-1.81	(3.87)	0.72	(5.87)	0.05	(4.71)	1.10	0.35
CFSB - CFSA *	2.01	(8.81)	1.20	(6.56)	-0.06	(9.92)	1.43	(9.74)	1.62	(8.98)	0.26	0.86
CFSC - CFSA **	-3.17	(9.59)	1.67	(7.58)	-1.00	(12.36)	-3.16	(10.40)	-2.71	(9.93)	0.80	0.49

NOTE: NO EXP group = No experience with either GA or extraction
GA group = Had experience with GA
LA group = Had experience of extraction with local anaesthetic
EXT group = Had experience with extraction under GA

• No Experience group	N = 84	* No Experience group	N = 99
GA group	N = 6	GA group	N = 10
LA group	N = 11	LA group	N = 16
Ext group	N = 27	Ext group	N = 39
**No Experience group	N = 96	+ No Experience group	N = 113
GA group	N = 9	GA group	N = 10
LA group	N = 13	LA group	N = 18
Ext group	N = 38	Ext group	N = 44



Note: CFSA = Parental view of child's dental anxiety assessed pre-operatively at 1st visit

CFSB = Parental view of child's dental anxiety assessed at 2nd visit (1 month follow-up visit)

CFSC = Parental view of child's dental anxiety assessed by telephone interview (3 months after treatment)

Figure 6.4: Parent's view of child's dental anxiety at pre- and post-treatment sessions by experimental groups indicating child's previous experience (as measured by DS-CFSS)

Table 6.8 Comparison of child's reported dental anxiety (from the Modified Children's Dental Anxiety Scale) on dental procedures pre- and post-extraction sessions.

Question	NO EXP Group (n = 84)	GA Group (n = 6)	LA Group (n = 11)	EXT Group (n = 27)
	CANXA CANXB M SD M SD	CANXA CANXB M SD M SD	CANXA CANXB M SD M SD	CANXA CANXB M SD M SD
1.'How do you feel about going to the dentist generally?"	1.23 (0.80) 1.19 (0.77)	1.17 (0.41) 1.67(1.63)	1.00 (0.00) 1.09 (0.30)	1.48 (0.97)1.48 (1.19)
2.'How do you feel about having your teeth looked at?"	1.21 (0.68) 1.40 (1.15)	1.17 (0.41) 1.83 (1.60)	1.55 (1.21) 1.09 (0.30)	1.63 (1.31) 1.59 (1.28)
3.'How do you feel about having your teeth scraped and polished?"	1.35 (0.71) 1.31 (0.92)	1.50 (0.84) 1.83 (1.60)	1.00 (0.00) 1.73 (0.91)*	1.26 (0.86) 1.56 (1.28)
4.'How do you feel about having an injection in the gum?"	3.74 (1.67) 3.87 (1.54)	5.00 (0.00) 4.50 (1.23)	3.82 (1.66) 3.82 (1.66)	4.07 (1.52) 4.26 (1.35)
5.'How do you feel about having a filling?"	1.80 (1.44) 2.23 (1.62)*	3.00 (2.19) 3.17 (2.04)	1.73 (1.42) 2.27 (1.49)	2.00 (1.59) 2.74 (1.68)
6.'How do you feel about having a tooth taken out?"	2.00 (1.66) 2.10 (1.67)	1.67 (1.63) 2.33 (2.07)	2.18 (1.83) 1.45 (1.21)	2.37 (1.90) 2.41 (1.89)
7.'How do you feel about being put to sleep to have treatment?"	1.79 (1.47) 2.14 (1.60)	2.33 (2.07) 3.00 (2.19)	2.09 (1.87) 2.64 (1.91)	2.30 (1.88) 2.78 (1.97)

Note: * = $p < 0.05$

the question (Q.7) from the Modified Children's Dental Anxiety Scale (MCDAS) which asked the child about general anaesthesia (i.e. "How do you feel about being put to sleep to have treatment?") was investigated. A cross tabulation was computed (Figure 6.5) and 4 groups of children were found.

There were 72 children whose anxiety remained low before and after treatment, these children comprised LOW group. There were 24 children who had an increase in their anxiety after treatment, this group comprised INCREASED group. There were 13 children whose anxiety was decreased after treatment, this group comprised DECREASED group. Finally, there were 15 children who reported being highly anxious before and after treatment, this group comprised HIGH group. There were 4 children who could not be grouped because of their anxiety, and were therefore deleted from this analysis.

The sex and age distribution of these 4 groups are given in Table 6.9. To investigate in more detail, an analysis of variance was computed (Table 6.10) using age, number of teeth extracted, number of dental quadrants from which teeth were extracted in each mouth, pre and post-operative dental anxiety of parent and of child (as reported by parent of child and as reported by the child), the child's behaviours following treatment and change scores in parent's and child's dental anxiety (i.e. the pre-anxiety measures subtracted from the post-anxiety measures).

To check the significance at the p level of 0.05, the LSD test was conducted. The number of teeth extracted and number of quadrants respectively in the LOW group

($M = 3.58$, $SD = 2.58$; $M = 2.42$, $SD = 1.03$) were found to be statistically greater than those in the HIGH group ($M = 1.93$, $SD = 1.10$; $M = 1.60$, $SD = 0.91$; $p < 0.05$).

According to parental view of child's dental anxiety before treatment (CFSA: as assessed by the DS-CFSS), the parents in the HIGH group reported of their children as being more anxious ($M = 40.60$, $SD = 12.74$) than those in the LOW group ($M = 31.89$, $SD = 9.62$; $p < 0.05$). On the 1 month follow-up visit after treatment (CFSB), the parents still rated their children's anxiety similar to what they reported in the first visit: children in the HIGH group ($M = 41.07$, $SD = 14.99$) were more anxious than those in the LOW group ($M = 33.50$, $SD = 11.74$; $p < 0.05$). It was found that the interview with the parents 3 months after treatment (CFSC) also demonstrated similar results that children in the HIGH group ($M = 37.07$, $SD = 13.01$) were more anxious than children in the LOW group ($M = 29.18$, $SD = 9.02$; $p < 0.05$).

The analysis also revealed a significant interaction between changes in child's dental anxiety and his/her negative behaviours on the way home from hospital (HOSNEG: in pain, crying, distressed, vomiting, nausea and bleeding). The children in the HIGH group showed more negative behaviours following treatment ($M = 1.73$, $SD = 1.39$) than those in the LOW group ($M = 0.89$, $SD = 1.08$; $p = 0.05$).

(d) *The relationship between parent's and child's dental anxiety*

Another important factor to be considered in the development of child's dental anxiety is parent's dental anxiety as indicated in the literature review (section 2.3.1.d, page 28). To study the relationship between parent's dental anxiety, child's dental anxiety and parental view of their child's dental anxiety, a brief analysis was conducted. In a group of research participants, each child and each parent provided observations on pre-extraction and 1 month-post-extraction anxiety. The parental view of child's dental anxiety was also examined on three variables i.e. pre-extraction, 1 month-post-extraction and 3 month-post-extraction anxiety (see Figure 6.1). The relationship between pre- and post-extraction anxiety was measured by the Pearson product-moment correlation coefficients.

In Table 6.11, no significant correlations were found to exist between the parental dental anxiety and child's dental anxiety before extraction and after extraction ($p > 0.05$). However, parent's dental anxiety correlated significantly to his/her view of child's dental anxiety ($p < 0.01$). These positive and rather strong correlations indicate that parents with high anxiety tend to think of their children as highly anxious.

In order to demonstrate the reliable results of parental view of child's dental anxiety, the Pearson product-moment correlations were calculated and statistically significant findings were found. The parental view of child's dental anxiety as assessed by the

Fig. 6.5 Crosstabulation of groups of children who changed or did not change their anxiety to treatment under general anaesthesia

Q.7 (from the MCDAS) = "How do you feel about being put to sleep to have treatment?"

Count	CANXB7 1.00	2.00	3.00	4.00	5.00	Row Total
CANXA7						
1.00	57	13		5	17	92
2.00	2		1		2	5
3.00	1				1	2
4.00		1			3	4
5.00	10	2	1	1	11	25
Column Total	70	16	2	6	34	128

Note: Number of Missing Observations = 75 cases

CANXA7 = Child's dental anxiety about general anaesthesia assessed pre-operatively at first visit
CANXB7 = Child's dental anxiety about general anaesthesia assessed post-operatively at 1 month follow-up visit

■ = Remained low anxious group

■ = Increased anxiety group

■ = Decreased anxiety group

■ = High anxious group

Table 6.9 Sex and age distribution of experimental design indicating change in child's dental anxiety to GA.

Group	Change in anxiety	Age	No. of boys	No. of girls	N
LOW	Remained low in anxiety	5	14	14	28
		6	13	7	20
		7	9	4	13
		8	6	5	11
					Total 72
INCREASED	Increased anxiety	5	7	3	10
		6	2	6	8
		7	2	3	5
		8	0	1	1
					Total 24
DECREASED	Decreased anxiety	5	2	1	3
		6	1	3	4
		7	3	1	4
		8	1	1	2
					Total 13
HIGH	Remained highly anxious	5	4	3	7
		6	0	2	2
		7	1	1	2
		8	3	1	4
					Total 15
Total Sample			68	56	124

Table 6.10 Comparison of demographic and dentally related variables, child's and parent's dental anxiety, and parental view of child's anxiety at pre- and post-treatment sessions by high and low anxious groups.

Variables	LOW group (n = 72) M	SD	INCREASED group (n = 24) M	SD	DECREASED group (n = 13) M	SD	HIGH group (n = 15) M	SD	Total (n = 124) M	SD	F	p
Age	6.10	(1.09)	5.88	(0.90)	6.38	(1.04)	6.20	(1.32)	6.16	(1.09)	0.69	0.56
No. of extractions	**3.58**	**(2.58)**	**3.25**	**(1.39)**	**2.31**	**(1.44)**	**1.93**	**(1.10)**	**3.20**	**(2.24)**	**3.23**	**0.03**
No. of quadrants	**2.42**	**(1.03)**	**2.46**	**(0.88)**	**2.00**	**(0.91)**	**1.60**	**(0.91)**	**2.27**	**(1.02)**	**3.50**	**0.02**
Pre-treatment dental anxiety												
CANXA	10.97	(3.09)	12.67	(4.21)	19.00	(4.47)	22.07	(5.95)	13.73	(5.89)	43.26	0.00
VA	0.67	(1.56)	2.29	(3.36)	1.85	(3.08)	3.80	(3.65)	1.65	(2.74)	7.98	0.00
PANXA	11.65	(5.24)	11.75	(5.83)	10.54	(4.89)	11.20	(4.96)	12.17	(5.49)	0.20	0.90
PCANXA	14.29	(6.29)	15.75	(6.70)	16.46	(5.30)	18.40	(6.41)	16.01	(6.52)	2.01	0.12
CFSA	**31.89**	**(9.62)**	**35.71**	**(11.84)**	**37.54**	**(9.79)**	**40.60**	**(12.74)**	**35.39**	**(11.13)**	**3.62**	**0.02**
Post-treatment dental anxiety												
CANXB	11.64	(3.26)	20.83	(6.12)	13.00	(5.23)	23.40	(4.75)	14.96	(6.35)	48.56	0.00
VB	0.29	(1.09)	0.88	(2.42)	0.31	(0.63)	1.20	(2.27)	0.50	(1.57)	1.93	0.13
PANXB	11.21	(4.99)	11.50	(5.39)	9.62	(4.11)	11.60	(6.08)	11.77	(5.41)	0.47	0.71
PCANXB	13.89	(5.55)	16.42	(5.84)	15.46	(5.11)	17.67	(7.30)	15.84	(6.15)	2.45	0.07
CFSB	**33.50**	**(11.74)**	**40.08**	**(11.11)**	**35.23**	**(10.07)**	**41.07**	**(14.99)**	**36.82**	**(12.38)**	**2.92**	**0.04**
CFSC *	**29.18**	**(9.02)**	**33.00**	**(11.05)**	**30.00**	**(8.95)**	**37.07**	**(13.01)**	**32.79**	**(11.17)**	**2.83**	**0.04**
Child's behaviours after treatment												
HOSPOS	0.81	(0.52)	0.88	(0.54)	1.08	(0.49)	0.73	(0.46)	0.80	(0.55)	1.28	0.29
HOSNEG	**0.89**	**(1.08)**	**1.33**	**(1.31)**	**0.85**	**(1.21)**	**1.73**	**(1.39)**	**1.12**	**(1.25)**	**2.70**	**0.05**
HOMEPOS	0.68	(0.75)	0.75	(0.99)	1.00	(1.15)	0.73	(0.88)	0.74	(0.83)	0.51	0.68
HOMENEG	0.90	(1.01)	1.29	(1.20)	0.92	(1.38)	1.53	(1.51)	1.17	(1.36)	1.67	0.18
Change in child's dental anxiety												
CANXB-CANXA	0.67	(3.12)	8.17	(7.25)	-6.00	(6.10)	1.33	(5.96)	1.34	(6.23)	26.03	0.00
CANXB1-CANXA1	0.07	(0.76)	0.33	(1.49)	-0.31	(1.11)	-0.40	(1.72)	0.01	(1.12)	1.77	0.16
CANXB2-CANXA2	0.14	(0.88)	0.29	(1.83)	0.31	(1.65)	-0.47	(2.33)	0.11	(1.39)	1.06	0.37
CANXB3-CANXA3	0.06	(0.55)	0.58	(1.47)	0.31	(1.49)	0.13	(2.20)	0.18	(1.17)	1.26	0.29
CANXB4-CANXA4	0.24	(1.70)	0.38	(2.00)	-0.77	(1.54)	0.33	(1.05)	0.10	(1.72)	1.55	0.21
CANXB5-CANXA5	0.33	(1.71)	1.21	(1.98)	-0.46	(2.07)	1.20	(1.66)	0.49	(1.86)	3.44	0.02
CANXB6-CANXA6	-0.32	(1.45)	1.67	(2.39)	-1.38	(1.89)	0.40	(1.68)	0.04	(1.99)	11.12	0.00
CANXB7-CANXA7	0.15	(0.43)	3.71	(0.46)	-3.69	(0.63)	0.13	(0.52)	0.41	(2.04)	25.46	0.00
VB-VA	-0.38	(1.82)	-1.42	(4.61)	-1.54	(3.10)	-2.60	(3.58)	-0.94	(2.94)	2.92	0.04
Change in parent's dental anxiety												
PANXB - PANXA	-0.44	(3.95	-0.25	(4.37)	-0.92	(3.62)	0.40	(5.08)	-0.28	(4.07)	0.26	0.85
Change in parent's view of child's anxiety												
PCANXB-PCANXA	-0.40	(4.58)	0.67	(4.82)	-1.00	(3.96)	-0.73	(3.69)	0.05	(4.71)	0.54	0.66
CFSB-CFSA	1.61	(7.86)	4.38	(8.87)	-2.31	(10.17)	0.47	(8.18)	1.62	(8.98)	1.92	0.13
CFSC-CFSA *	-2.87	(8.44)	-3.57	(9.10)	-7.54	(9.56)	-4.93	(12.17)	-2.71	(9.93)	1.02	0.39

Note:

LOW group	=	Remained low anxious group	* LOW group	n = 67
INCREASED group	=	Increased anxiety group	INCREASED group	n = 23
DECREASED group	=	Decreased anxiety group	DECREASED group	n = 13
HIGH group	=	High anxious group	HIGH groiup	n = 14

MDAS before (PCANXA) and after treatment (PCANXB) were correlated significantly with parent's view measured by the DS-CFSS (CFSA,CFSB) which is the well validated assessment ($r = 0.78$, $p < 0.001$, $n = 203$; $r = 0.81$, $p < 0.001$, $n = 164$).

(e) *Parental report of child's fear of dentist*

To study the prevalence of dental fear in children aged 5 to 8 years who participated in the present study, parental report of child's dental fear using the DS-CFSS on three occasions was investigated: before treatment (CFSA: $n = 203$), 1 month-post-treatment (CFSB: $n = 164$) and 3 month-post-treatment (CFSC: $n = 156$). Each score of the DS-CFSS was converted to a binary variable indicating if the child was fearful (1) or not fearful (0) of the dentist. An average score was obtained by dividing the aggregated score of data by the number of assessments ($n = 3$).

The means, standard deviations and total scores are demonstrated in Table 6.12 separate by gender. For boys, the mean was 30.64 (SD = 9.71) with a range from 16 to 69. For girls, the mean was 35.38 (SD = 12.27) with a range from 15 to 70. Both boys and girls showed the most fear to choking, injections, having a stranger touch him/her and the dentist drilling. Using a score above 40 to indicate that a child is fearful (DS-CFSS has a range of 0: not afraid of dentist to 75: very afraid of dentist), 30.05% (61/203) of the children are classified as being fearful of dentistry at their first visit before receiving treatment. On the 1 month-follow-up visit and 3 month-follow-up interview, 39.63% (65/164) and 23.72% (37/156) of children are

Table 6.11 Relationship between pre- and post-extraction child's and parent's dental anxiety and parental view of child's dental anxiety (Pearson product-moment coefficients)

Sessions	Measures	Pre-extraction parent's dental anxiety PANXA r	p	Post-extraction parent's dental anxiety PANXB r	p
Pre-extraction	*Parent's view of child's anxiety*				
	PCANXA	0.24[a]	0.00	0.22[b]	0.005
	CFSA	0.28[a]	0.00	0.24[b]	0.002
	Child's dental anxiety				
	CANXA	0.06[a]	0.40	0.12[b]	0.13
	VA	0.06[a]	0.40	- 0.01[b]	0.90
Post-extraction	*Parent's view of child's dental anxiety*				
	PCANXB	0.31[b]	0.00	0.31[b]	0.00
	CFSB	0.25[b]	0.001	0.30[b]	0.00
	CFSC	0.29[c]	0.00	0.30[c]	0.00
	Child's dental anxiety				
	CANXB	0.06[d]	0.49	0.10[d]	0.26
	VB	0.06[d]	0.49	0.11[d]	0.21

Note: a: n = 203
b: n = 164
c: n = 156
d: n = 128

identified as fearful patients respectively.

6.5.2.c Discussion

The present study of 5 to 8 year old children who had dental extraction under general anaesthesia addresses important issues regarding the development and prediction of dental anxiety in children, the effects of parent's dental anxiety on child's dental anxiety and the potential effects of extraction on post-operative child's dental anxiety. The present investigator found that (a) there was some evidence of previous dental/general anaesthetic experiences predicting post-operative dental anxiety in children from the parents' opinion; (b) there was no positive relationship between parent's and child's dental anxiety and (c) the degree of physical trauma from extraction was related in a complex manner to whether the child became more or less anxious after treatment. The negative behaviour on the way home from hospital was a significant predictor of child's dental anxiety. These findings support the importance of studying children's dental anxiety and reactions to dental treatment and anaesthetic induction.

The dental literature has presented many examples of the relationship between previous unpleasant dental or medical experiences with dental anxiety in children (Kleinknecht *et al.*, 1973; Sermet, 1974; Marks, 1978;). Similarly, the well-published relationship of parental anxiety to child's dental anxiety can be a significant predictor of child's fear level (Milgrom *et al.*, 1995). However, the present findings indicate that the quality of the child's previous experience is not a significant

Table 6.12 Means, standard deviations and total scores of the Dental Subscale of the Children's Fear Survey Schedule for boys and girls.

Item	Boys		Girls	
	Mean	SD	Mean	SD
1. Dentists	1.47	(0.91)	1.77	(1.28)
2. Doctors	1.09	(0.33)	1.24	(0.62)
3. Strangers	2.78	(1.20)	3.04	(1.48)
4. Injections	**3.09**	**(1.54)**	**3.31**	**(1.52)**
5. Having someone examine his/her mouth	1.32	(0.64)	1.52	(0.97)
6. Having to open his/her mouth	1.14	(0.47)	1.42	(0.98)
7. Having a stranger touch him/her	**2.78**	**(1.32)**	**3.45**	**(1.50)**
8. Having the dentist clean his/her teeth	1.49	(0.88)	1.85	(1.15)
9. The dentist drilling	**2.84**	**(1.41)**	**3.18**	**(1.54)**
10. The sight of the dentist drilling	2.39	(1.42)	2.79	(1.48)
11. The noise of the dentist drilling	2.51	(1.39)	2.85	(1.52)
12. Having somebody put instruments in his/her mouth	1.67	(1.04)	2.06	(1.17)
13. Choking	**3.35**	**(1.56)**	**3.52**	**(1.48)**
14. Having to go to the hospital	1.51	(0.97)	2.01	(1.35)
15. People in white uniforms	1.20	(0.67)	1.37	(0.81)
Total	**30.64**	**(9.71)**	**35.38**	**(12.27)**

Note: Scale ranges from 1 (not afraid at all) to 5 (very afraid)

predictor of his/her self-report of dental anxiety which supports the study by Neverlien (1994). However, the parent's estimate of child's dental anxiety is a better predictor. The present study found that parents are perceptive to how their child is feeling. This is not unexpected as it has been reported in many studies that the parent, particularly mother, has a great experience and consciousness of child's emotion (Melamed, 1992; Lumley *et al.*, 1993). However, parent's dental anxiety is unrelated to the child's dental anxiety; the surprising finding which supports the present author's previous study (Phinainisatra, 1993).

Regarding parental report of children's previous dental/general anaesthetic experiences, this study found that negative past surgery experience is related to more dental anxiety in children, like the Lumley (1987) study of children's previous experience and reaction to anaesthesia induction. As there is an urgent need for analgesics in children receiving multiple extractions under general anaesthesia indicating acute pain and post-operative trauma (Fung *et al.* 1993), it might be predicted that the more teeth the child had extracted the more anxious he/she would become. However, partly supporting the Fung *et al.* (1993) study, the present study shows that there was a complex relationship between the number of teeth extracted/number of quadrants from which teeth were extracted and the change in a child's dental anxiety. Similar to the earlier study on general anaesthesia and behavioural changes in children (Bothe & Galdston, 1972) the present findings support the importance of studying post-operative discomfort. Although the incidence varies depending on the criteria used, parental report of the child's behavioural distress exhibited on the way home from hospital was found to indicate the level of change in child's self-report of dental anxiety.

Finally, the present study supports the results of the Milgrom *et al.* (1995) study in that three groupings of children's concerns were found. The highly invasive procedures such as injections and drilling; fear of potential victimisation including fear of strangers and choking; and fear of less invasive procedures such as having instruments in the mouth and being examined by the dentist are the most common sources of children's fear. It seems that dental treatment experiences may be the source of more general fears reported by some children (Ollendick & King, 1991) which they acquired directly or through vicarious experiences (Rachman, 1977).

In conclusion, the prospective study of child's dental anxiety suggests that previous experience does not predict either a child's dental anxiety or any changes. The non-association between parental and child's dental anxiety indicate that the children did not learn their fear from parents. However, the present study is limited to the lack of data on the quantity of child's previous experience and oral health status.

A further limitation to selecting certain children for studying is also a lack of information on demographic background and parental experience which can help the present author understand more about the influence of parental anxiety on child's dental anxiety. Therefore, future studies should include these variables.

6.5.3 The influence of informative leaflet on parent's and child's dental anxiety

The data analysis of the influence of the informative leaflet is shown in the following part.

6.5.3.a Statistical analysis

The statistical approaches used in this section are more sophisticated than those already employed in the previous results. To evaluate anxiety changes occurring over the longitudinal study, a multivariate analysis of variance (MANOVA) was employed. This data analysis strategy is particularly appropriate because the parental assessments (MDAS, DS-CFSS) were conducted on three occasions. Also, the child's assessments (VP, MCDAS) were administered twice. When multiple statistical tests are carried out over time, the analysis of repeated data measurements is needed. To check for equal variance the test for homogeneity of variance, i.e. Levene's Test was also conducted. Then the data was further analysed with ANOVA. The t-test was also employed in the comparison between dental anxiety of those who did and did not receive the informative leaflet about general anaesthesia, bleeding prevention after extraction and pain management in children.

6.5.3.b Results

As reviewed in Chapter 2 (section 2.3.3.a), the informative leaflet has the benefits of increasing patient's satisfaction and knowledge. It was predicted by the present author that the informative leaflet, given to the parent, would reduce parental anxiety and that this effect would result in a less anxious child-patient. The results of the present investigation on this hypothesis are presented in the proceeding section.

(a) *Effects of informative leaflet on anxiety*

To investigate the effects of information on anxiety after dental extraction under general anaesthesia, this study analysed the data collected pre- and post-treatment for child's self-report dental anxiety (VA, VB; CANXA, CANXB), parent's dental anxiety (PANXA, PANXB) and parental view of child's dental anxiety (PCANXA, PCANXB; CFSA, CFSB, CFSC). The age and gender distribution by experimental groups are presented in Table 6.13. A total of 203 children comprised 2 groups:- LEAFLET group (n = 92), the parents who received informative leaflets and NO LEAFLET group (n = 111), the parents who did not receive informative leaflets. As explained previously, the data in this part included only children anaesthetised with halothane. The t-tests revealed that there were no significant differences between these two groups in age, sex, number of teeth extracted and number of dental quadrants from which teeth were extracted in each mouth ($p > 0.05$).

Although the appreciable effect of the informative leaflet on the reduction of anxiety has been reported with adult dental-patients, no significant group by time interaction ($p > 0.05$) was found when a repeated measure ANOVA was conducted with the anxiety-rating scales data.

The results demonstrated that the informative leaflet provided in this study had no effect on either the parents' or the child's dental anxiety (as reported by the child and reported by the parent of change in child's dental anxiety).

(b) *Effects of leaflet on negative reaction of child after treatment*

Significant differences between the LEAFLET group and NO LEAFLET group were found in the behaviour of the child when leaving hospital and at home (Table 6.14). According to the Three Days Post-Treatment Questionnaire, parents reported that children in the LEAFLET group ($n = 84$) showed lower levels of negative reactions from hospital and at home ($t = -2.39$, $df = 183$, $p < 0.001$; $t = -1.89$, $df = 183$, $p = 0.05$) compared to those in the NO LEAFLET group ($n = 101$).

6.5.3.c Discussion

The results show that post-treatment anxiety in parents and in children cannot be reduced by giving them a leaflet which contains information about anaesthetic procedure, bleeding prevention after extraction and pain management in children. Although there is no research on the effect of written information on parents' and children's dental anxiety, many studies have demonstrated the advantages of written information on adults' satisfaction and knowledge (e.g. Humphris *et al.*, 1993; O'Neill *et al.*, 1996). Furthermore, a recent study investigating anxiety in new dental patients reported the reduction of dental anxiety in those patients after they received an informative leaflet (Jackson & Lindsay, 1995).

Table 6.13 Sex and age distribution by experimental groups

group	Description	Age	No. of boys	No. of girls	n
LEAFLET group	Informative leaflet was given to the parent	5	16	11	27
		6	18	11	29
		7	10	7	17
		8	9	10	19
					Total 92
NO-LEAFLET group	No informative leaflet was given	5	27	20	47
		6	12	14	26
		7	13	12	25
		8	6	7	13
					Total 111
Total sample			**111**	**92**	**203**

Table 6.14 Comparison of child's negative reactions on the way home from hospital and negative reactions at home by experimental groups

	LEAFLET group (n = 84) M	SD	NO LEAFLET group (n = 101) M	SD	t	p
Negative reactions from hospital	0.88	(1.21)	1.32	(1.26)	- 2.39	0.002
Negative reactions at home	0.94	(1.25)	1.34	(1.41)	- 1.89	0.05

Note: The negative reactions on the way home from hospital included in pain, crying, distressed, vomiting, nausea and bleeding.

The negative reactions at home included in pain, crying, distressed, vomiting, nausea, bleeding and sleeping.

The failure of the informative leaflet in this present study could have resulted from the parents being too anxious to read the leaflet or a link in the parent's chain of *information* → *parents became less anxious* → *child's anxiety lessened* having been disrupted. It is possible that parents in the present study had not been able to implement these steps in the chain to affect their children's dental anxiety. Alternatively the assumed model may be incorrect.

Despite the fact that this informative leaflet was designed to the standard test of readability, the benefit of the written information also relies on the educational level of the parent (Kinnby *et al.*, 1991). As mentioned earlier, the benefits of the leaflet have been successfully reported in new dental patients (Jackson & Lindsay, 1995); it is likely that parental experience with extraction under general anaesthesia might play a role here.

The results also demonstrated that the parents who received the leaflet reported less negative behaviour in their children, both leaving hospital and at home, than those who did not receive the leaflet reported. It suggests an improvement in parental knowledge when parents are faced with the children's post-operative reactions which they perceived as a stressful event and that the information helps them lessen their negative attitudes, and possibly anxiety, towards their children's behaviour by reporting more improved behaviour in the children. However, it is likely that parental anxiety had changed to become consistent with their original levels of anxiety rather than with the actual feeling. In other words, at the time of reading the informative leaflet parents might become less anxious but then their anxiety increased to their pre-appointment levels afterward. When the parent and child next attended the dentist it was the anxiety they took with them at their pre-treatment assessments plus the effect of memory of experience from previous visit, not their anxiety when they received information (Kent, 1990).

The results of the present study warrant several remarks. It is probable that the benefit of the leaflet may be evident if the parents are prompted to read the information immediately after it was given. Furthermore, the results suggest that oral information cannot be replaced, yet this verbal communication between parent and clinician seems to reinforce the written information when the latter is poorly designed.

Further investigation on parental education and experience could identify the parents who would benefit most from the use of the informative leaflet. Also, future work could establish which aspects of the leaflet are most beneficial. It seems that parental anxiety needs to be assessed quickly after the leaflet is given. Although the reduction in parental anxiety is appreciable, dental anxiety in children is what dentists concentrate on. This means that to generate positive changes in a child's dental anxiety, much more is required than simply the provision of the informative leaflet to the parent.

6.5.4 The anaesthetic effects of sevoflurane and halothane on children

The statistical analysis of the comparison between sevoflurane and halothane is described in the following section.

6.5.4.a Statistical analysis

The same analysis strategy was adopted for the study of the anaesthetic effects of sevoflurane and halothane as in the results part 6.5.3. The present investigator was interested in determining the effect of two anaesthetic agents and therefore this was entered as a separate factor in the analysis of variance.

6.5.4.b Results

As reviewed in Chapter 2 (section 2.3.1.f), sevoflurane has been *suggested as an* alternative agent to halothane for paediatric anaesthesia due to its rapid induction and fast recovery. Therefore, it was predicted by the present investigator that sevoflurane administration would produce fewer psychological complications compared with halothane. The results of this prediction are presented after the test of group equivalence is demonstrated.

A number of 126 children were selected and the randomisation procedure resulted in the administration of sevoflurane to 77 children and halothane to 49 children. The sex and age distributions for anaesthetic group are listed in Table 6.15 and Table 6.16. The mean age for the SEVO group was 6.22 (SD = 1.15), and for the HALO group was 6.51 (SD =1.19).

To test the representation of the children and parents who completed all the questionnaires compared with those who partially completed the questionnaire, the children were divided into 4 groups: Group 1, the children ($n = 19$) who completed the pre-extraction questionnaire and whose parents sent the three days post-treatment questionnaire back, Group 2, those who completed only the pre-extraction questionnaire ($n = 26$), Group 3, those who completed the pre-extraction questionnaire and returned later to answer only the 1 month post-extraction questionnaire ($n = 10$) and finally, Group 4, those who completed all the questionnaires ($n = 71$) (with the exception of 14 parents who were interviewed by telephone for 1 month follow-up). In order to check that these groups were not different in age, number of teeth extracted, number of dental quadrants from which teeth were extracted in each mouth and pre-extraction dental anxiety of parents and of child (as reported by parent of their child and as reported by the child), an analysis of variance was computed.

It was found that there was no significant difference between these groups ($p > 0.05$) nor was sex an important factor in explaining differences in responding to the various questionnaires as shown by a chi-square test ($p > 0.05$).

(a) *The influence of anaesthetic agent on change in child's dental anxiety and child's reactions following treatment*

In an attempt to explore the effects of anaesthetic administration on postoperative reactions and child's dental anxiety, parental and child's responses to dependent

Table 6.15 Sex and age distributions of experimental groups indicating anaesthetic agent administered.

Group	Description	Age	No. of boys	No. of girls	n
SEVO group	Anaesthetised with sevoflurane	5	21	9	30
		6	7	7	14
		7	10	9	19
		8	9	5	14
				Total	**77**
HALO group	Anaesthetised with halothane	5	9	5	14
		6	4	6	10
		7	7	4	11
		8	7	7	14
				Total	**49**
Total Samples			**74**	**52**	**126**

Table 6.16 Distribution of case children by age group and sex.

Group	Age group		No. of boys	No. of girls	n
	Young	Old			
SEVO group	44	33	47	30	77
HALO group	24	25	27	22	49

Note: Young group = 5-to 6-year-old
Old group = 7-to 8-year-old

measures of anxiety and behaviour were examined. The following measures were included in the analysis: the Modified Children's Dental Anxiety Scale (MCDAS), Venham Picture Scale (VP), Three Days Post-Treatment Questionnaire, Modified Dental Anxiety Scale (MDAS: for parent's dental anxiety (PANX); for parental view of child's dental anxiety (PCANX)) and the Dental Subscale of Children's Fear Survey Schedule (DS-CFSS).

Interestingly, a statistical significant interaction between age, anaesthetic effect and time was found with the child's dental anxiety (as measured by the VP: $F = 5.70$, $df = 1$, $p < 0.05$). The results (Table 6.17) comprised 4 groups of children ($n = 61$): the first group consisted of children ($n = 21$) aged 5-6 years who were anaesthetised with sevoflurane (young SEVO group), the second group, those ($n = 9$) aged 5-6 years who were anaesthetised with halothane (young HALO group), the third group, those ($n = 20$) aged 7-8 years who were anaesthetised with sevoflurane (old SEVO group and finally the fourth group, those ($n = 11$) aged 7-8 years who were anaesthetised with halothane (old HALO group). The transformation of this anxiety data to use separate variance tests (i.e. without assuming equal variances as in ANOVA) confirmed a similar significant finding (Table 6.18). This test was conducted in addition as the original variances between the groups studied were not equal as shown by Levene's test of homogeneity of variance. The reduction of state (dental) anxiety from pre- to post-operative sessions was found in children aged 5-8 years with sevoflurane administration (young SEVO group: $M = -0.91$, $SD = 3.33$; old SEVO group: $M = -0.65$, $SD = 1.84$, $p < 0.05$), whereas only children aged 7-8 years became less anxious after halothane induction (old HALO group: M = -3.00, SD = 3.52).

Although children reported their dental anxiety to be changed with respect to anaesthetic effects, parental report of child's dental anxiety did not agree with this. No significant interactions for parent's dental anxiety and for parental view of child's dental anxiety by anaesthetic effects were found with the exception of parental report of child's dental anxiety (PCANX) as assessed by the MDAS. The analysis revealed that there was a statistically significant difference for sex and anaesthetic variables considered simultaneously. (Table 6.17). In other words, there were effects of the difference of child's gender and anaesthetic administration on what parent thought of change in child's dental anxiety. Children, both boys and girls, in the SEVO group and girls in the HALO group became less anxious after treatment, as reported by their parents ($F = 5.08$, $df = 1$, $p < 0.05$).

The anaesthetic effects were also found to affect child's reactions following treatment according to parental report on the Three Days Post-Treatment Questionnaire (Table 6.17). The interaction of negative reactions at home (i.e. crying, sleeping, nausea, vomiting, in pain, bleeding and distressed) by age and by anaesthetics was found to be statistically significant ($F = 5.79$, $df = 1$, $p < 0.05$). Children aged 5-6 years (young SEVO group, n = 31) seemed to respond well to the sevoflurane induction by showing fewer negative reactions when they were at home.

However, the child's positive reactions at home (i.e. content, watching television, reading and playing) were found to interact significantly with the gender of the child

($F = 4.29$, df = 1, $p < 0.05$), but not with the anaesthetics. Boys ($n = 57$) were reported to show greater positive behaviours at home ($M = 0.78$) than girls ($n = 43$, $M = 0.45$) after treatment (Table 6.17).

In order to check that the degree of trauma from the extraction treatment was not associated with the effects of the interaction by age and anaesthetics by time on child's self-report of dental anxiety, the interaction by sex by anaesthetics by time on parental view of child's anxiety and the interaction by age by anaesthetics on child's reactions following procedure, the number of teeth extracted was included as a covariate for every repeated measures analysis of variance. The results did not differ from those without the covariate (i.e. no changes were found in the significance levels of the tests that were performed).

(b) *The influence of anaesthetic on child's drowsiness*

Table 6.19 shows the number and proportions from the questions asking parents about their child's behaviour following treatment that indicated negative or positive reactions while leaving hospital and at home. As can be seen from the table, it was found that the number of children who exhibited drowsiness was greater in the HALO group (66.7%) than in the SEVO group (41.0%, $p < 0.02$). The child's sleeping did vary by group as a statistical significant difference between these two groups was obtained (SEVO: 31.1%; HALO: 56.4%, $p < 0.02$). Having been more drowsy seemed to affect the child's behaviour in the first hour when he/she got home in the HALO group in comparison to the SEVO group.

Table 6.17 Summary table of the analysis of variance for the anaesthetic agents effects

Tested Effects	F	df	Significance of F *	Time	Sevoflurane Young	Sevoflurane Old	Halothane Young	Halothane Old
Negative reactions at home by age, by drug: interaction •	5.79	1	0.02	-	0.90 (n=31)	1.21 (n=30)	1.84 (n=19)	1.05 (n=20)
Child's dental anxiety by age, by drug, by time: interaction +	5.70	1	0.02	Before treatment	1.95	1.15	0.11	3.09
				After treatment	1.04 (n=21)	0.50 (n=20)	0.11 (n=9)	0.09 (n=11)
					Boys	Girls	Boys	Girls
Parental view of child's dental anxiety by sex, by drug, by time: interaction ++	5.08	1	0.03	Before treatment	15.29 (n=47)	15.11 (n=30)	15.29 (n=27)	20.47 (n=22)
				After treatment	14.50 (n=28)	14.61 (n=18)	16.64 (n=14)	17.47 (n=15)
Positive reactions at home by sex: interaction ••	4.29	1	0.04	Means of Boys = 0.78 (n=57) Means of Girls = 0.45 (n=43)				

(Interaction: Means of Variables)

Note:

* The significance was tested at level 0.05.

• The negative reactions at home included crying, sleeping, nausea, vomiting, in pain, bleeding and distressed.

•• The positive reactions at home included content, watching television, reading and playing.

\+ Child's dental anxiety was measured by VP.

++ Parental view of their child's dental anxiety was measured by MDAS (PCANX)
In this analysis, age was coded as 1 = young = 5-6 yrs, 2 = old = 7-8 yrs; anaesthetic agents were coded as 1 = sevoflurane, 2 = halothane; and sex was coded as 0 = boys, 1 =girls.

Table 6.18 Comparison of anaesthetic agent effects on change scores in child's dental anxiety (The pre-anxiety Venham Picture Scale subtracted from the post-anxiety Venham Picture Scale)

	Young children 5-6 years		Old children 7-8 years	
Scores	**Sevoflurane (n = 21)**	**Halothane (n = 9)**	**Sevoflurane (n = 20)**	**Halothane (n = 11)**
Mean	**- 0.91**	**0.00**	**-0.65**	**- 3.00**
Variance	11.09	0.25	3.40	12.40
Standard deviation	3.33	0.50	1.84	3.52
Maximum Scores	8.00	1.00	3.00	1.00
Minimum Scores	- 8.00	- 1.00	- 5.00	-8.00

Table 6.19 Summary of responses to questions about child's reactions after treatment (from Three Days Post-Treatment Questionniare)

Question	Number (%) SEVO (n = 61)		Number (%) HALO (n = 39)	
How was your child on the way home from hospital?				
Content	12	(19.6%)	6	(15.4%)
In pain	11	(18.0%)	3	(7.7%)
Crying	20	(32.7%)	12	(30.8%)
Distress	8	(13.1%)	6	(15.4%)
Vomiting	6	(9.8%)	2	(5.1%)
Nausea	8	(13.1%)	8	(20.5%)
Bleeding	15	(24.6%)	10	(25.6%)
Drowsy	**25**	**(41.0%)**	**26**	**(66.7%)***
Other	0	(0%)	0	(0%)
Did you give any painkillers to your child?				
Yes	37	(60.7%)	23	(59%)
No	22	(36.1%)	16	(41%)
How many times did you give your child painkillers?				
1 day after the operation	35	(57.4%)	23	(58.9%)
2 days after the operation	12	(19.6%)	4	(10.3%)
3 days after the operation	2	(3.3%)	2	(5.1%)
How was your child, in the first hour after you got home?				
Content	8	(13.1%)	7	(17.9%)
Crying a little	10	(16.4%)	6	(15.4%)
Crying a lot	7	(11.5%)	4	(10.3%)
Sleeping	**19**	**(31.1%)**	**22**	**(56.4%)** *
Nausea	4	(6.6%)	6	(15.4%)
Vomiting	1	(1.6%)	0	(0%)
In Pain	10	(16.4%)	6	(15.4%)
Bleeding	6	(9.8%)	6	(15.4%)
Distressed	3	(4.9%)	6	(15.4%)
Watching TV	24	(39.3%)	13	(33.3%)
Reading	0	(0%)	0	(0%)
Playing	8	(13.1%)	3	(7.7%)
Other	0	(0%)	0	(0%)

Note: * = $p < 0.02$

(c) *The anaesthetic effects on child's cooperation and recovery*

The measurement specifications for behavioural assessments rated by the nurse and anaesthetist are presented in Table 6.20. The t-tests were conducted to compare sevoflurane and halothane on the child's pre-operative cooperation and post-operative recovery. As the nurse assessed the child's behaviours before the anaesthetic was administered (i.e. in the examination room, while entering the operating room and on the dental chair), these scores were therefore not included in the analysis. However, the observation of child's cooperation with induction procedure by anaesthetist (i.e. presentation of mask → induction of anaesthetic → child was unconscious) and the observation of child's recovery by nurse were examined because they could demonstrate how well the child responded to anaesthetist agent.

The results (Table 6.21) show that no statistical significant difference was found between sevoflurane and halothane on the child's pre-operative and post-operative responses ($p > 0.05$).

(d) *The anaesthetic effects on child's post-operative pain*

To study the influence of anaesthetic agent on child's pain threshold, as shown by the number of analgesics given by the parent (Table 6.21), the t-test was performed. No significant result was found ($p > 0.05$) which indicates that sevoflurane has the same level of post-operative analgesia as halothane has (SEVO: M = 1.31, SD = 1.59; HALO: M = 1.26, SD = 1.68).

Table 6.20 Measurement specification used for observation scales of child's behaviour rated by anaesthetist and nurse

Observers	Description	Phases of observation	Variable name
Nurse	Rating of Co-operation by Nursing staff	*Before treatment* • When the child is in the examination room • When the child is entering the operating-theatre • When the child is sitting on the dental chair	 **N1** **N2** **N3**
	Nurse's Rating of Recovery	*After treatment* • When the child is in the recovery room	**REC**
Anaesthetist	Anaesthetist's Rating of Co-operation	*During treatment* • Mask presentation to the child • Administration of anaesthetic induction until the child is unconscious	**ANAES**

Table 6.21 Comparison of child's pre-extraction behavioural cooperation observed by anaesthetist, post-extraction recovery and number of analgesics taken by experimental groups.

Variables	SEVO group (n = 77)		HALO group (n = 49)		Total (n = 126)		t	p
	M	SD	M	SD	M	SD		
Pre-extraction responses								
ANAES	5.96	(1.60)	5.61	(1.86)	5.83	(1.71)	1.12	0.27
Post-extraction responses								
REC	5.69	(1.52)	5.65	(1.72)	5.67	(1.69)	0.12	0.90
Number of * analgesics	1.31	(1.59)	1.26	(1.68)	1.29	(1.62)	0.17	0.87

Note: * As reported by parent from the Three Days Post-Treatment Questionnaire (SEVO group: n = 61; HALO group: n = 39)

(e) *The benefits of child's behavioural assessment in the operating room*

As mentioned in the part of Method, every assessment (i.e. self-report measures, behavioural measures) was administered to all the children who participated in the present research except the Recovery Scale which was administered to 126 children selected for the investigation of anaesthetic effects. (see Figure 6.2). The present investigator was also interested in evaluating the advantages of the Rating of Co-operation by Nursing staff (N1, N2, N3), the Anaesthetist Rating of Co-operation (ANAES) and the Recovery Scale (REC), and therefore the Pearson product-moment correlations were calculated between these behavioural measures and the assessments of child's dental anxiety (VP, MCDAS: n = 203 = children who were anaesthetised with halothane). The results show that the assessments of child's behaviour were all significantly correlated with each other ($p \leq 0.05$) and with the child's self-report of dental anxiety (Table 6.22). Interestingly, the post-operative child's dental anxiety in the 1 month follow-up visit (CANXB: as measured by MCDAS) was found to be significantly correlated with the nurse's rating of child's behaviour when the child was sitting on the dental chair waiting for treatment, the anaesthetist's rating of overall child's reaction to anaesthetic induction and the nurse's rating of child's recovery from anaesthesia ($r = -0.27$, $p < 0.005$; $r = -0.39$, $p < 0.001$; $r = -0.36$, $p < 0.05$ respectively).

6.5.4.c Discussion

Does sevoflurane have fewer psychological anaesthetic effects on children compared with halothane? The results of this study suggest that the answer depends on the child's age and negative reactions at home following treatment. In the present study the reduction of dental anxiety, as reported by the child, at the post-operative interview was found in the older children (7-8 years) who were anaesthetised with halothane while children anaesthetised with sevoflurane became less anxious regardless of their age. The parental report of child's negative behaviours at home partially supported this finding, in that younger children (5-6 years) anaesthetised with sevoflurane exhibited less crying, sleeping, nausea, vomiting, in pain, bleeding and distressed after they went home.

The findings that the administration of sevoflurane seems to produce less aversive anaesthetic effects in young children are interesting. Although the comparison of child's post-operative anxiety has not been reported, the investigation of sevoflurane on rapid and smooth induction of anaesthesia in children compared with halothane has been demonstrated in many studies (Piat *et al.*, 1994; Sarner *et al.*, 1995; Smith *et al.*, 1995). This advantage of sevoflurane may be considered as a less aversive experience of general anaesthetic procedure while the longer induction of halothane may have been perceived as a frightening event for children as it implies that the child's anxiety would be provoked for a longer period by the presentation of mask, a significant arousal of child's anxiety (Lumley *et al.*, 1993). How do the results of this present study compare to prior research on the administration of sevoflurane? The results of reduction in post-operative dental anxiety of young children in the present study provide partial support for the Lerman *et al.* (1994) study which reported less complicated anaesthesia with sevoflurane in younger children (1-3 years)

Table 6.22 Relationship between self report of child's dental anxiety and child's behaviour observed by staff (Pearson product-moment coefficients)

Description	Measures	Self-report of dental anxiety by the child				Observation of child's cooperation and recovery by staff				
		VA	VB	CANXA	CANXB	N1	N2	N3	ANAES	REC
Self-report of dental anxiety by the child	VA	1.00								
	VB	0.10	1.00							
	CANXA	0.44•	0.06	1.00						
	CANXB	0.30+	0.48•	0.46•	1.00					
Observation of child's cooperation and recovery by staff	N1	-0.20••	0.08	-0.31•	-0.01	1.00	0.64•	0.45•	0.26•	-0.06
	N2	-0.25•	-0.07	-0.31•	-0.09		1.00	0.64•	0.31•	0.09
	N3	-0.26•	-0.17	-0.32•	-0.27+			1.00	0.51•	0.17++
	ANAES	-0.20••	-0.06	-0.30•	-0.39•				1.00	0.32•
	REC*	0.06	-0.13	-0.06	-0.36••					1.00

Note: • : $p < 0.001$
+ : $p < 0.005$
•• : $p < 0.05$
++ : $p = 0.05$

All data in this table derived from children anaesthetised with halothane only where n = 203 except VB and CANXB: n = 128. Please note further that the recovery data (*) was derived from the sevoflurane/halothane study where n = 126 except VB, CANB where n = 61.

than in older children (3-5 years and 5-12 years). The fewer negative behaviours at home showed by young children anaesthetised with sevoflurane further supports Lerman *et al.*'s suggestion that there is an effect of age with sevoflurane anaesthesia. Although the parent reported the significant effect of gender differences in anaesthetic effects on children, this relationship is complex and the results are unclear which supports the findings in many previous studies (Liddell, 1990; Neverlien, 1994).

Another question of interest in the present study was whether sevoflurane affected children's post-operative complications and post-operative pain. The findings of this study partially support the faster recovery of sevoflurane than halothane, which has been demonstrated in recent studies of paediatric anaesthesia (Piat *et al.*, 1994; Sarner *et al.*, 1995), in that the drowsiness was greater in children anaesthetised with halothane than in children anaesthetised with sevoflurane on their way home from the hospital. However, it was found that there was no difference in child's behaviour during recovery due to anaesthetic effects.

The low incidence of post-operative vomiting in the children anaesthetised with sevoflurane was reported (Naito *et al.*, 1991) and the present study found this non-significant incidence in 6 children (9.8%) anaesthetised with sevoflurane and 2 children (5.1%) anaesthetised with halothane. Post-operative effect of analgesia of sevoflurane is an important area of concern in paediatric anaesthesia as the faster recovery of sevoflurane which results in shorter time of children's first post-operative analgesics implies more analgesics taken in children compared with halothane (Sury *et al.*, 1996). However, the findings indicate no significant difference in the number of analgesics, given to the child by parent, between these two agents. Perhaps the parent just gave analgesics enough to reduce acute post-operative pain in the child receiving sevoflurane though the child suffered more and longer discomfort than halothane (Sury *et al.*, 1996).

Finally, the significant strong correlations between the assessments of child's behaviour by nurse and child's self-report of dental anxiety as measured by the MCDAS in comparison with the correlations of child's dental anxiety measured by the VP and child's behaviour suggest the high reliability of the MCDAS, as the MCDAS actually assesses how the child feels when he/she goes into the operating room for treatment while the VP assesses how the child feels at that time of interview in the waiting room. Also, the present study found the significant relationships between children's dental anxiety in the 1 month-follow-up visit and their uncooperative behaviours in the operating-room while they were sitting on the dental chair and their distressed behaviours during recovery period. The findings support the Burn *et al.* (1992) suggestion that general anaesthesia has a long-term effect on child's emotional response to dentistry. However, unlike Burn *et al.* study, the present results imply that the clinicians can predict child's anxiety in the next appointment from the way he/she reacts just before receiving general anaesthesia or from the child's behaviour in the recovery room.

In conclusion, the present clinical investigation of sevoflurane and halothane administration suggests that sevoflurane has an advantage in young dental patients only. The model that takes into account results of this advantage is presented in

Figure 6.6. It forces us to consider the less aversive anaesthetic effects of sevoflurane compared with halothane in children. The model is the present author's conclusion which views general anaesthesia procedure as an arousal of child's anxiety both externally and internally experienced. General anaesthesia can thus be understood by studying the child's reactions with the anaesthetic agent. In this model the arrows reflect a causal pathway which is likely to have an effect on the child's dental anxiety in the follow-up visit. Whether anaesthetic induction results in the increase level of anxiety in the child or has a positive outcome depends on whether the child, in response to the anaesthetic agent (sevoflurane/halothane), exhibits post-operative drowsiness and negative behaviours at home (i.e. crying, sleeping, nausea, vomiting, in pain, bleeding and distressed). However, in this model the age of the child seems to be influential. Only young children anaesthetised with sevoflurane will demonstrate more alertness and improved behaviours following treatment and thus become less anxious compared with children anaesthetised with halothane.

Further research is needed to examine complications of anaesthesia in recovery in children anaesthetised with sevoflurane compared with halothane. Also, the future study on child's self-report of post-operative pain will give more information whether sevoflurane is the ideal anaesthetic for children receiving dental extraction. To help predict child's distress, it is useful for dentists to assess the children with some of the behavioural and anxiety assessments before they receive general anaesthesia.

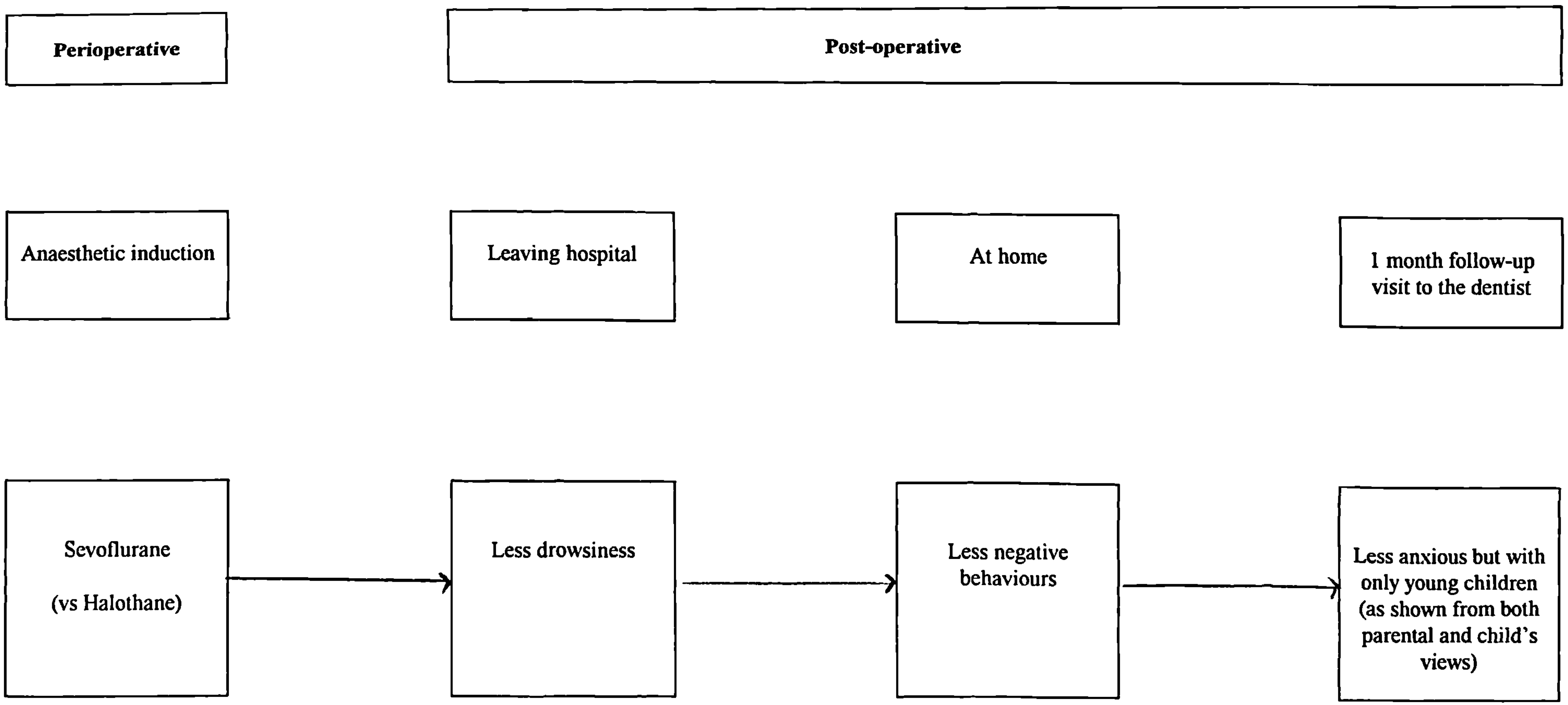


Figure 6.6 Proposed model to explain the effect of sevoflurane on child's dental anxiety

6.6 General discussion

Together, the results of the study of factors influencing dental anxiety in relation to extraction under general anaesthesia in 5 to 8 year-old children support the importance of looking at self-report data on dental anxiety of parents and their children, and also at observational data on child's responses to the anaesthetic procedure. The relationship between anxiety and behavioural distress suggests that many children in this study were anxious as assessed by both psychological and behavioural means. The important issues regarding the effects of intellectual level, previous dental/general anaesthetic experience, the parental informative leaflet and the anaesthetic agent (sevoflurane versus halothane) on post-operative dental anxiety of the child are addressed.

The present author found that (a) children who had high intellectual level and had no experience with either dental or general anaesthetic procedure reported less anxiety at their first dental visit before treatment compared with children who had lower intellectual level; (b) there was relationship between child's previous experiences and dental anxiety, from parental view; (c) parent's dental anxiety was unrelated to child's dental anxiety but correlated significantly with their prediction of child's dental anxiety; (d) the informative leaflet had no benefit in the reduction of dental anxiety of parent and child; and (e) the influence of different general anaesthetic agents was sensitive to the age of the child. This study supports the advantages of studying children's anxiety and reactions to treatment under general anaesthesia as a useful method of predicting children's preoperative anxiety and subsequent anxiety changes.

The finding of negative relationship between intellectual level and child's anxiety is consistent with previous research in the dental setting when the child had received no previous dental treatment (Rud & Kisling, 1973; Toledano *et al.*, 1995). Furthermore, it was found that the effects of other factors such as previous dental and general anaesthesia experience could not differentiate between the fearful and non-fearful children. This is consistent with previous literature (Corkey & Freeman, 1994) on experience and children's dental anxiety. A child with the high level of intelligence would be expected to have relatively high psychological development. In addition, it is likely that children at this stage would be able to cope better with the potentially anxiety-provoking dental situation than the children with the lower level of intelligence (Rud & Kisling, 1973).

The finding of no significant relationship between parental and child's dental anxiety is consistent with previous study of the effects of maternal anxiety on children's responses to dental stress (Koplik *et al.*, 1992). Many workers (Johnson & Baldwin, 1969; Wright & Alpern, 1971) also reported a significant relationship between parental anxiety and child's anxiety at the initial dental visit which did not exist during the following appointments. This little or non association of child's and parent's anxiety may be explained in part by the reluctance of the parent in revealing details of his/her own and his/her child's anxiety in fear that it would be discredible to his/herself and the child (Shaw, 1975). In addition, Carlsen and colleagues (1993) reported the relationship between parental and child's dental anxiety with ratings of specific treatment session but not with the general rating of anxiety. These results probably explain why the informative leaflet could not reduce dental anxiety in children as the provision of informative leaflet was based on the present author's hypothesis that reduction in parental anxiety would have a positive effect on child's dental anxiety as well. It was found in the present study that neither parental anxiety nor child's anxiety (from parent's view) reduced with the offer of the written information.

Also, it seems that negative behaviours demonstrated by the child after treatment can also help us in predicting his/her change in dental anxiety. This study found that children who reported high levels of dental anxiety had more negative behaviours than the others. Consistently, another important finding of this study is that young children (5-6 years) who were anaesthetised with sevoflurane and exhibited improved behaviours following treatment, became less anxious at the next appointment. The relationship between the children's responses to and recovery from anaesthetic induction and their subsequent anxiety are supported by Lumley *et al.* (1993) who reported the effects of child's behavioural distress during induction on the intensity of problematic behaviour changes after surgery.

Though the results of the present study suggest that there are many factors affecting children undergoing extraction under general anaesthesia in becoming more or less anxious, there are some methodological limitations of this study. First, the data on children's post-operative discomforts were obtained from the parents whose reports may have been biased. It should be noted, however, that parental reports are important, since parents are likely to play a major role in all aspects of children's behaviours. Furthermore, parents may be more accurate than children in recalling the child's discomfort. Nonetheless, future studies should consider assessing the child's own complaints.

Second, the limitation of time did not allow the researcher to gain greater details of family background (e.g. culture, siblings) and parents' previous dental and anaesthesia experience reflected in their children's behaviour which would be interesting to investigate. The parent's level of education and knowledge about dental procedures particularly extraction under general anaesthesia which can be obtained through asking questions or encourage parents to pose questions, will reveal parents with insufficient knowledge and parents with unsuitable attitudes and behaviours. This could be important in identifying parents at risk for the failure of the informative leaflet as they might have insufficient interest to profit from new information or it is the result of their culture.

Third, one obvious characteristic of past research is the emphasis on the influence of parents' coping styles on children's response to stress. Although it is the mothers who mostly accompany children to medical and dental appointments, many children participated in this study were accompanied by fathers (18.8%, total n = 313). A greater number of children would allow more intensive investigation of the comparison between mother's and father's coping styles and interactions with their children.

Fourth, anxiety is difficult to measure accurately as it is an emotion. Self assessment by psychological questionnaire is considered a sensitive and accurate method of measurement of anxiety by many researchers, however, it depends mainly on the individual's interpretation. Also, limitation of experience is likely to prevent young children from giving the accurate answers. Therefore, the observer should be able to know the child's means of communication and to detect subtle clues and changes in responses, and further research is recommended.

Fifth, despite the finding that young children became less anxious after they were anaesthetised with sevoflurane, it may apply to children only where the induction is brief, the pain resultant from the treatment is minor and where intubation is not taken. The time record during induction and emergence would give the present researcher broader access to the comparison between halothane and sevoflurane. Given that no studies of the psychological effects of these two anaesthetic agents have been published, further work needs to be performed with both agents and the others (i.e. desflurane, isoflurane) before sevoflurane likely place in paediatric anaesthesia can be stated with more confidence.

However, more research on the causes of dental anxiety in children is still needed. Changes in the criteria of this study may provide some new questions for the researchers. The results described here have limitations in terms of interpretations. The present author did not investigate the possible confounding factors that may influence the child such as number of dental visits, oral hygiene status (DMFT) and parent's dental attendance patterns. The association between the different anaesthetic agents and the child's dental anxiety also warrants further investigation on the long-term effects of this finding in different age group of children. The present study is just an initial step in examining psychological effects of anaesthetic agents in children.

It is recommended that behaviour and anxiety in children should be studied with a variety of dental procedures and different age-groups to establish generalisability. The psychological preparation such as information should be replicated over a series of treatment visits to assess its long-term effects. In addition, sophisticated research tools (i.e. video) are needed to explore the dynamics of communication with the young or fearful child. The interaction between dentist, anaesthetist, operating-theatre staff and child-patient in the stressful environment may provide a means of recognising the factor at risk for exacerbating the child's anxiety and disruptiveness during the anaesthetic procedure and perhaps for strengthening learning process towards dental care.

In summary, the present research has sought to address the factors influencing dental anxiety in children who underwent extraction under general anaesthesia by determining rates of anxiety before, during and after treatment. The goal was to aid in the selection of at-risk children and to predict the later anxiety problems so that the dentists would use their resources more efficiently. Selection of those at-risk children would be aided by asking the parent's prediction of his/her child's anxiety. Also, asking the nurse's ratings of child's behaviour during treatment and recovery period would help the dentists predict post-operative levels of anxiety in the children. In other words, the findings described in the present study are important, but should be treated with some caution, however they have some important clinical implications.

Such factors as the child's level of intelligence together with his/her nature of experience with health care should be considered by dentists when assessing dental anxiety in their child-patients in order to help those at-risk children cope with dental treatment. Children who have had a difficult time around anaesthesia or significant agitation after recovery from anaesthesia and which anaesthetic agent administered should have these noted in their records. The parents should be asked how children have reacted to their previous anaesthetic. This would alert the dentists if the child has had negative behaviours at home following general anaesthesia so that special attention should be taken.

Therefore, it is important that dentists are aware of factors influencing dental anxiety in children in order to take this knowledge into account while treating their patients. Recognition of an at risk child is possible, though not always straightforward. It is a prerequisite both for prevention of dental anxiety and for its treatment. Dentists should be prepared to analyse their observations of a child and parent as well as their own attitudes to the nature of dental treatment. Although this complex task is demanding and challenging, it is surely one of the most satisfying experiences for all concerned.

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INDICES OF TABLES AND FIGURES

APPENDICES

APPENDIX 1

Assessment of dental anxiety in children

In order to understand and to reduce dental fears and anxiety it is necessary to assess children's experiences of fear and anxiety in an objective and consistent manner. Because children differ in their psychological, cultural and developmental background, it is also important to determine the accurate multiple measures that assess the behavioural, cognitive and physiological aspects of the children. Therefore, an evaluation of dental anxiety requires not only a reliable index of the child's anxiety level but also a consideration of multiple factors that can affect anxiety in a particular clinical situation (McGrath, 1986).

The requirements for an accurate anxiety measure are identical to those necessary for any measurement instrument. These are reliability, validity, minimal inherent bias and versatility (Moore *et al.*, 1991; Stouthard *et al.*, 1995).

There are three general categories of methods that have been evaluated as measures of anxiety for children (Melamed, 1986; McGrath, 1986; Alwin *et al.*, 1991) :

1. Behavioural Measures
2. Self-Report Measures
3. Physiological Measures

(1) *Behavioural Measures*

Behavioural rating scales are the most commonly and frequently used by the observers for assessing dental anxiety in children. They are rating scales which employ independent observations of children's behaviour during dental treatment or medical situations (Melamed *et al.*, 1976; Melamed *et al.*, 1979; Melamed & Siegel 1980).

These scales include measurement made from both overt and covert signs of anxiety or by measuring the covert signs of anxiety. In general, numerical estimates of anxiety scores are obtained by differentially weighing the anxious behaviours that occur, as well as scoring their frequency (Schor, 1983).

These scales have differing degrees of validity and the choice of instrument has been made based on the degree of precision regarding quantification or observer's needs. It can be either a simple rating or more sophisticated observation including videotapes. For examples, some investigators including Melamed and her colleagues (1975) and Hosey and Blinkhorn (1995) used video recording the dentist-child interaction to obtain the accuracy in child's behaviour pattern.

It was noted that these scales can be influenced by observer biases. The absence of signs of noncooperation or anxiety as recorded on behavioural scales does not necessarily signify that the child is not experiencing anxiety. In other words, the child might feel anxious but show no sign of distress (Winer, 1982; Lindsay, 1984; Parkin, 1989).

Rating scales that appear in the literature are presented in summary form in Table 1:

Table 1. Summary of behavioural measures for children

Name of Scale	Authors	Year	Comment
Frankl Scale	Frankl, Shiere and Fogels	1962	It consists of four categories of behaviour ranging from definitely positive to definitely negative.
Visual Analogue Scale (VAS)	Aiken	1969	The scales are made along a horizontally-placed 100 mm line between bipolar extremes of meaning: noisy-quiet or low anxiety-high anxiety.
Houpt Scale (H)	Nazif	1971	It is four-point categorical rating scale of crying, cooperation, apprehension and sleep.
Swallow and Sermet's Simple Rating Scale	Swallow and Sermet	1972	The purpose of this scale is to score different component of dental anxiety. It is based on VAS concept and the line can be measured to a resolution of 1 mm to provide a numerical score.
Melamed Behaviour Profile -Rating Scale	Melamed and her colleagues (Melamed, Hawes, Heiby and Glick; Melamed, Weinstein, Hawes and Katin-Borland)	1975	It is 3 minutes interval measure of 27 different behaviours which have been weighted for disruptiveness.
Venham Behaviour Rating Scale	Venham, Gaulin-Kremer, Munster, Bengston-Audia and Coham	1980	It consists of ratings of cooperative behaviour ranging from total cooperation to require physical restraint. The scores range from 0 to 5.
Global Rating Scale (GR)	Hasty, Vann, Dilley and Anderson	1981	It is rating scale of overall behaviour scored by the child's dentist after each visit and is a measure of both the successful completion of treatment at that visit and of the dentist's perception of the child's anxiety.
Weinstein Behaviour Rating Scale	Weinstein, Getz, Ratener and Domoto	1982	It is the rating scale of coaxing behaviour in dentists and fear-related behaviour in children. The child's fear-related behaviours are divided by conditional probability of 0 to 7.

(2) ***Self-Report Measures***

The way to get at the effect on preverbal children is to give them a way of telling the investigators how they feel before a visit. The self-report measures of children's anxiety before or during treatment include drawings, selecting smiling or sad face from cartoon or responding to questionnaires.

For questionnaires, although easy to administer, these methods do not allow researchers to obtain directly the view-point of very young children as they are unable to fill out the questionnaires themselves (Klingberg & Hwang, 1994). Furthermore, children's self-ratings of dental anxiety are not as reliable an indication of their fears as their actual behaviour in the dental settings because fear and anxiety are multidimensional emotions in that they depend on a variety of psychological, social and situation factors (Weinstein *et al.*, 1983).

Self-report rating scales that appear in the literature are presented in summary form in Table 2:

Table 2 Summary of self-report measures for children

Name of Scale	Authors	Year	Comment
Fear Survey Schedule for Children (FSS-FC)	Scherer and Nakamura	1968	The 80 items for this scale were developed under the following categories: school, home, social, physical, animal, travel, classical phobia and miscellaneous. Items are randomly assigned to odd-even positions within the scale so there would be a fairly even distribution items for each category within these positions. The total degree of fear based on scoring of 'non' = 1 to 'very much' = 5
Corah's Dental Anxiety Scale (CDAS)*	Corah	1969	This scale consists of four items with five answers ranging from 'relaxed' to 'so anxious I sometimes break out in a sweat or almost feel physically sick
Projective Drawings	Eichenbaum and Dunn	1971	The technique of projective drawing involves having the child draw a picture, either of a person or of the other objects during dental or medical situation
State-Trait Anxiety Inventory for Children (STAIC)	Speilberger and his colleagues	1973	The STAIC is used to measure two distinct anxiety concepts: state anxiety, the transitory feeling of anxiety experienced in specific situation, and trait anxiety, the relatively stable level of anxiety proneness of the subject. It consists of 40 statements: 20 are designed to measure trait anxiety and the others measure state anxiety. The four alternative answers are not at all, somewhat. moderately so or very much so
The Human Figure Drawing Test (HFD)	Sonnenberg and Venham	1977	This scale consists of 8 pairs of cartoon style pictures and the child will be asked to select smiling or sad faces from human figure drawings which best describe how he or she feels at the moment
Dental anxiety scale for adolescents**	Humphris	1981	This measurement is the modified version of the CDAS. It is 5-item rating scale with 5 categories with verbal anchors at each end. namely: "relaxed", "worried". Each of the 5 items referred to a separate dental procedure.
Dental Subscale of the Children's Fear Survey Schedule (CFSS-DS)	Cuthbert and Melamed	1982	It is a subscale of 15 situations on a Fear Thermometer, a thermometer showing a range from 1 (not afraid at all) to 5 (very afraid)
The Children's Dental Fear Picture Test (CDFP)	Klingberg and Hwang	1994	The measurement consists of three different subtests: the Dental Setting Pictures (CDFD-DS), the Pointing Pictures (CDFP-PP) and a Sentence Completion task (CDFP-SC)

Note: * The scale was modified and used with children by Wright *et al.* (1980). Murray *et al.* (1989), Neverlien *et al.* (1991), Bedi *et al.* (1992) and Neverlien *et al.*(1994).

** This scale was modified and used with children by Humphris *et al.* (1991) and Carlsen *et al.* (1993).

(3) *Physiological Measures*

Assessing electrochemical changes, electromyographic or cadiovascular have been used in studies on anxiety (Mair *et al.*, 1989; Alwin *et al.*, 1991) but to measure physiological changes require monitoring equipment to be attached to the subject.

Melamed *et al.* (1978) found that the Palmar Sweat Index was correlated with the measures of children's fear while Sonnenberg and Venham (1977) reported low correlation between heart rate and anxiety and projective ratings.

However, many studies have failed to show that the changes in the physiological responses are related to changes in anxiety, rather than to a general arousal state (McGrath, 1986).

Physiological scales appear in this literature ar presented in summary form in Table 3:

Table 3 **Summary of physiological scales for children and adolescents**

Name of Scale	Authors	Year
Heart or Pulse Rate	Lewis & Law Mair *et al.* Alwin *et al.*	1958 1989 1991
Galvanic Skin Response	Lewis & Law Mair *et al.*	1958 1989
Skin temperature	Lewis & Law	1958
Respiration	Simpson *et al.*	1974
Muscle tension	Simpson *et al.*	1974
Palmar Sweat Index	Melamed, Hawes, Heiby and Glick	1975b
Basal Skin Response	Sonnenberg & Venham	1977

APPENDIX 2

MODIFIED CHILDREN'S DENTAL ANXIETY SCALE

Child Questionnaire / Before Treatment Session

For the next 7 questions I would like you to show me how relaxed or worried you get about the dentist and what happens to you at the dentist.

To show me how relaxed or worried you feel please use the simple scale below. This scale is just like a ruler going from 1 which would show that you are relaxed to 5 which would show that you are very worried.

Point to the number which shows me how relaxed or worried you are for that question:

so that	**1**	**would mean : relaxed/not worried**
	2	**would mean : very slightly worried**
	3	**would mean : fairly worried**
	4	**would mean : worried a lot**
	5	**would mean : very worried**

How do you feel about................................

1. ...going to the dentist generally ?

relaxed ☐☐☐☐☐ **worried**
1 2 3 4 5

2 ...having your teeth looked at ?

relaxed ☐☐☐☐☐ **worried**
1 2 3 4 5

3. ...having your teeth scraped and polished ?

relaxed ☐☐☐☐☐ **worried**
1 2 3 4 5

4. ...having an injection in the gum ?

relaxed ☐☐☐☐☐ **worried**
1 2 3 4 5

5. ...having a filling ?

relaxed ☐☐☐☐☐ **worried**
1 2 3 4 5

6. ...having a tooth taken out ?

relaxed ☐☐☐☐☐ **worried**
1 2 3 4 5

7. ...being put to sleep to have treatment ?

relaxed ☐☐☐☐☐ **worried**
1 2 3 4 5

VENHAM PICTURE SCALE

The Venham Picture Scale

STATE VERSION OF THE STATE-TRAIT ANXIETY INVENTORY FOR CHILDREN

HOW-I-FEEL QUESTIONNAIRE

NAME..AGE..............................DATE......................................

DIRECTIONS: A number of statements which boys and girls use to describe themselves are given below. Read each statement carefully and decide how you feel *right now.* Then put an X in the box in front of the word or phrase which best describes how you feel. There are no right or wrong answers. Do not spend too much time on any one statement. Remeber, find the word or phrase which best describes how you feel *right now, at this very moment.*

1.	I feel	☐ very calm	☐ calm	☐ not calm
2.	I feel	☐ very upset	☐ upset	☐ not upset
3.	I feel	☐ very pleasant	☐ pleasant	☐ not pleasant
4.	I feel	☐ very nervous	☐ nervous	☐ not nervous
5.	I feel	☐ very jittery	☐ jittery	☐ not jittery
6.	I feel	☐ very rested	☐ rested	☐ not rested
7.	I feel	☐ very scared	☐ scared	☐ not scared
8.	I feel	☐ very relaxed	☐ relaxed	☐ not relaxed
9.	I feel	☐ very worried	☐ worried	☐ not worried
10.	I feel	☐ very satisfied	☐ satisfied	☐ not satisfied
11.	I feel	☐ very frightened	☐ frightened	☐ not frightened
12.	I feel	☐ very happy	☐ happy	☐ not happy
13.	I feel	☐ very sure	☐ sure	☐ not sure
14.	I feel	☐ very good	☐ good	☐ not good
15.	I feel	☐ very troubled	☐ troubled	☐ not troubled
16.	I feel	☐ very bothered	☐ bothered	☐ not bothered
17.	I feel	☐ very nice	☐ nice	☐ not nice
18.	I feel	☐ very terrified	☐ terrified	☐ not terrified
19.	I feel	☐ very mixed-up	☐ mixed-up	☐ not mixed-up
20.	I feel	☐ very cheerful	☐ cheeful	☐ not cheerful

TRAIT VERSION OF THE STATE-TRAIT

ANXIETY INVENTORY FOR CHILDREN

<u>**HOW-I-FEEL QUESTIONNAIRE**</u>

NAME..AGE..............................DATE......................

DIRECTIONS: A number of statements which boys and girls use to describe themselves are given below. Read each statement and decide if it is *hardly-ever*, or sometimes, or *often* true for you. The for each statement, put an X in the box in front of the word that seems to describe you best. There are no right or wrong answers. Do not spend too much time on any one statement. Remember, choose the word which seems to describe how you usually feel.

1. **I worry about making mistakes**

☐ hardly-ever ☐ sometimes ☐ often

2. **I feel like crying**

☐ hardly-ever ☐ sometimes ☐ often

3. **I feel unhappy**

☐ hardly-ever ☐ sometimes ☐ often

4. **I have trouble making up my mind**

☐ hardly-ever ☐ sometimes ☐ often

5. **It is diffiuclt for me to face my problems**

☐ hardly-ever ☐ sometimes ☐ often

6. **I worry too much**

☐ hardly-ever ☐ sometimes ☐ often

7. **I get upset at home**

☐ hardly-ever ☐ sometimes ☐ often

8. **I am shy**

☐ hardly-ever ☐ sometimes ☐ often

9. **I feel troubled**

☐ hardly-ever ☐ sometimes ☐ often

10. **Unimportant thoughts run through my mind and bother me**

☐ hardly-ever ☐ sometimes ☐ often

11. *I worry about school*

☐ hardly-ever ☐ sometimes ☐ often

12. **I have trouble deciding what to do**

☐ hardly-ever ☐ sometimes ☐ often

13. **I notice my heart beats fast**

☐ hardly-ever ☐ sometimes ☐ often

14. **I am secretly afraid**

☐ hardly-ever ☐ sometimes ☐ often

15. **I worry about my parents**

☐ hardly-ever ☐ sometimes ☐ often

16. **My hands get sweaty**

☐ hardly-ever ☐ sometimes ☐ often

17. **I worry about things that may happen**

☐ hardly-ever ☐ sometimes ☐ often

18. **It is hard for me to fall asleep at night**

☐ hardly-ever ☐ sometimes ☐ often

19. **I get a funny feeling in my stomach**

☐ hardly-ever ☐ sometimes ☐ often

20. **I worry about what others think of me**

☐ hardly-ever ☐ sometimes ☐ often

CORAH'S DENTAL ANXIETY SCALE

PLEASE TICK ONE BOX

1. If you had to go to the dentist tomorrow, how would you feel about it ?

   a) I would look forward to it as a reasonably enjoyable experience.. ☐

   b) I wouldn't care one way or the other.. ☐

   c) I would be a little uneasy about it... ☐

   d) I would be afraid that it would be unpleasant and painful.................. ☐

   e) I would be very frightened of what the dentist might do...................... ☐

2. When you are waiting in the dentist's waiting room for your turn in the chair, how do you feel ?

   a) Relaxed.. ☐

   b) A little uneasy... ☐

   c) Tense.. ☐

   d) Anxious.. ☐

   e) So anxious that I sometimes break out in a sweat or almost feel physically sick... ☐

3. When you are in the dentist's chair waiting while he gets his drill ready to begin working on your teeth, how do you feel ?

   a) Relaxed.. ☐

   b) A little uneasy... ☐

   c) Tense.. ☐

   d) Anxious.. ☐

   e) So anxious that I sometimes break out in a sweat or almost feel physically sick... ☐

4. You are in the dentist's chair to have your teeth cleaned. While you are waiting and the dentist is getting out the instruments which he will use to scrape your teeth around the gums, how do you feel ?

   a) Relaxed.. ☐

   b) A little uneasy... ☐

   c) Tense.. ☐

   d) Anxious.. ☐

   e) So anxious that I sometimes break out in a sweat or almost feel physically sick... ☐

MODIFIED DENTAL ANXIETY SCALE

Parental Questionnaire / Before Treatment Session

CAN YOU TELL US HOW ANXIOUS YOU GET, IF AT ALL, WITH YOUR DENTAL VISIT

PLEASE INDICATE BY INSERTING "X" IN THE APPROPRIATE BOX

1. **If you want to your Dentist for TREATMENT TOMORROW, how would you feel ?**

   Not ☐ Anxious | Slightly ☐ Anxious | Fairly ☐ Anxious | Very ☐ Anxious | Extremely ☐ Anxious

2. **If you were sitting in the WAITING ROOM (waiting for treatment, how would you feel ?**

   Not ☐ Anxious | Slightly ☐ Anxious | Fairly ☐ Anxious | Very ☐ Anxious | Extremely ☐ Anxious

3. **If you were about to have a TOOTH DRILLED, how would you feel ?**

   Not ☐ Anxious | Slightly ☐ Anxious | Fairly ☐ Anxious | Very ☐ Anxious | Extremely ☐ Anxious

4. **If you were about to have your TEETH SCALED AND POLISHED, how would you feel ?**

   Not ☐ Anxious | Slightly ☐ Anxious | Fairly ☐ Anxious | Very ☐ Anxious | Extremely ☐ Anxious

5. **If you were about to have a LOCAL ANAESTHETIC INJECTION in your gum, above an upper back tooth, would you feel ?**

   Not ☐ Anxious | Slightly ☐ Anxious | Fairly ☐ Anxious | Very ☐ Anxious | Extremely ☐ Anxious

6. **How difficult was it bringing your child for extractions with gas?**

   Not ☐ Difficult | Slightly ☐ Difficult | Fairly ☐ Difficult | Very ☐ Difficult | Extremely ☐ Difficult

Please try to estimate how much pain or disomfort your child will feel on this visit.
Please use the rating scales below:

so that	1	would mean : no pain
	2	would mean : a little pain
	3	would mean : quite a lot of pain
	4	would mean : very much pain
	5	would mean : pain as bad as it could be

7. How much pain do you think your child will feel on this visit ?

no pain ☐☐☐☐☐ pain as bad as it could be
1 2 3 4 5

Please would you try to estimate how worried your child is about this dental visit.
Please use the rating scales below:

so that	1	would mean : relaxed/not worried
	2	would mean : very slightly worried
	3	would mean : fairly worried
	4	would mean : worried a lot
	5	would mean : very worried

How does your child feel about.................................

8. ...going to the dentist generally ?

relaxed ☐☐☐☐☐ worried
1 2 3 4 5

9. ...having his/her teeth looked at ?

relaxed ☐☐☐☐☐ worried
1 2 3 4 5

10. ...having his/her teeth scraped and polished ?

relaxed ☐☐☐☐☐ worried
1 2 3 4 5

11. ...having an injection in the gum ?

relaxed ☐☐☐☐☐ worried
1 2 3 4 5

12. **...having a filling ?**

relaxed ☐☐☐☐☐ **worried**

1 2 3 4 5

13. **...having a tooth taken out ?**

relaxed ☐☐☐☐☐ **worried**

1 2 3 4 5

14. **...being put to sleep to for extractions ?**

relaxed ☐☐☐☐☐ **worried**

1 2 3 4 5

15. **Has your child received dental treatment before ?**

Yes ☐

No ☐

If Yes - tick what they have received.

Filling ☐

Tooth extraction...................................... ☐

Scale and Polish..................................... ☐

Injection in mouth................................. ☐

Topical fluoride gel onto the teeth....... ☐

Other... ☐ please explain

APPENDIX 3

CONSENT FORMS

THE UNIVERSITY
of LIVERPOOL

Dr M V Martin
BDS, BA, PhD, FRCPath
Senior Lecturer/Consultant
Oral Microbiology

Clinical Dental Sciences

School of Dentistry

Liverpool
L69 3BX

Telephone: 0151 706 5266
Facsimile: 0151 706 5809

MVM/JO/5266

26 June, 1995

Mr G T Lee
4th Floor
L U D H

Dear George,

Re: A study of the factor influencing dental anxiety in relation to treatment under general anaesthesia in 5-8 year old children

Thank you for the amended protocol. I am happy to take Chairman's action and give Local Research Ethical Committee approval to this protocol.

Good luck with this project.

Yours sincerely,

Michael Martin

Dr M V Martin

Parent's Copy

We are trying to find ways of helping children who have to be put to sleep to take out a tooth.

It would be a great help if you would answer some questions which would tell us how you and your child feel today. We also would like to ask some further questions following your child's treatment.

All this information would be in the strictest confidence and would show us ways in which we might be able to improve this service which the hospital gives.

If you decide to take part then please sign the consent form. We would like to thank you in advance for your assistance.

You can of course withdraw from this study at any time. Please contact one of the people below.

If you do not want to take part then this will have no effect on your child's treatment.

Contact Names:	Mr George Lee Consultant tel: 0151 706 5236	Dr Gerry Humphris Clinical Lecturer tel: 0151 794 5525

Address: Liverpool University Dental Hospital
Pembroke Place
L69 3BX

Interviewer's Copy

I understand the purpose of this study and agree for my child to take part

Signed :...

Please Print Name:...

Interviewer's Name:...

INFORMATIVE LEAFLET

INFORMATION TO HELP YOU AND YOUR CHILD AFTER THE OPERATION.

This information is to ensure trouble-free and swift recovery for your child.

THE ANAESTHETIC

* modern anaesthetics

- work safely & efficiently
- have only occasional mild side-effects

* your child is unlikely to remember anything until he/she wakes up

* your child may feel slightly dizzy for a short time. For this reason he/she, for the rest of the day, **should not:-**

- be allowed to go to school
- ride a bicycle
- play unsupervised

THE EXTRACTION(S)

PAIN

- sometimes there may be slight pain which can be eased by giving your child paracetamol (eg Calpol) when you get home. Please read the instructions on the bottle carefully.

BLEEDING

Prevention

* Bleeding from the gums can happen some time after extraction. This may be due to the disturbance of the socket. Some precautions can be taken:-

- do not let your child keep rinsing his/her mouth until the next day.
- stop him/her from touching the socket with his/her fingers or tongue.
- tell him/her to bite in an area away from the socket whilst eating

TO STOP BLEEDING

- should bleeding occur, this can often be stopped by getting your child to bite on a clean folded handkerchief for at least 15 minutes

IF IT DOES NOT STOP

- then please
  return to Dental Hospital during normal working hours (9am - 5pm, Monday to Friday)

  or

  attend the casualty department at Alder Hey at other times.

MODIFIED DENTAL ANXIETY SCALE

(FOR PARENTAL VIEW OF CHILD'S DENTAL ANXIETY)

Parental Questionnaire / BEFORE Treatment Session

Please show how worried you think your child is about this dental visit.

	relaxed/ not worried	very slightly worried	fairly worried	worried a lot	very worried
Please show how worried you think your child is about this dental visit.	☐	☐	☐	☐	☐

How does your child feel about

	relaxed/ not worried	very slightly worried	fairly worried	worried a lot	very worried
.....going to the dentist generally?	☐	☐	☐	☐	☐
.....having his/her teeth looked at ?	☐	☐	☐	☐	☐
.....having his/her teeth scraped and polish ?	☐	☐	☐	☐	☐
.....having an injection in the gum ?	☐	☐	☐	☐	☐
.....having a filling ?	☐	☐	☐	☐	☐
.....having a tooth taken out ?	☐	☐	☐	☐	☐
.....being put to sleep for extractions ?	☐	☐	☐	☐	☐

Has your child received dental treatment before ? Yes ☐ No ☐

If yes - tick what they have received:
- Filling ☐
- Tooth extraction ☐
- Scale and Polish ☐
- Injection in the mouth ☐
- Put to sleep with gas ☐
- Other ☐ (Please specify.................................)

MODIFIED DENTAL ANXIETY SCALE

(FOR PARENT'S DENTAL ANXIETY)

AND

DENTAL SUBSCALE OF

CHILDREN'S FEAR SURVEY SCHEDULE

Can you tell us how anxious you get, if at all, with your dental visit (please indicate by inserting " X" in the appropriate box)

1 If you went to the dentist for **treatment tomorrow**, how would you feel ?

not anxious	slightly anxious	fairly anxious	very anxious	extremely anxious
☐	☐	☐	☐	☐

2 If you were sitting in the **waiting room** (waiting for treatment), how would you feel ?

not anxious	slightly anxious	fairly anxious	very anxious	extremely anxious
☐	☐	☐	☐	☐

3 If you were about to have a **tooth drilled**, how would you feel ?

not anxious	slightly anxious	fairly anxious	very anxious	extremely anxious
☐	☐	☐	☐	☐

4 If you were about to have your **teeth scaled and polished**, how would you feel ?

not anxious	slightly anxious	fairly anxious	very anxious	extremely anxious
☐	☐	☐	☐	☐

5 If you were about to have a **local anaesthetic injection** in your gum, above an upper back tooth, how would you feel ?

not anxious	slightly anxious	fairly anxious	very anxious	extremely anxious
☐	☐	☐	☐	☐

For each of the situations, events, or people listed below think how afraid your child is or imagine how afraid he/she might be. Then, please rate your child's fear for each item by circling one of the numbers (1, 2, 3, 4 or 5) which is the closest match. If your child has never been to the dentist try to imagine his/her fear.

(Circle one number for each item)

		Not afraid at all	a little afraid	A fair amount	Pretty much afraid	Very afraid
1	Dentists	1	2	3	4	5
2	Doctors	1	2	3	4	5
3	Strangers	1	2	3	4	5
4	Injections	1	2	3	4	5
5	Having someone examine his/her mouth	1	2	3	4	5
6	Having to open his/her mouth	1	2	3	4	5
7	Having a stranger touch him/her	1	2	3	4	5
8	Having the dentist clean his/her teeth	1	2	3	4	5
9	The dentist drilling	1	2	3	4	5
10	The sight of the dentist drilling	1	2	3	4	5
11	The noise of the dentist drilling	1	2	3	4	5
12	Having somebody put instruments in his/her mouth	1	2	3	4	5
13	Choking	1	2	3	4	5
14	Having to go to the hospital	1	2	3	4	5
15	People in white uniforms	1	2	3	4	5

THREE DAYS POST-TREATMENT QUESTIONNAIRE

Parental Questionnaire/ **THREE DAYS AFTER** treatment

1. How was your child on the way home from hospital ? (Please tick one or more)

Content	☐	In pain	☐
Crying	☐	Distressed	☐
Vomiting (feeling sick)	☐	Nausea (feeling sick)	☐
Bleeding	☐	Drowsy (sleepy)	☐
Other	☐	If other, please say............................	

2. **Did you give any pain killers to your child ?** Yes ☐ No ☐

3. **How many times did you give your child pain killers (e.g. Paracetamol) ?**

	Once	Twice	3 times	4 times	More than 4 times
1 day after the operation	☐	☐	☐	☐	☐
2 days after the operation	☐	☐	☐	☐	☐
3 days after the operation	☐	☐	☐	☐	☐

4. **How was your child, in the first hour after you got home ?**

Content	☐	Crying a little	☐
Crying a lot	☐	Sleeping	☐
Nausea (feeling sick)	☐	Vomiting (feeling sick)	☐
In pain	☐	Bleeding	☐
Distressed	☐	Watching T.V.	☐
Reading	☐	Playing	☐
Other	☐	If other, please say............................	

5. **Did your child eat anything later that day ?**

Yes ☐ If yes, please say..

No ☐

6. **How did your child sleep that night ?**

well ☐ Quite well ☐ Badly ☐ Very badly ☐

7. **How was your child the next day ?**

Tired ☐
In Pain ☐
Crying ☐
Much better ☐

Thank you very much for filling in this form. Please place this in the stamped addressed envelope, and post it back to me.

PARENTAL QUESTIONNAIRE

FOR

1 MONTH FOLLOW-UP VISIT

Parental Questionnaire / 1 Month Follow-Up

Please show how worried you think your child is about this dental visit.

Please show how worried you think your child is about this dental visit.	relaxed/ not worried ☐	very slightly worried ☐	fairly worried ☐	worried a lot ☐	very worried ☐

How does your child feel about

.....going to the dentist generally ?	relaxed/ not worried ☐	very slightly worried ☐	fairly worried ☐	worried a lot ☐	very worried ☐
.....having his/her teeth looked at ?	relaxed/ not worried ☐	very slightly worried ☐	fairly worried ☐	worried a lot ☐	very worried ☐
.....having his/her teeth scraped and polish ?	relaxed/ not worried ☐	very slightly worried ☐	fairly worried ☐	worried a lot ☐	very worried ☐
.....having an injection in the gum ?	relaxed/ not worried ☐	very slightly worried ☐	fairly worried ☐	worried a lot ☐	very worried ☐
.....having a filling ?	relaxed/ not worried ☐	very slightly worried ☐	fairly worried ☐	worried a lot ☐	very worried ☐
.....having a tooth taken out ?	relaxed/ not worried ☐	very slightly worried ☐	fairly worried ☐	worried a lot ☐	very worried ☐
.....being put to sleep for extractions ?	relaxed/ not worried ☐	very slightly worried ☐	fairly worried ☐	worried a lot ☐	very worried ☐

Has your child received dental treatment before ? Yes ☐
No ☐

If yes - tick what they have received: Filling ☐
Tooth extraction ☐
Scale and Polish ☐
Injection in the mouth ☐
Put to sleep with gas ☐
Other ☐ (Please specify.................................)

Can you tell us how anxious you get, if at all, with your dental visit (please indicate by inserting " X" in the appropriate box)

1 If you went to the dentist for **treatment tomorrow**, how would you feel ?

not anxious	slightly anxious	fairly anxious	very anxious	extremely anxious
☐	☐	☐	☐	☐

2 If you were sitting in the **waiting room** (waiting for treatment), how would you feel ?

not anxious	slightly anxious	fairly anxious	very anxious	extremely anxious
☐	☐	☐	☐	☐

3 If you were about to have a **tooth drilled**, how would you feel ?

not anxious	slightly anxious	fairly anxious	very anxious	extremely anxious
☐	☐	☐	☐	☐

4 If you were about to have your **teeth scaled and polished,** how would you feel ?

not anxious	slightly anxious	fairly anxious	very anxious	extremely anxious
☐	☐	☐	☐	☐

5 If you were about to have a **local anaesthetic injection** in your gum, above an upper back tooth, how would you feel ?

not anxious	slightly anxious	fairly anxious	very anxious	extremely anxious
☐	☐	☐	☐	☐

For each of the situations, events, or people listed below think how afraid your child is or <u>imagine</u> how afraid he/she might be. Then, please rate your child's fear for each item by circling one of the numbers (1, 2, 3, 4 or 5) which is the closest match. If your child has never been to the dentist try to <u>imagine</u> his/her fear.

		Not afraid at all	**a little afraid**	**A fair amount**	**Pretty much afraid**	**Very afraid**
		(Circle one number for each item)				
1	Dentists	1	2	3	4	5
2	Doctors	1	2	3	4	5
3	Strangers	1	2	3	4	5
4	Injections	1	2	3	4	5
5	Having someone examine his/her mouth	1	2	3	4	5
6	Having to open his/her mouth	1	2	3	4	5
7	Having a stranger touch him/her	1	2	3	4	5
8	Having the dentist clean his/her teeth	1	2	3	4	5
9	The dentist drilling	1	2	3	4	5
10	The sight of the dentist drilling	1	2	3	4	5
11	The noise of the dentist drilling	1	2	3	4	5
12	Having somebody put instruments in his/her mouth	1	2	3	4	5
13	Choking	1	2	3	4	5
14	Having to go to the hospital	1	2	3	4	5
15	People in white uniforms	1	2	3	4	5

PARENTAL QUESTIONNAIRE

FOR

3 MONTH FOLLOW-UP INTERVIEW BY TELEPHONE

Parental Questionnaire / 3 Month Follow-Up Telephone interview

Thank you for allowing me to talk to you on the phone about your child. I wanted to ask how you felt your child had reacted to having a tooth/teeth extracted by putting them to sleep.

How does your child feel about

.....going to the dentist generally ?	relaxed/ not worried	very slightly worried	fairly worried	worried a lot	very worried
	☐	☐	☐	☐	☐

For each of the situations, events, or people listed below think how afraid your child is or imagine how afraid he/she might be. Then, please rate your child's fear for each item by circling one of the numbers (1, 2, 3, 4 or 5) which is the closest match. If your child has never been to the dentist try to imagine his/her fear.

		Not afraid at all	**a little afraid**	**A Fair amount**	**Pretty much afraid**	**Very afraid**
		(Circle one number for each item)				
1	Dentists	1	2	3	4	5
2	Doctors	1	2	3	4	5
3	Strangers	1	2	3	4	5
4	Injections	1	2	3	4	5
5	Having someone examine his/her mouth	1	2	3	4	5
6	Having to open his/her mouth	1	2	3	4	5
7	Having a stranger touch him/her	1	2	3	4	5
8	Having the dentist clean his/her teeth	1	2	3	4	5
9	The dentist drilling	1	2	3	4	5
10	The sight of the dentist drilling	1	2	3	4	5
11	The noise of the dentist drilling	1	2	3	4	5
12	Having somebody put instruments in his/her mouth	1	2	3	4	5
13	Choking	1	2	3	4	5
14	Having to go to the hospital	1	2	3	4	5
15	People in white uniforms	1	2	3	4	5

Generally, would you say he/she is more or less anxious about visiting the dentist, following his/her tooth extraction ?

More anxious ☐ No change ☐ Less anxious ☐

MODIFIED CHILDREN'S DENTAL ANXIETY SCALE

Child Questionnaire / After Treatment Session

For the next 7 questions I would like you to show me how relaxed or worried you get about the dentist and what happens to you at the dentist.

To show me how relaxed or worried you feel please use the simple scale below. This scale is just like a ruler going from 1 which would show that you are relaxed to 5 which would show that you are very worried.

Point to the number which shows me how relaxed or worried you are for that question:

so that	1	would mean : relaxed/not worried
	2	would mean : very slightly worried
	3	would mean : fairly worried
	4	would mean : worried a lot
	5	would mean : very worried

How do you feel about................................

1. ...going to the dentist generally ?

relaxed ☐☐☐☐☐ worried
1 2 3 4 5

2 ...having your teeth looked at ?

relaxed ☐☐☐☐☐ worried
1 2 3 4 5

3. ...having your teeth scraped and polished ?

relaxed ☐☐☐☐☐ worried
1 2 3 4 5

4. ...having an injection in the gum ?

relaxed ☐☐☐☐☐ worried
1 2 3 4 5

5. ...having a filling ?

relaxed ☐☐☐☐☐ worried
1 2 3 4 5

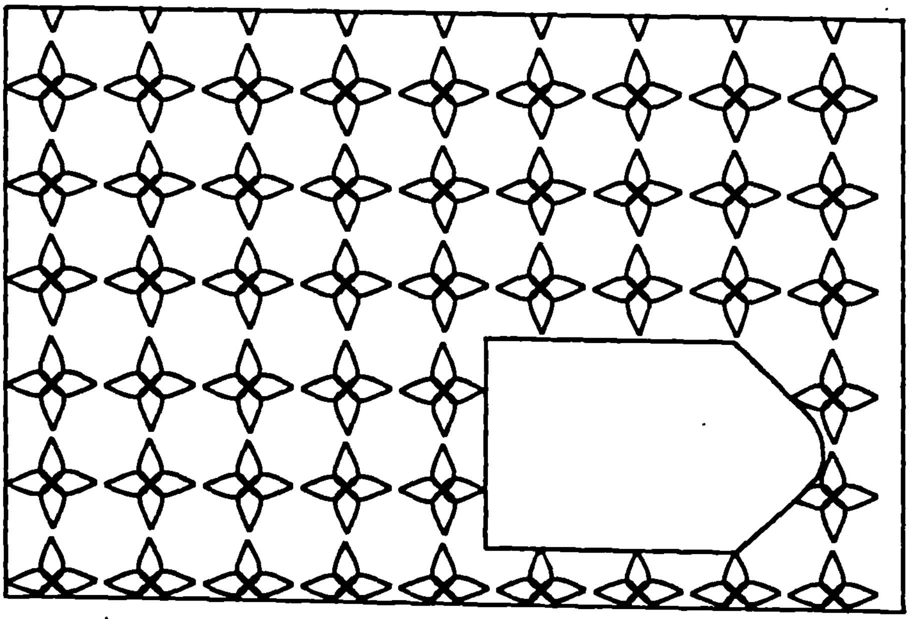
6. ...having a tooth taken out ?

relaxed ☐☐☐☐☐ worried
1 2 3 4 5

7. ...being put to sleep to have treatment ?

relaxed ☐☐☐☐☐ worried
1 2 3 4 5

COLOURED PROGRESSIVE RAVEN'S MATRICES



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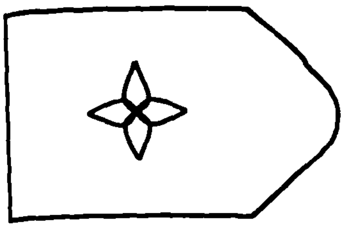

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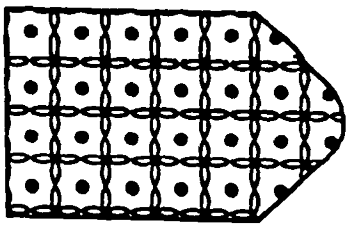

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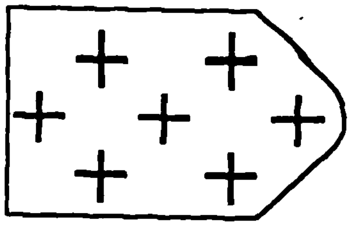

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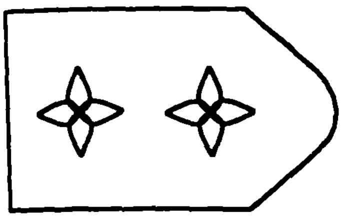

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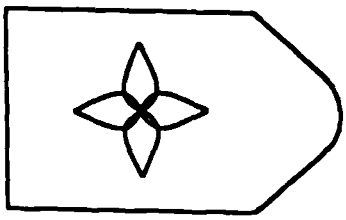

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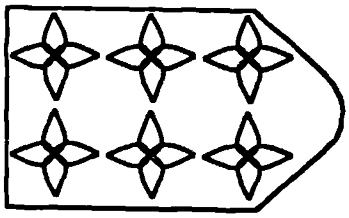

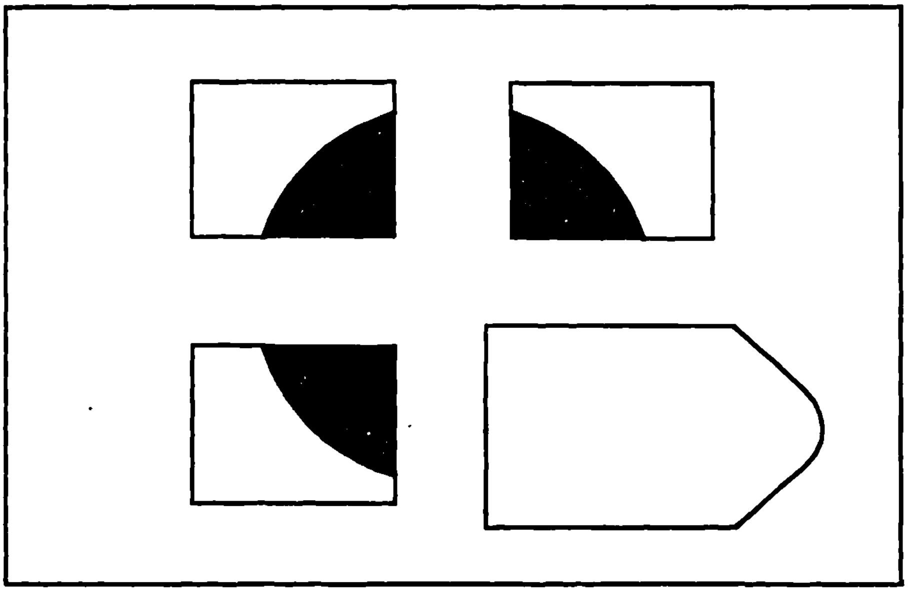

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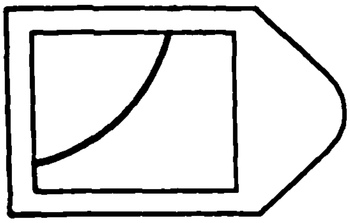

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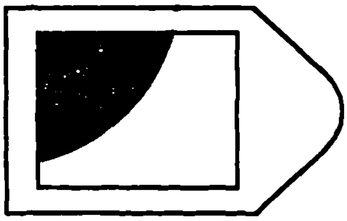

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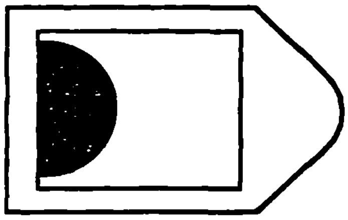

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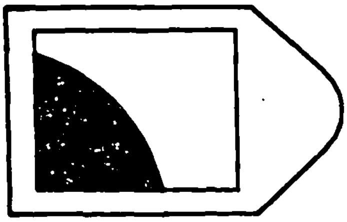

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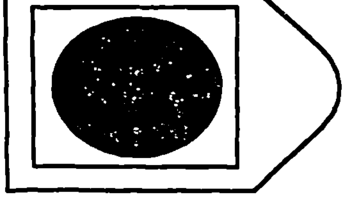

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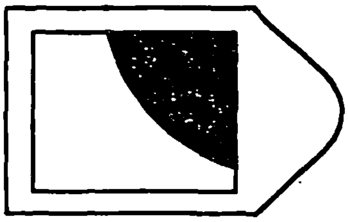

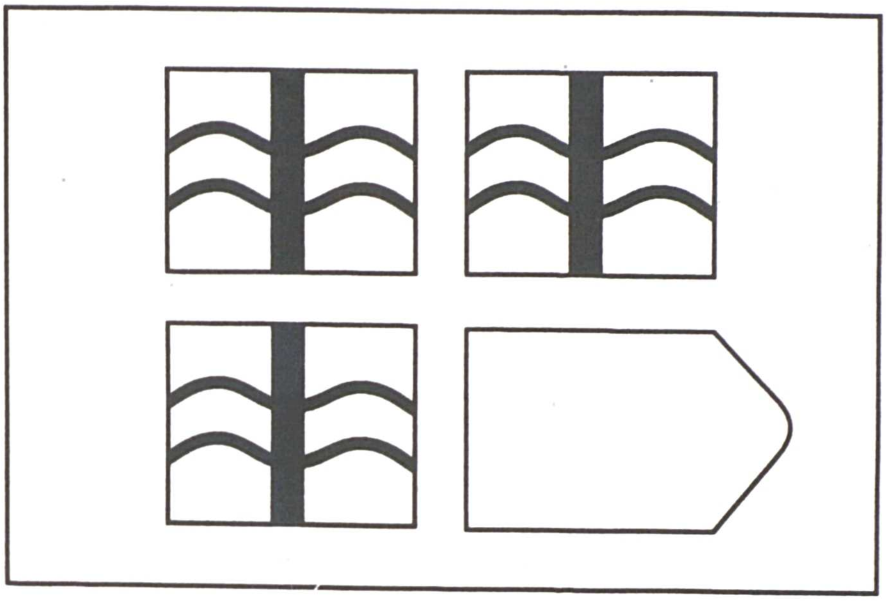

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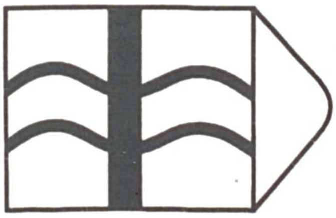

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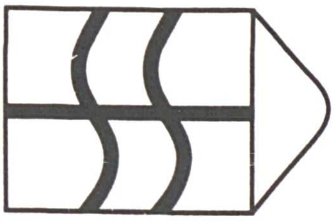

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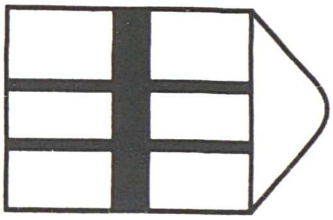

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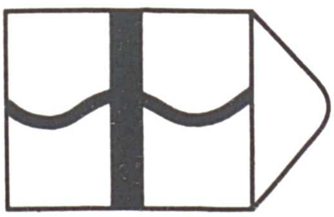

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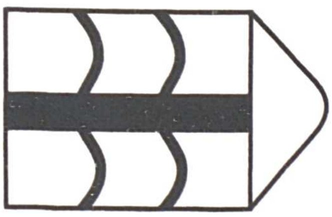

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