Predictors of publication in Dental Research. The analysis of clinical trials from 2005-2007.

Thesis submitted in accordance with the requirements of the University of Liverpool in partial fulfilment for the degree of Doctorate in Dental Science by Gareth Williams.

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Structured Abstract

Aims:

2005-2007 abstracts

This study aimed to identify the:

- number of clinical trials that were presented from 2005-2007 at the conferences of the:
    - American Association of Orthodontists (AAO),
    - European Orthodontic Society (EOS),
    - International Association for Dental Research (IADR),
    - European Organisation for Caries Research (ORCA)
    - Australian Society of Orthodontists Congress (ASO)
- abstracts that went on to be published as a full paper in a peer reviewed journal.
- time to publication for those abstracts that were subsequently published as a full paper in a peer reviewed journal.
- following characteristics of the abstract and determine their influence on the rate of and time to publication:
    - Result significance: (Significant, Non-significant, or Unclear)
    - Mode of presentation (Oral or Poster)
    - Study design (RCT / CCT)
    - Sample Size: (Absolute number)
    - Funding disclosure: (Yes / No)

    - Continent of origin: (North America, South America, Europe, UK, Asia, Africa, Australasia).
    - Primary author:
        - Gender (Male / Female / Unclear)
        - Professional status: (Professor / Non-professor / Unclear)
- Identify reasons why abstracts did not achieve publication.

University Teachers Group (UTG) abstracts

This study aimed to identify the:

- number of abstracts presented at the University Teachers Group session, from 1999-2010, at the British Orthodontic Conference.
- following characteristics of the abstract and determine their influence on rate of and time to publication:
    - Funding disclosure: (Yes / No)
    - Dental School of origin
- abstracts that went on to be published as a full paper in a peer reviewed journal.

Design:

Retrospective, observational study.

Subject and Setting:

The sample frame included dental clinical trials presented at the conferences of the International Association of Dental Research (IADR), European Orthodontic Society (EOS), European Organisation for Caries Research (ORCA), The American Association of Orthodontists (AAO) and The Australian Society of Orthodontists (ASO) from January 2005 to December 2007.

The sample frame for the University Teachers Group (UTG) abstracts, included abstracts presented at the UTG session of the British Orthodontic Conference (BOC) 1999-2010.

Sample size

Spencer[1] found a publication rate of 38% from abstracts of clinical trials presented at EOS, IADR, ORCA and a 50% increase would be give a publication rate of 57%. Using data from Spencer in Pocock's formula, 210 abstracts would be required to give 80% power, at the 5% level, and enable me to detect a 50% rise in the proportion of clinical trial abstracts published.

Method:

Clinical trials presented at above conferences were identified from the associated journals or conference proceedings. Inter-examiner and intra-examiner reliability were assessed using a random 10% sample of abstracts. A MEDLINE search was undertaken to determine whether the abstract had been published in full. The date of publication was recorded. Authors of abstracts that did not reach publication were contacted to determine the reasons.

Results:

Seven thousand and sixty-nine abstracts presented from 2005-2007 were identified, including 215 clinical trials. 142 abstracts were identified from the UTG session from 1998 – 2008, and all were included. The publication rate for the 2005-2007 sample was 32.6% and the UTG sample 34.5%. There were no predictors of publication in either group studied. The median time to publication of the 2005 – 2007 group was 16.00 months, IQR (10, 26) and the mean time to publication for the UTG group was 18.3 months (95% CI 14.38, 22.19).

For the unpublished 2005-2007 group, reasons given for failure to publish were lack of time (8.3%), language, culture, lack of teaching (1.4%), rejection (0.7%), motivation (0.7%), perceived editorial bias (0.7%) and length of review process (0.7%).

For the UTG group, reasons given included lack of time (19.4%), lack of interest from SpR (9.7%) or in press (7.5%).

Conclusions:

No predictors of publication were found for either group studied. For the unpublished 2005-2007 group, main reasons given were lack of time (8.3%), language, culture and lack of teaching (1.4%).

For the UTG group, reasons given included lack of time (19.4%), lack of interest from SpR (9.7%) or *in press* (7.5%). The qualitative results should be viewed with caution due to the low response rate (12.4% for the 2005 – 2007 sample, and 68.8% for UTG).

Chapter 1 - Introduction

Early forms of Evidence based medicine (EBM) have been recognised by some as far back as Ancient Greece,[2] while others trace its roots to ancient Chinese medicine. However, it was only in the 20th Century that EBM was actively pursued across all fields of health care. Archie Cochrane, a Scottish epidemiologist, through his book[3] and subsequent advocacy, initiated an increasing acceptance of EBM concepts and validity. David Eddy, a heart surgeon turned mathematician and health-care economist, first used the term "evidence based" in 1990.[4] He used this alongside one of his most infamous quotes "the problem is that we don't know what we are doing".[5] His highest impact work involved dismissing bone marrow transplants as a treatment for breast cancer (a common treatment at the time) and changing the focus in diabetes treatment from aggressive glucose control to the prevention of secondary illnesses.[6] It is indubitable that David Eddy has saved countless lives through the prevention of ill-informed, often harmful, treatments being continued and thus has greatly contributed to the effective evolution of healthcare.

Green and Byar[7] formulated a hierarchy of evidence that was later modified by Harrison[8] (Figure 1.1) so that the hierarchy increases in strength of evidence from apex to base so that systematic reviews of Randomised Controlled Clinical Trials (RCTs) can be seen as a strong foundation on which healthcare decisions can be based.

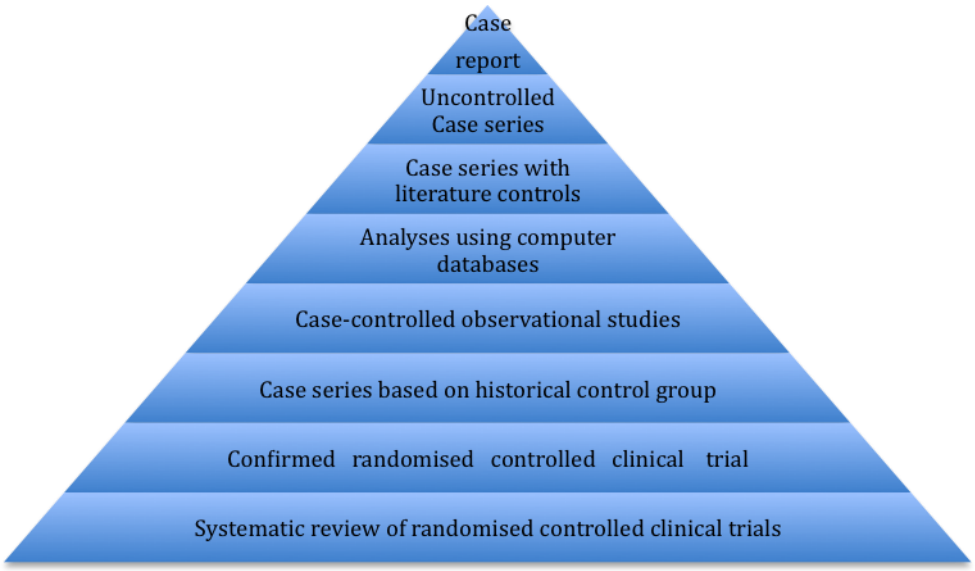

Figure 1.1: Hierarchy of evidence

In an editorial in the Journal of Orthodontics in 2003, Burden[9] espoused the virtues of "Selective reading" as a method of increasing the efficiency of evidence analysis. This is usually partly performed for the reader by the referees and editorial teams of Journals, so that studies with inferior methods do not achieve full publication.

This study aims to determine factors that influence publication, most notably the significance of the results. This will identify whether there was publication bias in dental research, that is, the publication of studies with significant results in preference to those with inconclusive or non-significant results, which would skew the results of systematic reviews[10].

In this thesis I will be exploring the issues surrounding the publication of research in a sample of abstracts from dental research conferences. Thus I shall try to establish factors which may affect the publication outcomes of research, that is, determine whether articles are published or not and hence ultimately whether or not publication bias exists within the field of dental research.

Chapter 2 – Literature Review

Evidence Based Practice and Publication Bias:

The First Five Years[11] a guidance document issued by the General Dental Council (GDC) in 2004, outlines legal responsibilities for different sectors of dentistry. The *Learning outcomes required for registration* include "familiarity with an evidence-based approach to treatment, and (an ability) to apply evidence-based treatment". The *Responsibilities for dental schools* include providing students with an understanding of "the importance of evidence-based dentistry and how this relates to clinical practice, and an ability to evaluate the evidence and critically assess its relevance to treatment planning, advice and treatment provision". *The Responsibilities of the GDC include a regulation of educational provision* that is "evidence-based in its judgments". The curriculum of the Membership in Orthodontics also delineates the roles of the specialist orthodontist in relation to evidence based dentistry, stating candidates should "Demonstrate understanding of research methods and statistical evaluation, and be able to critically appraise published work".[12] In addition to this, accepted publications are now viewed as *sine qua non* for application to specialist training; this has been adopted in the contemporary advice given to those applying for specialist training interviews as "publish or perish". This phrase has been previously discussed in the orthodontic literature.[13,14]

It is logical, therefore, that if dental students are required to have a familiarisation with Evidence Based Dentistry (EBD) that this should include knowledge of how to interpret not only published data, but why data remain unpublished, so that published data may be put in context. It has been previously documented that many people will perform studies that remain unpublished, and Rosenthal discussed this "file drawer problem", stating that:

"*For any given research area, one cannot tell how many studies have been conducted but never reported. The extreme view of the "file drawer problem" is that journals are filled with the 5% of the studies that show Type I errors, while the file drawers are filled with the 95% of the studies that show non-significant results*".[15]

Following this 1979 paper, Peterson held similar discussions and criticised the representativeness of published research.[16] However, not until recently, has this problem been analysed in the medical field.[17] The Cochrane Collaboration discusses these issues, now known as publication bias, in the following manner.[18]

Publication bias and other related biases, can be related to the statistical significance of the results with 'positive' results being more likely to be:

- *Published (publication bias)*
- *Published rapidly (time lag bias)*
- *Published in English (language bias)*
- *Published more than once (multiple publication bias)*
- *Cited by others (citation bias)*

All of these reporting biases make positive studies easier to find than those with non-significant results, something that we can try to minimise by extensive searching."

Another bias, not mentioned in the list above, which could be considered under the heading of reporting bias is White hat bias (WHB). Cope and Allison defined white hat bias in 2010 as "bias leading to distortion of information in the service of what may be perceived to be righteous ends".[19] These authors postulated that the effects of white hat bias were inter-related with citation and publication bias.

Bias is defined as:[20]

- **Noun**: inclination or prejudice in favour of a particular person, thing, or viewpoint.
- **Verb**: influence unfairly; prejudice.

Song *et al.* have defined publication bias.[21] as "a bias with regard to what is likely to be published, among what is available to be published."

Wikipedia[22] notes that "not all bias is inherently problematic, for instance, a bias against publishing lies is a good bias, but one very problematic, and much discussed bias, is the tendency of researchers, editors, and pharmaceutical companies to handle the reporting of experimental results that are *positive* (that is, showing a significant finding) differently from results that are *negative* (that is, supporting the null hypothesis) or inconclusive, leading to a misleading bias in the overall published literature."

Dickersin[10] comments "Publication bias is the tendency on the parts of investigators, reviewers, and editors to submit or accept manuscripts for publication based on the direction or strength of the study findings. Much of what has been learned about publication bias comes from the social sciences, less from the field of medicine". She states that the "prevention of publication bias is important both from the scientific perspective (complete dissemination of knowledge) and from the perspective of those who combine results from a number of similar studies (meta-analysis)". She also advises that the literature include all available data of acceptable quality, especially if it is to support treatment decisions. She discusses the difficulties in retrieving information on all studies in a named field, and advises

that “Registration of clinical trials, and perhaps other types of studies, is the direction in which the scientific community should move.”

Easterbrook *et al.*[23] add that “conclusions based only on a review of published data should be interpreted cautiously, especially for observational studies. Improved strategies are needed to identify the results of unpublished as well as published studies.”

Wikipedia[22] again discusses the broader effect of publication bias, stating that published studies might not truly reflect all valid performed studies, and this bias could skew meta-analyses in systematic reviews, “on which evidence-based medicine . . . increasingly relies. The problem may be particularly significant when the research is sponsored by entities that may have a financial or ideological interest in achieving favourable results.” and “Those undertaking meta-analyses and systematic reviews need to take account of publication bias in the methods they use for identifying the studies to include in the review (including) a thorough search for unpublished studies, and . . . analytical tools”. The analytical tools discussed in this reference are Begg's funnel plot and Egger's plot, which are methods that attempt to quantify publication bias. Wikipedia again states that these “rely on the underlying theory that small studies with small sample size (and large variance) would be more prone to publication bias, while large-scale studies would be . . . more likely to be published regardless of significance of findings. Thus, when overall estimates are plotted against the variance (sample size), a symmetrical funnel is usually formed in the absence of publication bias, while a skewed, asymmetrical funnel is observed in presence of potential publication bias. Extending the funnel plot, the "Trim and Fill" method has also been suggested as a method to infer the existence of unpublished hidden studies, as determined from a funnel plot, and subsequently correct the meta-analysis by imputing the presence of missing studies to yield an unbiased pooled estimate.”

A 2005 paper by Hans-Hermann Dubben and Hans-Peter Beck-Bornholdt states:[24]-

"Publication bias is a well known phenomenon in clinical literature, in which positive results have a better chance of being published, are published earlier, and are published in journals with higher impact factors. Conclusions exclusively based on published studies, therefore, can be misleading". The authors posit that this "selective under-reporting" might be more common and adversely consequential for patients than the "publication of deliberately falsified data." The authors declare "We found no evidence of publication bias in reports on publication bias." Ben Goldacre, however, reports evidence of publication bias in trials of publication bias in a recent Technology Entertainment Design (TED) talk, including the following diagram taken from the Dubben and Beck-Bornholdt paper.[25]

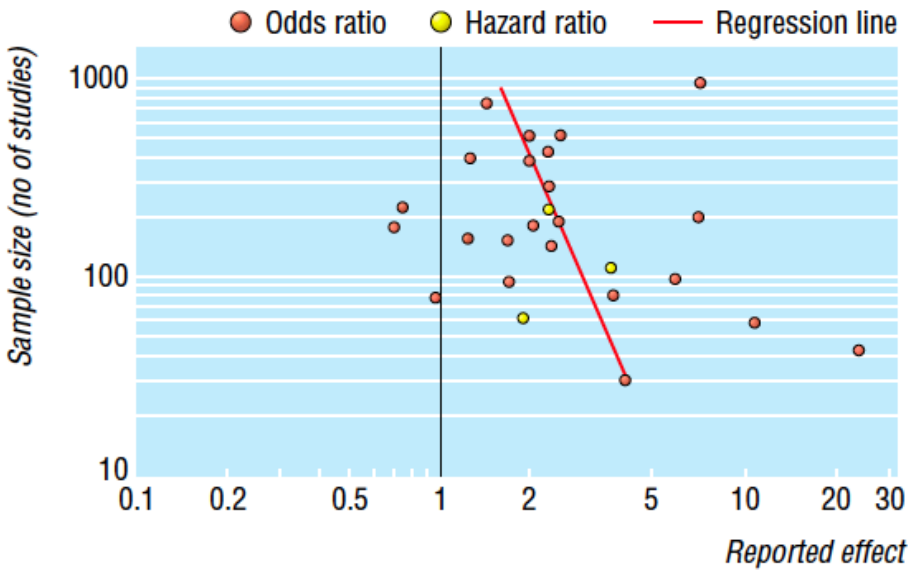

Figure 2.1: Example of a Funnel plot[24]

Ben Goldacre states in his blog[26] and associated Guardian article[27]: "One thing we cover regularly in Bad Science is the way that only certain stories get media coverage. Scares

about mercury fillings get double page spreads and Panorama documentaries; the follow-up research, suggesting they are safe, is ignored. Unpublished research on the dangers of MMR gets multiple headlines; published research suggesting it is safe somehow gets missed. This all seems quite normal to us now".

"Strangely, the very same thing happens in the academic scientific literature, and you catch us right in the middle of doing almost nothing about it". Dr Goldacre suggests a compulsory international trials register as his favourite solution, claiming that it is both very simple and widely accepted. "Give every trial a number, so that double counting is too embarrassingly obvious to bother with, so that trials can't go missing in action, so that researchers can make sure they don't needlessly duplicate, and much more. It's not a wildly popular idea with drug companies". He goes on to list current successful registers "The US has its own register, but only for US trials, and specifically not for clinical trials in the developing world (I leave you to imagine why companies might do their trials in Africa). The EU has a sort of register, but most people aren't allowed to look at it, for some reason. The Medical Research Council has its own. Some companies have their own. Some research charities do too. The best register is probably Current Controlled Trials, and that's a completely voluntary one set up by some academics a few years ago".

According to Dr Goldacre, there has been public and academic pressure toward a compulsory register for two decades, yet only this month, following long consultations, the World Health Organisation (WHO) have announced a voluntary code along with a metadirectory of clinical trials. He closes his statement with "If it's beyond the wit of humankind to make a compulsory register for all published trials, then we truly are lame."

If the predictors of publication are identified, it may be possible to decide whether the selection measures employed by journals are fair or otherwise, and whether the term bias is applicable in the dental field. Several studies have investigated the publication of abstracts presented at conferences, presenting the results as the percentage of the abstracts that progress to full publication.[28,29,30,1]

Table 2.1: Previous studies[29–34].

Author	Year	Speciality	Design	Number of Abstracts	Percentage Published	Time to Publication (Months)	Factors Affecting Publication
Scherer *et al.* (1994)	1994	Ophthalmology	Abstracts of RCTs from 2 different conferences in 1988 and 1989.	93	66%	Not found	Result significance and sample size above median
Cheng *et al.* (1998)	1998	Paediatric Pulmonology	Abstracts of RCTs from conference 1965 - 1995	178	32%	Not found	No factors
Evers (2000)	2000	Reproductive research	RCTs from annual meetings 1992-1997	2691	56%	32.5	Presentation style: Oral>Posters

Author	Year	Speciality	Design	Number of Abstracts	Percentage Published	Time to Publication (Months)	Factors Affecting Publication
Klassen *et al.* (2002)	2002	Paediatrics	RCTs from conferences 1992-1995	447	59.1%	Not found	Bias toward new therapies Sample size larger in published RCTs. 5% published abstracts show dissent regarding Rx efficacy.
Hopewell and McDonald (2003)	2003	Medicine	Abstracts of controlled trials from conferences 1980-2000	962	61%	12-24	1/3 CTs unpublished and therefore not easily accessible

Author	Year	Speciality	Design	Number of Abstracts	Percentage Published	Time to Publication (Months)	Factors Affecting Publication
Krzyzanowska *et al.* (2003)	2003	Oncology	Abstracts of large stage 3, randomised controlled trials from conferences 1989-1998	510	74%	Within 5 yrs	Result significance. Significant > non-significant Presentation style: oral or plenary>not presented Pharmaceutical sponsor published sooner Non-publication from lack of time, funds or other resources

Why does publication bias exist?

In the simplest sense, publication bias exists, in part, because publication and journals exist.

Academic journals

"PhD comics" is a graduate student comic that commonly satirises the paradigm of mainstream journal publication. It is a commonly held view, among this group, that journals are essentially comic books for scientists and academics. A comic strip produced recently by Jorge Cham[35] draws parallels between the two by paraphrasing a public talk given by Timo Hannay, Nature's online publishing director, stating "Basically, scientists give us their work for free, then we have volunteer scientists review it for us for free, then we bundle it all up and sell it back to them for a profit. It sounds outrageous but scientists will do it because they want to be published. We can charge whatever we want, it's essentially a monopoly."

The more mainstream journals for example, *Nature*, *New Scientist*, *Science* are often found in staff rooms to be looked through at break times. They are often on newsagent shelves with other "specialist magazines" including photography and computing. These are readily available to the general public and as such are subject to free market forces. It is a safe assumption that these journals would need similar marketing to the other texts that occupy the same shelves. The writers would likely feel pressure to generate stories of high interest to people browsing these shelves. It can therefore be seen how publication bias would affect these more mainstream journals.

Very recently, the New York Times reported a boycott of Elsevier by more than 5700 researchers.[36] This protest allegedly originated from a "provocative blog post by the

mathematician Timothy Gowers of Cambridge University, who announced on Jan. 21 that he would no longer publish papers in any of Elsevier's journals or serve as a referee or editor for them."[37] Following this, a group of mathematicians issued a statement denouncing "a system in which commercial publishers make profits based on the free labour of mathematicians and subscription fees from their institutions' libraries, for a service that has become largely unnecessary."[38] These events led to an interesting article by Mathew Ingram[39] in which he discusses whether we have any need for academic journals, stating "in an era of democratized distribution of information, why do we need expensive pay walled journals in the first place?". Kevin Bonham in his online Science Blogs entry[40] adds "We don't need *any* academic journal's services anymore. If you publish in *any* journal, you are making it easier for them to take action that harms academic institutions, so you shouldn't". He realises that this statement might be utopian however, and demonstrates an awareness of the difficulties, stating that "any academic scientists that took such a principled stand against all publishers would be ineligible for promotions or tenure and would have a much more difficult time securing grants to continue funding their research. But the truth is, journals add very little value to science, and impose huge monetary costs, as well as costs in terms of delayed publication and limited distribution." He closes his article with a thought-provoking statement "Science benefits when the flow of information is unrestricted and everyone benefits when scientific knowledge advances. Journals no longer assist in the distribution of knowledge, they only impede it, and no one benefits from this arrangement except the journals themselves. It's time for something new."

The Impact Factor

The impact factor (IF) is defined by Thomson Reuters[41] as "a measure of the frequency with which the average article in a journal has been cited in a particular year or period. It is one of the evaluation tools provided by Thomson Reuters *Journal Citation Reports*® (*JCR*®)." This is calculated annually by Thomson Reuters as "a ratio between citations and recent citable items published: a journal's impact factor is calculated by dividing the number of current year citations to the source items published in that journal during the previous two years." It is frequently used as an indicator of the relative importance of a journal in its field; those with higher impact factors generally thought to be most important. The impact factor was conceived by Eugene Garfield, the founder of the Institute for Scientific Information (ISI).[42]

The impact factor is calculated as shown below:

$$IF = A/B$$

Where A is the number of citations for articles published in the preceding year and B is the total number of "citable items" published in the preceding year. "Citable items" are most articles, excluding editorials and letters to the editors.

A journal can adopt editorial policies to increase its impact factor.[43,44] For example, journals might publish a larger proportion of review articles that are thought to be cited more than research reports.[41] Journals may also make attempt at limiting the number of "citable items" – the denominator of the impact factor equation, by declining to publish articles thought to be unlikely to be cited. If it is the feeling of the editors that positive results are more likely to receive attention and citation, it is conceivable that this could lead, in part, to publication bias. Citation bias,[18,45] as previously discussed, is another bias closely linked to publication

bias in which those studies with positive results show a higher likelihood of citation. It is not unreasonable to assume that these biases may be inter-related.

Why is this important?

The implementation of flawed evidence has been shown to lead to large-scale public health issues. A doctor who falsified MMR vaccine evidence, falsely linking it to the development of autism in vaccinated children has recently been removed from the medical register for serious professional misconduct.[46] The Times reported, "*Despite involving just a dozen children, the 1998 paper's impact was extraordinary. After its publication, rates of inoculation fell from 92% to below 80%. Populations acquire "herd immunity" from measles when more than 95% of people have been vaccinated*".[47] In November 2009, investigations were undertaken by the American Congress regarding alleged bias in global warming evidence, an emotive subject with far reaching consequences.[48] BBC News recently reported a story in which Stem Cell Researchers had written an open letter to journal editors citing their dissatisfaction with current publication bias.[49] Professor Lovell Badge, Head of Division at the National Institute for Medical Research is reported as saying:[49]

"*We are seeing the publication of a lot of papers in high profile journals with minimal scientific content or advance, and this is partly because of these high-profile journals needing to keep their so called 'impact factors' as high as possible".*

He goes on to state that the impact factors are *"determined by the number of citations that the papers have"* and that the journals are more concerned with this parameter than the validity of the scientific advance provided.

If publication bias is the tendency for papers to be accepted on the direction or strength of the findings,[49] then this may lead to an over estimation of treatment effects in published work and over use or prescription of an intervention be it a drug, mouthwash, filling material, surgical procedure or orthodontic technique.

NICE is a special health authority of the English NHS serving both England and Wales. It was set up in 1999 as the National Institute for Clinical Excellence and in 2005 merged with the Health Development Agency to become the National Institute for Health and Clinical Excellence.

NHS Evidence is a service provided by NICE. It provides fast access to authoritative health and social care evidence through a web-based portal. It aims to provide a "one stop shop" where one can easily search over 250,000 resources from hundreds of sources including the Cochrane library.

NICE has published guidance on dental issues such as miniscrew placement for orthodontic anchorage in November 2007, Wisdom tooth removal in March 2000, tooth decay treatment with Heal Ozone in July 2005 as well as some oral health guidelines.

The National Institute of Health and Clinical Excellence states on its web page section *How we work:* "We are internationally recognised for the way in which we develop our recommendations, a rigorous process that is centered on using the best available evidence and includes the views of experts, patients and carers, and industry."[50] It is fair to assume that if publication affects the availability of evidence, then the best evidence and the best available evidence may not be synonymous, and as such these guidelines could be influenced by systematic data misrepresentations.

Setting the scene

Several studies have investigated the proportion of abstracts presented at a conference that are subsequently published in a peer-reviewed journal. [1,28,29,30]

Peer review is a generic term describing a process of self-regulation by a profession. Peer review methods are employed to maintain standards, improve performance, and provide credibility of Journals. Kassirer and Campion[51] expressed concerns regarding the reliability of peer review and discussed its previous descriptions as "arbitrary, subjective, and secretive." They also highlighted the potential for reviewer bias, editorial bias both in isolation and combination – editors perhaps selecting certain reviewers of a similar bias-type.

Koletsi *et al.*[52] found that higher quality research has a greater likelihood of publication. However, many papers, looking at publication rate, overlook the impact factor of the journal the research was subsequently published in, with only some exceptions.[53,54]

Lee *et al.*[17] conducted a prospective cohort study to investigate the characteristics of submitted manuscripts that were associated with acceptance for publication in three major biomedical journals (*British Medical Journal*, *The Lancet* [UK] and *Annals of Internal Medicine* [USA]). The results showed an acceptance rate of 6% from 1107 studies, with 70% being rejected outright and 24% rejected after peer review. Predictors of publication included higher methodological quality, randomised controlled trials or the use of descriptive or qualitative analytical methods. They found that those studies reporting statistically significant results were no more likely to be published than those without, suggesting that the source of publication bias is not at the editorial level. In 2009, the Cochrane Collaboration published a review entitled "Publication bias in clinical trials due to statistical significance or direction of trial results".[55] This aimed to assess the extent to which publication of a cohort of clinical trials was influenced by the statistical significance,

perceived value and direction of their results. The reviewers found that studies deemed to have positive results, that is, statistically significant or showing a positive direction of effect, were nearly four times more likely to be published (OR 3.90; 95% CI 2.68, 5.68) than those with negative results. They also found that studies with positive results were published faster than those with negative results. Within the orthodontic literature, Koletsi *et al.*[52] conducted a retrospective analysis of the articles in five orthodontic journals over a 5-year period. They found that of the articles published, significantly more showed significant results ($p<0.02$) and journals with impact factors were twice as likely to publish a paper with a statistically significant result compared with journals with no impact factor (OR 1.99; 95% CI 1.19, 3.31). However, as this research was carried out retrospectively and there appears to have been no enquiry into the papers not accepted for publication; these data should be received with caution.

Previous work

Study design

Differences have been noted between publication rates of retrospective and prospective studies.[54,56] Work by Harrison[8] demonstrated a 100% increase in the publication of randomised controlled trials between 1989 and 1998. At this time, RCTs formed 7% of published clinical studies in orthodontics and it was predicted that this proportion would double over the following decade. This study was updated and an eight fold increase in the percentage of randomised controlled trials published as a proportion of the clinical studies between 1989-1998 (2.8%) and 1999-2008 (18.5%) was found (OR = 8.0, 95% CI 2.8, 23.1).[57]

Significance of results

Recent studies by Hopewell *et al.* have concluded that trials with positive findings were published more frequently and quickly than those with negative findings.[55,58] Other studies have corroborated with this, and suggest that the likelihood of publication is more related to positive outcome than to study design or quality.[59,60]

Scherer *et al.*[31], in their Cochrane review, found that 63% of results from abstracts describing RCTs or CCTs were published, and that "positive" results were more frequently published than those described as "not positive". They searched MEDLINE, EMBASE, The Cochrane Library, Science Citation Index, reference lists, and author files in 2003.

Krzyzanowska *et al.*[34] performed a survey of 510 abstracts from large RCTs between 1989 and 1998 in an oncology conference. Trial results were classified as significant or not significant, and the type of presentation and sponsorship were identified. Authors were contacted if the searches did not find evidence of publication. Of 510 randomized trials, 81% of the studies with significant results had been published within 5 years of the conference compared with 68% of the studies with no significant results. Studies with oral or plenary presentation were published sooner than those not presented, and studies with pharmaceutical sponsorship were published sooner than studies with cooperative group sponsorship or studies for which sponsorship was not specified. The most frequent reason cited by authors for not publishing was lack of time, funds, or other resources. Interestingly, the authors also suggested that non-publication breaks the contract that investigators make with trial participants, funding agencies, and ethics boards. It is also worrying but not surprising as is suggested in this paper that non-publication can lead to literature bias and inappropriate medical decisions.

Toma *et al.*[61] compared RCT abstracts presented in a late-breaking trials session versus other sessions at a large scientific conference and subsequent publications, by hand searching abstract booklets and associated Web sites for the American College of Cardiology Conference meetings (1999-2002). It was found that late-breaking trials were larger and less likely to report positive results than RCTs presented at other sessions, but discrepancies between the meeting abstract results and subsequent publication results were common even for late-breaking trials.

Blackwell *et al.*[62] also looked at publication bias by observing the rate and timing of full publication of clinical trials initially presented as abstracts at a national maternal-foetal medicine research meeting, then identifying factors associated with publication status. Full publication of clinical trials occurred more often if treatment differences were present, supporting the finding of a publication bias in this field.

Eloubeidi *et al.*[63] analysed factors associated with publication of gastro intestinal (GI) endoscopic research originally published in abstracts. They found the overall publication rate of abstracts to be 25%, lower than that in any published report from other medical societies. Abstracts from the United States were less likely to be published in full-manuscript form. Although there was no positive outcome bias for acceptance of abstracts for presentation at the meeting, there was bias toward publication of statistically significant results. Further investigations are warranted to determine the variation in the publication of research results according to country of origin and to determine factors that hinder publication of GI endoscopic research in manuscript form.

Elvik *et al.*[64] demonstrated that a meta-analysis of bicycle helmet efficacy described by Attewell, Glase, and McFadden[65] appeared to be influenced by publication bias. As a result, the author contended that the analysis overestimated the effects of bicycle helmets. Elvik's paper presented a re-analysis of the study that accounted and adjusted for publication bias through a variety of methods. This re-analysis showed lesser safety benefits from the use of bicycle helmets than the initial study.

Presentation at conferences

Scholey and Harrison, Evers, and Krzyzanowska[32,34,66] all found that studies presented orally were published more frequently than those presented as a poster at the conferences examined. Song *et al.*[21] however, found that publication bias appears to occur early, mainly before the presentation of findings at conferences or submission of manuscripts to journals.

Country of origin

This is a largely un-researched field, although work by Pitak-Arnnop *et al.*[67] showed a higher likelihood of publication in papers submitted from high-income countries. This study is supported by further American research[68] but this is complicated by so called "English language bias".[69]

Gender of primary author

A previous study, in the field of Oral and Maxillofacial Surgery, found a preferential for publishing work of male researchers.[67]

Disclosure of funding

Lee *et al.*[17] found a positive association between the disclosure of funding and likelihood of publication in his paper. This association was reinforced by the work of Pitak-Arnnop *et al.*[67]

Sample size

Lee *et al.*[17] also demonstrated a positive association between sample size and successful publication. However, the work of Pitak-Arnnop *et al.* demonstrated the opposite, with studies of a smaller sample size (n<100) showing a higher rate of successful publication.[67]

Submission email (institutional or personal)

No evidence of previous research could be found in this field.

Primary author's status

No evidence of previous research could be found in this field. Nevertheless, it was thought that it would be interesting to see whether, for example, papers whose first author was a Professor or Consultant were published more frequently than papers whose primary author was a lecturer, trainee or graduate student.

Publication rates

Scholey and Harrison[66] focused on three of the same conferences as this study and found the overall publication rate for abstracts from the conferences of the EOS, IADR and ORCA, held in 1993, was 46.1%. Other authors have found varying rates ranging from 32%[29] to 66%.[31]

Time to publication

Scholey and Harrison[66] studied the time taken for full publication, following presentation at the conferences of EOS, ORCA and IADR in 1993 and found this to be a median time of 18 months. Spencer[1] also looked at the time to publication for ORCA, EOS, and IADR in the 2000 and found the median time to publication was 20 months. For this reason, viewing the data from 2007 would provide a balance between a contemporary picture and a likelihood of high sample size.

Reyes *et al.* also investigated time to publication,[70] and aimed to determine whether there was evidence of a time-lag bias in the publication of paediatric antidepressant trials using a meta-analysis methodology. The authors found evidence of time lag bias in the publication of findings, which they claim had altered the perceived efficacy of paediatric antidepressants in the medical literature. A criticism of this study would be the small number of trials analysed (15).

Takeda *et al.*[71] aimed to identify the expected delay between publication of abstracts and full publication from trials of new anti-cancer agents using systematic review methodology. They found that only 18 relevant RCTs had one or more full papers that reported the same outcome measures (and stage of analysis) as an earlier conference abstract. This research only looked at a small number of studies, however. More recently, the same team assessed time to publication of these studies and the potential for publication bias.[72] Time delays ranged from 5 to 19 months. Eleven trial abstracts were still without a full publication at the end of their searches, varying from 3 to 38 months since abstract publication. Many papers appeared to be unlikely to ever be published.

The earlier work cited by Hopewell[58] contained two tributary studies.[73,74] The first, by Stern *et al.* in 1997 found a median time to publication of 4.7 years for studies with significant results and 8.0 years for studies with negative or null results in proposals submitted to the Royal Prince Alfred Hospital Ethics Committee in Sydney, Australia. The second, a paper by Ioannidis *et al.* in 1998 found that similarly, trials conducted in the field of HIV in America became published 2.2 years earlier if the results were statistically significant. These works are supported by similar findings from a retrospective study by Decullier *et al.* in 2005.[75]

Ioannidis *et al.*[74] also demonstrated that time lag bias might be introduced in systematic reviews even in situations when most or all studies will eventually be published. The author claimed "studies with positive results will dominate the literature and introduce bias for several years until the negative, but equally important, results finally appear". The author also stated that this could delay the discovery of rare adverse events, with many of the beneficial events being published first.

Reasons for failure to progress to full publication

This may be due to journal editors' rejection of submitted manuscripts or authors' failure to submit their work for publication. Previous work exists on reasons for rejection, either by way of speculation,[76] or direct investigation by contacting the authors of unpublished papers.[77,78]

Weber *et al.*[78] found that from the 179 investigators, who did not submit a full manuscript to a journal, the most common reason given (42%) was a lack of time. Only 7 investigators said they did not submit a manuscript because the statistical analysis was not positive, even though 43 controlled studies had negative results. De Bellefeuille *et al.*[77] also found that a

lack of time or resources to be the major reasons for non-publication along with insufficient priority which is supported by Timmer *et al.*[53]

Hartling *et al.*[79] identified factors associated with subsequent non-publication of abstracts presented at the Society for Paediatric Research meetings, using a cross-sectional survey to question researchers about their reasons for the selective publication of randomised controlled clinical trials (RCTs). Factors significantly associated with non-publication were the responder's report of scientific merit and result significance. Of those unpublished papers, only 17% had been submitted for publication. Authors of the unpublished studies recalled the following reasons for not publishing: lack of time, trouble with co-authors, and journal unlikely to accept. Of the RCTs presented and not subsequently published, most (83%) were never submitted for publication.

Sprague *et al.*[80] followed up abstracts presented at the 1996 Annual Meeting of the American Academy of Orthopaedic Surgeons, and surveyed those authors that had not gone on to publish their papers. They found that the failure to publish was due to one of three main reasons: insufficient time to prepare a manuscript for publication, ongoing studies and relationships with co-authors presenting a barrier to final publication.

Chapter 3 – Reliability studies

Calibration

Contact was made with the Trials Co-ordinator (Anne Littlewood) at the Cochrane Oral Health Group who provided GW with the guidance on hand searching for clinical trials. "*Hand searching involves a manual page-by-page examination of the entire contents of a journal issue or conference proceedings to identify all eligible reports of trials*" (A definition from the Cochrane Handbook, Section 6.2.2.1)

GW passed the Cochrane Oral Health Group Hand Searchers' Test to calibrate 10/8/2010.

Reliability

Aims

The reliability study aimed to:

Assess the inter- and intra-examiner reproducibility of the:

1. Identification of RCTs / CCTs
2. Assessment of the factors thought to influence publication from the abstracts, that is:
    a) Mode of presentation (Oral or Poster)
    b) Study design (RCT / CCT)
    c) Result significance: (Significant, Non-significant, or Unclear)
    d) Sample Size: (Absolute number)
    e) Funding disclosure: (Yes or No)
    f) Continent of origin: (North America, South America, Europe, UK, Asia, Africa, Australasia)
    g) Primary author:
        i) Gender (Male / Female / Unclear)
        ii) Professional status (Professor / Non-professor)
        iii) Submission email (Institutional / Other)

Null hypothesis

There was no difference in the identification of RCTs/CCTs and/or assessment of factors associated with publication, between GW and JEH and/or GW over time.

Method

1) GW hand-searched all conference abstracts to identify RCTs and CCTs.
2) GW and JH assessed the abstracts of a 10% random sample of RCT and CCT abstracts and recorded the factors thought to be associated with publication.
3) GW reassessed the random sample one month after his initial assessment.
4) The inter- and intra-examiner reliability was assessed using percentage agreement and Kappa statistic.

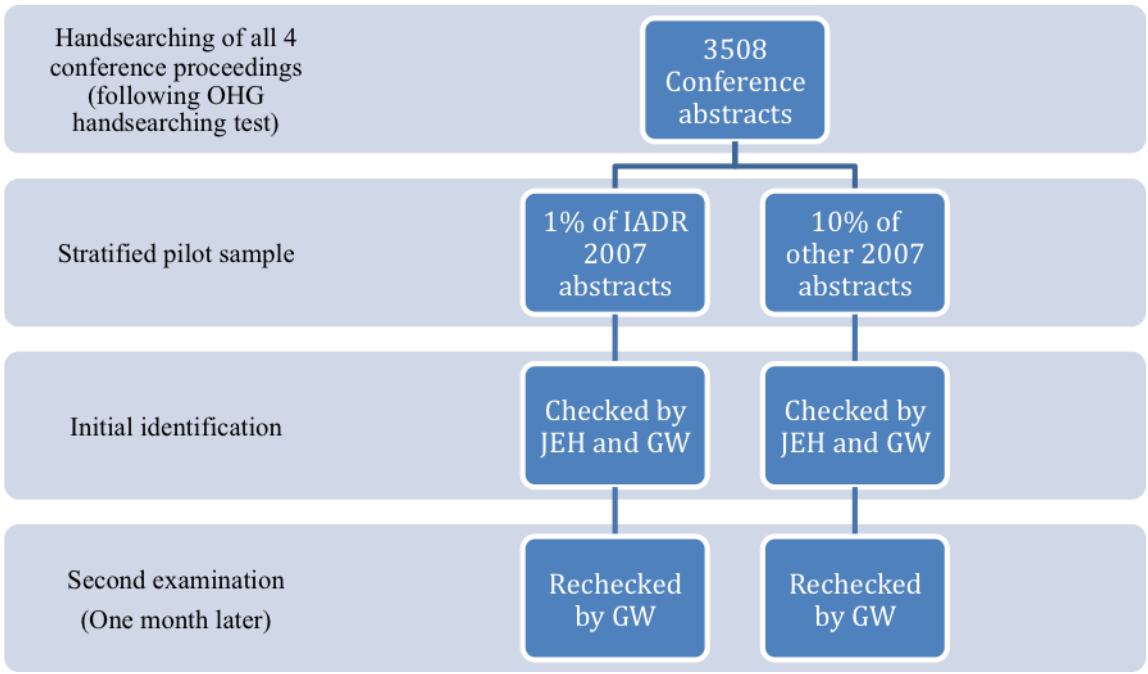

Figure 3.1: Flowchart of progress

Sample size

This was determined by taking a random 10% sample of the clinical trial abstracts presented at the conferences of the International Association of Dental Research, European Orthodontic Society, European Organisation for Caries Research and American Association of Orthodontists in 2007.

Source of abstracts

IADR 2007:	2998 abstracts:	87 eligible trials	7 for reliability
EOS 2007:	258 abstracts:	31 eligible trials	4 for reliability
ORCA 2007:	177 abstracts:	13 eligible trials	2 for reliability
AAO 2007:	75 abstracts:	9 clinical trials	3 for reliability
Total:	3508 abstracts	140 clinical trials	17 for reliability

Identification of abstracts:

Electronic copies of the abstracts were obtained listing 7069 abstracts of poster or oral presentations across all conferences in 2007. Hard copies of the IADR session abstracts were incomplete so these were searched electronically then hand-searched for clinical trials.

Each abstract was assigned a reference code comprising:

1. Conference identifier
    i. A – American Association of Orthodontics Conference
    ii. E – European Orthodontic Society Conference
    iii. I – International Association of Dental Research
    iv. O – European Organisation for Caries Research (ORCA)
2. A sequential number from that conference: for example: I34 = IADR 34th abstract

Inclusion criteria:

- Controlled clinical trials
- Randomised controlled clinical trials. As defined by Cochrane Collaboration guidelines (see Appendix 1):

Exclusion criteria

- Other studies

Assessments

Abstracts were analysed according to criteria discussed above.

Data collection

The abstracts were identified by GW from the main sample frame and assessed by both examiners (GW and JEH). Data were input to an Excel worksheet for analysis.

GW then re-assessed a random 10% sample of the initial sample frame and entered the data into a separate worksheet one month after the initial assessment to reduce any recall bias.

To prevent errors due to examiner fatigue, a maximum of ten abstracts were analysed at any one time.

During the reliability study, the results were analysed purely for reliability, as the sample size was too small to make any meaningful inferences.

Statistical methods

The percentage agreement and Cohen's kappa coefficient[81] (a statistical measure of inter-examiner agreement) was used to assess the reliability of the classification system. This was performed using SPSS.

Kappa Agreement	Interpretation
< 0	Less than chance agreement
0.01–0.20	Slight agreement
0.21– 0.40	Fair agreement
0.41–0.60	Moderate agreement
0.61–0.80	Substantial agreement
0.81–0.99	Almost perfect agreement

Table 3.1: Kappa agreement table[82]

Random selection

Reliability study numbers were randomly generated for each journal from the identified and sequentially numbered papers by GW, using GraphPad internet based software.[41] The following abstracts were identified from the sample frame for the reliability study.

Conference	Abstract Numbers
AAO	50, 45, 58
EJO	161, 5, 215, 3
IADR	0227, 0124, 1332, 1136, 2043, 2159, 2207
ORCA	16, 134

Table 3.2: Randomly generated articles

Results of Reliability Study

Phase 1

Initial percentage agreement for inter-examiner reliability for all the factors ranged from 76-100% and the Kappa score was 0.75-1.0 (Substantial to Perfect Agreement), which suggested, overall, good agreement and reliability.

When the data were analysed on an individual basis (Table 3.3), the following disagreements were noted:

1. Study Design: GW had incorrectly classified a split mouth "alternating trial" as an RCT.

2. GW had incorrectly cited a paper as being published, which showed slight differences in the methodology to the abstract, and was eventually considered a different publication by the same group of authors.

3. JH did not find a published paper, which was correctly found by GW.

4.Sample size: JH had incorrectly stated a sample size as 44 instead of 42.

Although two of these disagreements had arisen from the finding of a published paper, it was decided that the search protocol did not need modification, as unpublished studies would be identified via the authors who would inform us if their paper had been published.

Phase 2

GW then reassessed the same papers one month later and the mean percentage agreement for intra-examiner reliability was repeated. The mean percentage agreement was 100% and the Kappa statistic[81,82] was 1.0 suggesting perfect agreement and reliability. This was in agreement with the initial corrected findings.

As an excellent level of inter- and intra- examiner reliability had been achieved, the main study was able to start.

Category	Phase 1			Phase 2		
	Inter-examiner agreement			Intra-examiner agreement		
	Percentage	Kappa	Strength	Percentage	Kappa	Strength
Presentation type	100	1.0	Excellent	100	1.0	Excellent
Design	93.7	0.87	Excellent	100	1.0	Excellent
Result significance	100	1.0	Excellent	100	1.0	Excellent
Sample size	93.7	0.87	Excellent	100	1.0	Excellent
Funding disclosure	100	1.0	Excellent	100	1.0	Excellent
Publication	87.5	0.75	Good	100	1.0	Excellent
Continent of origin	100	1.0	Excellent	100	1.0	Excellent

Table 3.3: Results of reliability study

Discussion

The reliability study proved important in clarifying the classification system developed for the main investigation. The differences in interpretation were resolved through discussion between GW and JEH.

Conclusion

There were no differences in the assessment of type, subject, settings and methods of the abstracts presented at the four dental conferences, made by GW and JEH and/or GW over time differences with the categories of publication, sample size and study type within acceptable limits so the null hypothesis is upheld.

Chapter 4 – Main investigation

Aims:

2005-2007 abstracts

This study aimed to identify the:

- number of clinical trials that were presented from 2005-2007 at the conferences of the:
    - American Association of Orthodontists (AAO),
    - European Orthodontic Society (EOS),
    - International Association for Dental Research (IADR),
    - European Organisation for Caries Research (ORCA)
    - Australian Society of Orthodontists Congress (ASO)
- abstracts that went on to be published as a full paper in a peer reviewed journal.
- time to publication for those abstracts that were subsequently published as a full paper in a peer reviewed journal.
- following characteristics of the abstract and determine their influence on the rate of and time to publication:
    - Result significance: (Significant, Non-significant, or Unclear)
    - Mode of presentation (Oral or Poster)
    - Study design (RCT / CCT)
    - Sample Size: (Absolute number)
    - Funding disclosure: (Yes / No)
    - Continent of origin: (North America, South America, Europe, UK, Asia, Africa, Australasia).
    - Primary author:
        - Gender (Male / Female / Unclear)
        - Professional status: (Professor / Non-professor / Unclear)
- Identify reasons why abstracts did not achieve publication.

University Teachers Group (UTG) abstracts

This study aimed to identify the:

- number of abstracts presented at the University Teachers Group session from 1999-2010 at the British Orthodontic Conference.
- abstracts that went on to be published as a full paper in a peer reviewed journal.
- following characteristics of the abstract and determine their influence on rate of and time to publication:
    - Funding disclosure: (Yes / No)
    - Dental School of origin

Objectives:

1. To quantify the proportion of abstracts that went on to be published as a full paper in a peer reviewed journal.
2. To identify if the
    a. significance of results
    b. mode of presentation
    c. study design
    d. sample size
    e. funding
    f. primary author's:
        i. country of residence
        ii. gender
        iii. professional status
5. Determine whether these factors influenced the likelihood of publication.
6. To identify the time to publication for those abstracts that were subsequently published as a full paper in a peer reviewed journal.
7. Determine the influence of the above factors on time to full publication.

Null Hypotheses

2005 – 2007 sample

There was no difference in the publication rate of abstracts from dental conferences compared with previous studies.

There was no difference between the publication rates or time to publication of abstracts presented at five Dental / Orthodontic conferences from 2005-2007, with respect to the following factors:

- Result significance: (Significant, Non-significant, or Unclear)
- Mode of presentation (Oral or Poster)
- Study design (RCT / CCT)
- Sample Size: (Absolute number)
- Funding disclosure: (Yes / No)
- Journal of publication (Mother / Other)
- Continent of origin: (North America, South America, Europe, UK, Asia, Africa, Australasia).
- Primary author:
    - Gender (Male / Female / Not clarified)
    - Professional status (Professor / Non-professor)

There was no difference in the proportion of papers that were published in "mother" journal (that is, the journal associated with the conference) versus those published in "other" journals.

UTG sample

There was no difference between the publication rates or time to publication of abstracts presented at the UTG session over a decade, with respect to the following factors:

- Dental school of origin
- Primary author:

- Gender
- Status

Chapter 5 - Method

Design:

Retrospective, observational cohort study.

Subject and Setting:

The sample frame included dental clinical trials presented at the conferences of the International Association of Dental Research (IADR), European Orthodontic Society (EOS), European Organisation for Caries Research (ORCA), The American Association of Orthodontists (AAO) and The Australian Society of Orthodontists (ASO) from January 2005 to December 2007.

The sample frame for the University Teachers Group (UTG) abstracts, included abstracts presented at the UTG session of the British Orthodontic Conference (BOC) 1999-2010.

Sample size

Previous work in this area showed that:[1]

- It is difficult to control sample size in each group, as this is determined by the number of presentations at the conferences in the studied time frame.
- It is difficult to ascertain an appropriate power (size of difference we were trying to detect)

Harrison[8] discussed Pocock's formula for sample size calculation.[83]

$$\text{Number per group} = \frac{[p_1(1-p_1) + p_2(1-p_2)]}{(p2 - p1)^2} \times f(ab)$$

P1 = proportion of clinical trials published in original research = 0.38

P2 = expected proportion of RCTs published in current research = 0.57

F(ab) = factor (type I error (0.05), type II error (0.2)) = 7.9

$$\frac{(0.38[1-0.38]) + (0.57[1-0.57])}{(0.57-0.38)^2} \times (7.9)$$

= 105 abstracts per group

= 210 abstracts in total

Previous work by Harrison[8] revealed a 100% increase in the publication of clinical studies, using RCT methodology, in orthodontic journals between 1989 and 1998. This accounted for 7% of the clinical studies and it was hoped that there would be a continuation of the increase in the proportion of randomised controlled clinical trials published in journals over the ten year period reviewed to double that figure (14%). However, further research by Gibson and Harrison[57] found an increase to 10.8% from 1999-2008. Extrapolating the findings of these studies, I would hope to see an increase of approximately 50% over a 7-year period.

The most appropriate finding would be an increase in the publication rate of clinical trials presented as abstracts at these conferences. Spencer[1] found a publication rate of 38% from abstracts of clinical trials presented at EOS, IADR, ORCA and a 50% increase would give a publication rate of 57%. Using data from Spencer, 210 abstracts (105 per group) would be required to give 80% power, at the 5% level, and enable me to detect a 50% rise in the proportion of clinical trial abstracts published.

Source and selection

Source

Sampling frame of 2005 – 2007 study

Source of abstracts

Conference	Number of Abstracts	Number of Eligible Trials
IADR 2007	2998	87
IADR 2006	2616	24
EOS 2007	258	31
EOS 2006	346	19
EOS 2005	318	18
ORCA 2007	177	13
ORCA 2006	150	7
AAO 2007	75	9
AAO 2006	42	4
ASOC 2006	89	3
Total	7069	215

Table 5.1: Source of abstracts

Hand searching

Abstracts presented at scientific meetings, published either in the conference proceedings, as supplements to their associated journal, that is, *Journal of Dental Research* (IADR), *Caries*

Research (ORCA) and *American Journal of Orthodontics and Dentofacial Orthopaedics* (AAO) or within the substance of a regular issue of that journal (that is, *European Journal of Orthodontics* (EOS)), were searched to identify all reports of clinical trials (RCTs and CCTs).

Selection

Following calibration with the Cochrane Collaboration Oral Health Group, GW prepared a list of CCTs and RCTs presented at the five conferences in the years 2005-2007. A flowchart for categorising these studies is shown below: JEH is a calibrated and experienced hand searcher.

Hand searching procedure

Inclusion criteria:

- Controlled clinical trials
- Randomised controlled clinical trials

As defined in the Cochrane OHG hand searching manual. See Figure 5.1. and Appendix 1.

Exclusion criteria

Other studies

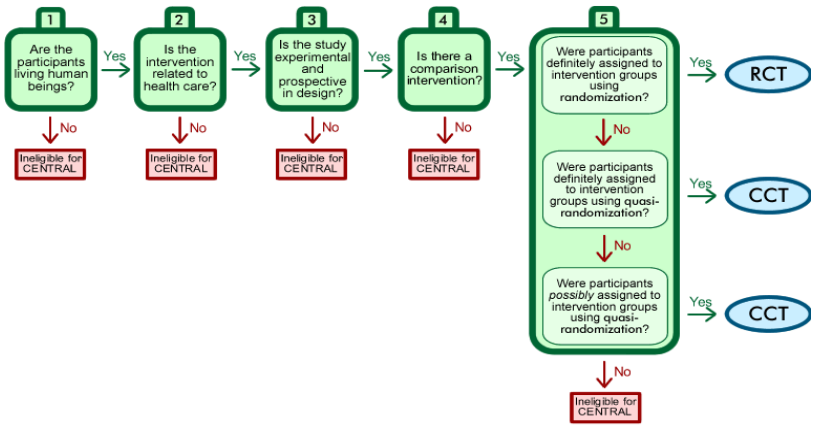

Figure 5.1 Cochrane Hand searching criteria[84]

Assessment of abstracts

All included abstracts were assessed for the following factors.

- Result significance: (Significant, Non-significant, or Unclear)
- Mode of presentation (Oral or Poster)
- Study design (RCT / CCT)
- Sample Size: (Absolute number)
- Funding disclosure: (Yes / No)
- Journal of publication (Mother / Other)
- Continent of origin: (North America, South America, Europe, UK, Asia, Africa, Australasia).
- Primary author:
  - Gender (Male / Female / Unclear)
  - Professional status (Professor / Non-professor)

Outcome Measures

These were publication (Published / Unpublished) and time to publication (in months)

Classification of factors

Result significance

The results were taken as significant at the 5% level of probability and recorded as being significant or not with respect to the primary aim of the study. The primary aim was taken as the main aim or first aim stated in the abstract.

The results were recorded as unclear if:

1. No primary aim was stated or the aim was unclear
2. There were both significant and non-significant results with respect to the primary aim
3. No statistical significance was stated
4. The study had not been completed

Sample Size

The sample size was the total number of participants quoted in the original abstract so as to make those abstracts that were published comparable with those that were not. The sample size was recorded as a total (all intervention and control groups).

If a split mouth design was used, the sample size was taken as the number of participants, **not** the number of teeth.

If no sample size was quoted, it was recorded as 'not quoted'.

Disclosure of funding

This was searched for in the abstract. It was recorded as disclosed or undisclosed.

Primary author

This was taken as the first author on the list of authors but for the IADR conferences, the primary investigator was underlined in blue, this was taken as first author even if not first in the list.

Gender

This was recorded as male or female. When this was unknown, efforts were made to determine the gender of the author. If this was not possible, the gender was stated as "Unclear".

Professional status

This was recorded as Professor or Non-Professor / Consultant. The inclusion of other staff grades (for example, registrar, house officers) was considered but it was decided to limit this category as many of these classifications were specific to the UK and not generalisable to papers of non-UK origin. Ranks of assistant professor, associate professor, clinical professor were counted as non-professor.

Continent of origin

This was recorded as North America, South America, Europe, UK, Asia, Africa or Australasia.

Identification of Full Reports

Conference reports were obtained to view the original abstracts from the scientific meetings.

The electronic database search engine 'MEDLINE' was used to identify full reports, published in peer-reviewed journals, of the abstracts originally presented at the chosen conferences.

Authors and titles may change between presentation and publication so each author's name, from the original abstract, was searched for and cross-referenced with key words from the abstract title. The names were searched in the following order: first author, last author and then subsequent authors in the order printed in the abstract.

Once a full report was identified in a peer-reviewed journal, the article was saved and compared to the abstract for similarity. The study design and aims were compared along with the sample sizes. Additional data were not sought from the published paper, as this would bias those abstracts that remained unpublished.

Time to publication

The month and year that the conference had taken place was recorded as the date of abstract presentation.

The month and year that the paper was published in a peer reviewed journal was recorded as the publication date. Where the journal date was published as a season, the estimated first month of the season was recorded, that is, Spring (March); Summer (June); Autumn (September) and Winter (December). In cases of nebulous publication dates, June was used within the publication year.

The time taken to publish was calculated as the number of months between abstract presentation and publication as a full paper in a peer-reviewed journal.

In order to study the length of time taken for abstracts to be published in full, a Kaplan Meier Survival Analysis was undertaken. If an abstract was unpublished at the time of the search, then the date of search completion (September 2010) was entered as the date of publication as the analysis assumes that the abstract was published.

Journal

The journal of publication was recorded. It was recorded as 'mother' if it was the journal associated to the original conference at which the abstract was presented and other if not. These were as follows:

- EOS – The European Journal of Orthodontics
- IADR – The Journal of Dental Research
- ORCA – Caries Research
- AAO – The American Journal of Orthodontics and Dentofacial Orthopedics
- ASOC – The Australian Orthodontic Journal
- BOC – The Journal of Orthodontics

It was recorded as 'other' if it is any other journal.

Data Collection and Entry

All abstracts of the fully published article, as identified from the conference reports, were saved electronically where possible. Paper copies were retained where this was not possible, either by printing or ordering copies. The fully published article was obtained either electronically online or directly from the Harold Cohen Library at The University of Liverpool.

Statistical Methods

All data were entered into the computer programme SPSS for statistical analysis:

- The proportion of clinical trials that proceeded to full publication was determined.
- The effect of all factors on the publication rate and time to publication was assessed.

Odds ratios (OR), and confidence intervals (95% CI) were used to assess binary data.

Chi-squared test was used to assess categorical data.

T test and weighted mean difference, with associated 95% confidence intervals, were used to assess continuous data.

A regression analysis was undertaken to identify key factors that influenced the publication rate and time to publication.

Descriptive statistics were used to calculate the mean and 95% CI and/or median and interquartile ranges of the time to publication, of those that reached publication, as appropriate.

Kaplan-Meier curves were used to study the time to publication of all abstracts, censoring those that had not achieved publication by December 2010. The abstracts were stratified for bivariate analysis by way of the most significant factor.

If an abstract was unpublished at the time of the search, the date of search completion was entered as the date of publication as the data analysis assumes abstract publication.

Chapter 6 - Results Main Investigation 2005-2007 Sample: Quantitative data

Overall Publication rate

The overall publication rate of abstracts presented at the 6 Dental conferences in 2005-2007 was 70 out of 215, giving a publication rate of 32.6%. See table 6.1 and figure 6.1.

Publication	Frequency	Percent (%)
Published	70	32.6
Unpublished	145	67.4
Total	215	100

Table 6.1: Proportion of published abstracts

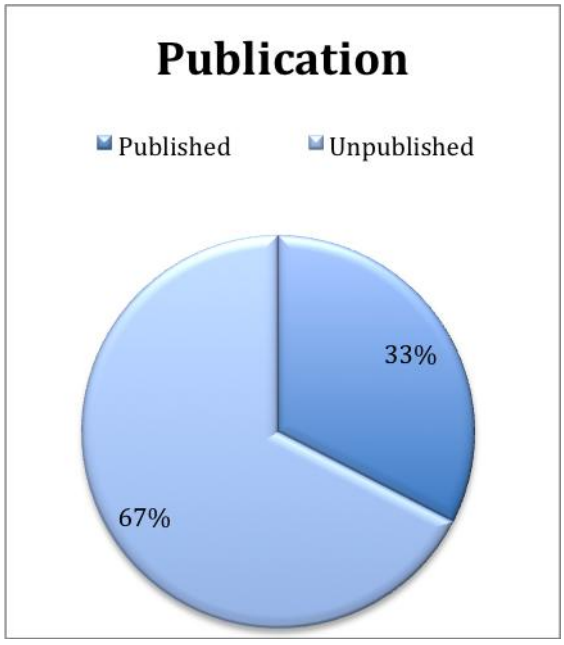

Figure 6.1: Proportion of published abstracts

Overall Time to publication

The mean time to publication for the 2005-2007 abstracts was 19.6 months, 95% confidence intervals (CI) 16.13, 23.04. However, this distribution was skewed (Skewness = 0.957) therefore a median gave a more accurate representation of these data. The median time to publication for these abstracts was 16.00 months, IQR (10, 26).

Result significance

Unclear conclusions were excluded from this analysis as missing data. There was no statistically significant difference between the publication rates of abstracts with significant or non-significant results presented at 6 Dental conferences in 2005-2007 OR = 1.9 (1.0, 3.5). See table 6.2 and figure 6.2.

Significance of results	Unpublished	Published	Percentage published (%)
Significant	64	40	57.7
Not significant	63	21	25.0
Unclear	*18*	*9*	*33.3*
Total	145	70	32.6

Table 6.2: Percentage of published abstracts against result significance

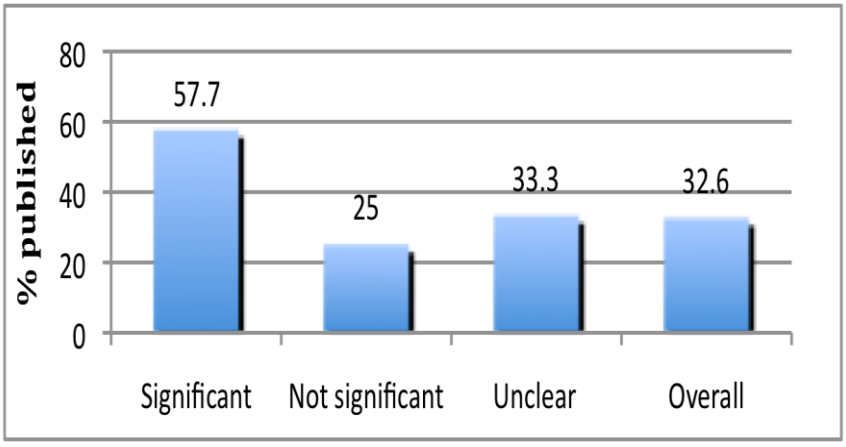

Figure 6.2: Percentage of published abstracts against result significance

Mode of presentation

There was no statistically significant difference between the publication rates of abstracts presented orally or as a poster at 6 Dental conferences in 2005-2007, (OR 0.87, 95% CI 0.48, 1.57). Unclear presentations were excluded from this analysis. See table 6.3 and figure 6.3.

Mode of presentation	Unpublished	Published	Percentage published (%)
Oral	55	29	34.5
Poster	85	39	31.5
Unclear	5	2	28.6
Total	145	70	32.6

Table 6.3: Percentage of published abstracts against mode of presentation

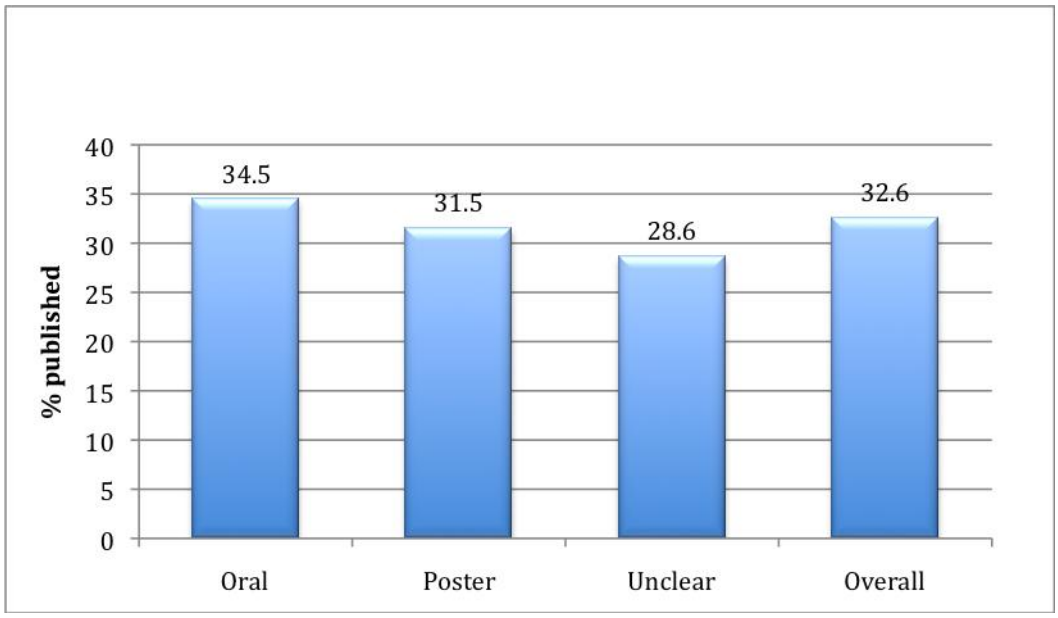

Figure 6.3: Percentage of published abstracts against mode of presentation

Study design

There was no statistically significant difference between the publication rates of abstracts of RCTs or CCTs presented at 6 Dental conferences in 2005-2007 (OR = 0.95, 95% CI 0.51, 1.77). See table 6.4 and figure 6.4.

Study Design	Unpublished	Published	Percentage published (%)
RCT	103	49	32.2
CCT	42	21	33.3
Total	145	70	32.6

Table 6.4: Percentage of published abstracts against study type

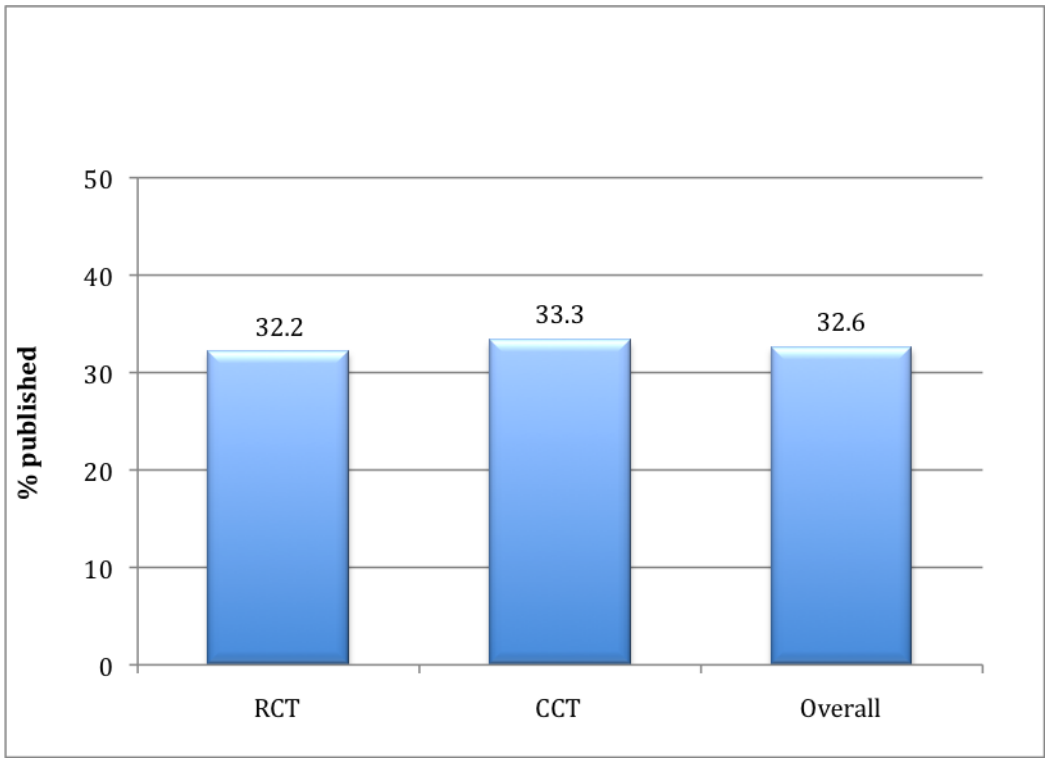

Figure 6.4: Percentage of published abstracts against study type

Sample size:

There was no statistically significant difference between the publication rates of abstracts presented at 6 Dental conferences in 2005-2007, with respect to sample size.

The mean sample size was 146.92, SD ± 386.27. However, a skewness value of 6.21 indicates a positive skewness towards smaller sample size values. The median sample size was 48.50 (IQR 27, 89.8), which reflects the large variations in sample size and outliers present. 7 abstracts did not report sample size. See figure 6.5.

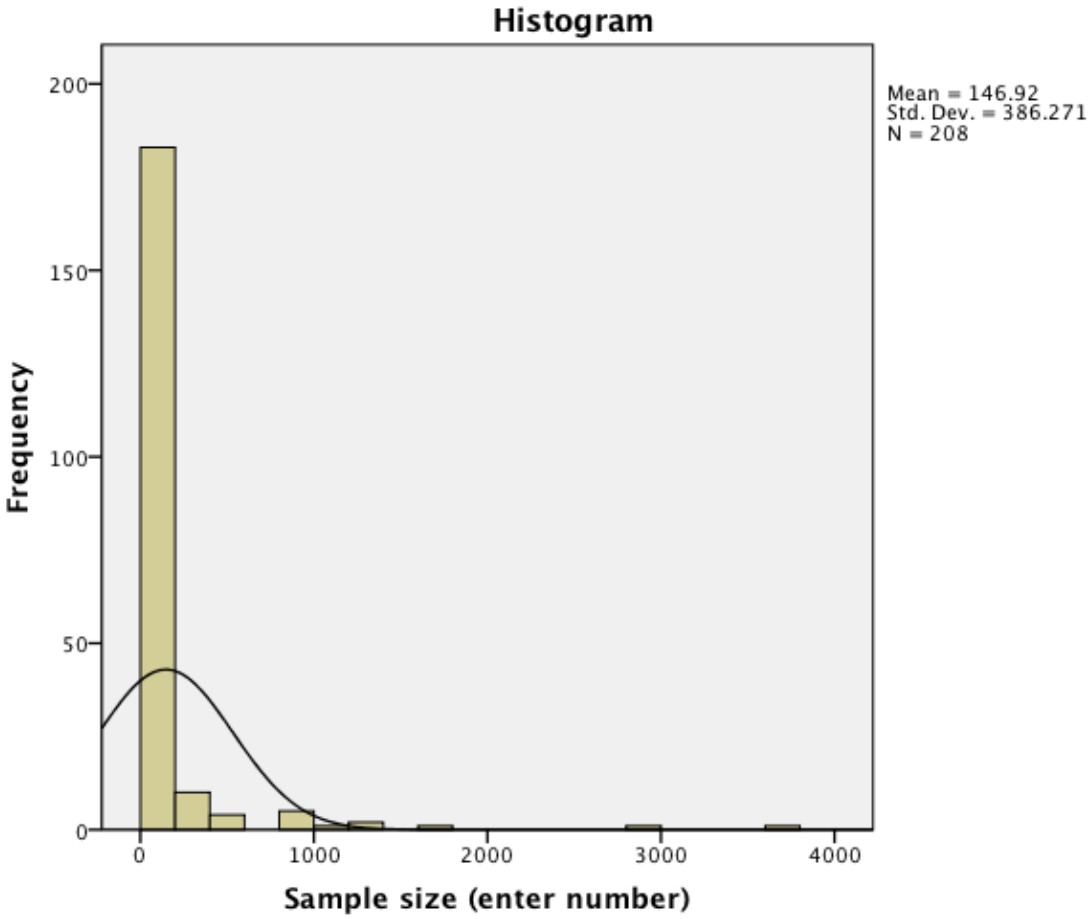

Figure 6.5: Histogram of sample size distribution

The sample was divided by a median split, into those trials with sample sizes below and above the median and the publication rates analysed. Statistical analysis was undertaken to assess whether there was a difference in publication rate between those with sample sizes below median and those with sample sizes above median. No statistically significant difference was found, OR = 0.78 (95% CI 0.41, 1.32).

Funding disclosure

There was no statistically significant difference between the publication rates of abstracts presented at 6 Dental conferences in 2005-2007, with respect to funding disclosure, OR = 0.83 (0.45, 1.55). See table 6.5 and figure 6.6.

Funding disclosure	Unpublished	Published	Percentage published (%)
Disclosed	40	22	35.5
Undisclosed	105	48	31.4
Total	145	70	32.6

Table 6.5: Percentage of published abstracts against funding disclosure

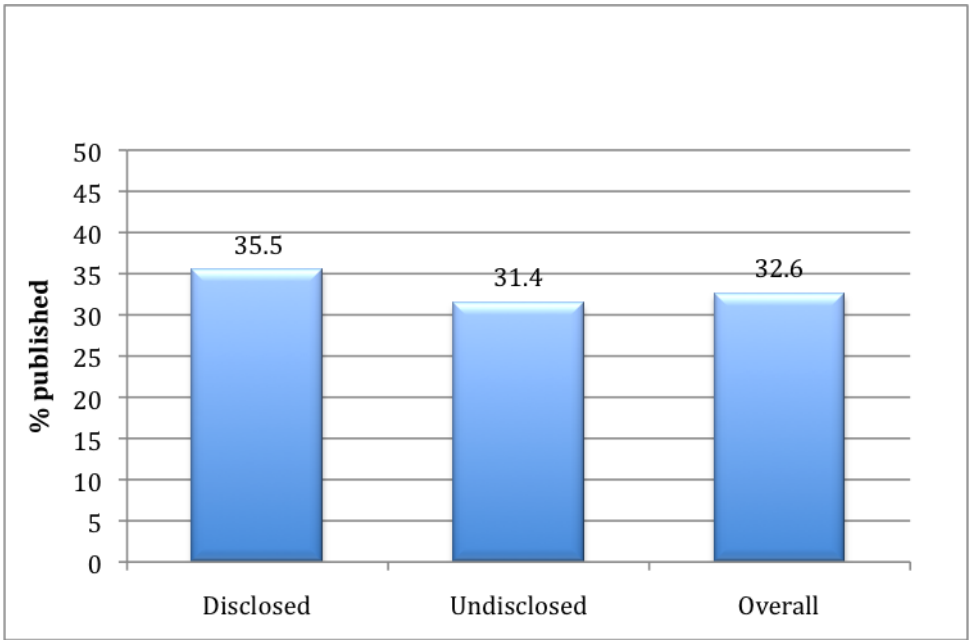

Figure 6.6: Percentage of published abstracts against funding disclosure

Continent of origin

There was no statistically significant difference between the publication rates of abstracts presented at 6 Dental conferences in 2005-2007, with respect to continent of origin. See table 6.6 and figure 6.7.

Continent	Unpublished	Published	Percentage published (%)
Africa	1	0	0
Asia	17	5	21.7
Australasia	1	8	88.9
Europe (excluding UK)	57	32	36
North America	54	15	21.7
South America	6	3	33.3
United Kingdom	9	7	43.8
Total	145	70	32.6

Table 6.6: Percentage of published abstracts against continent of origin

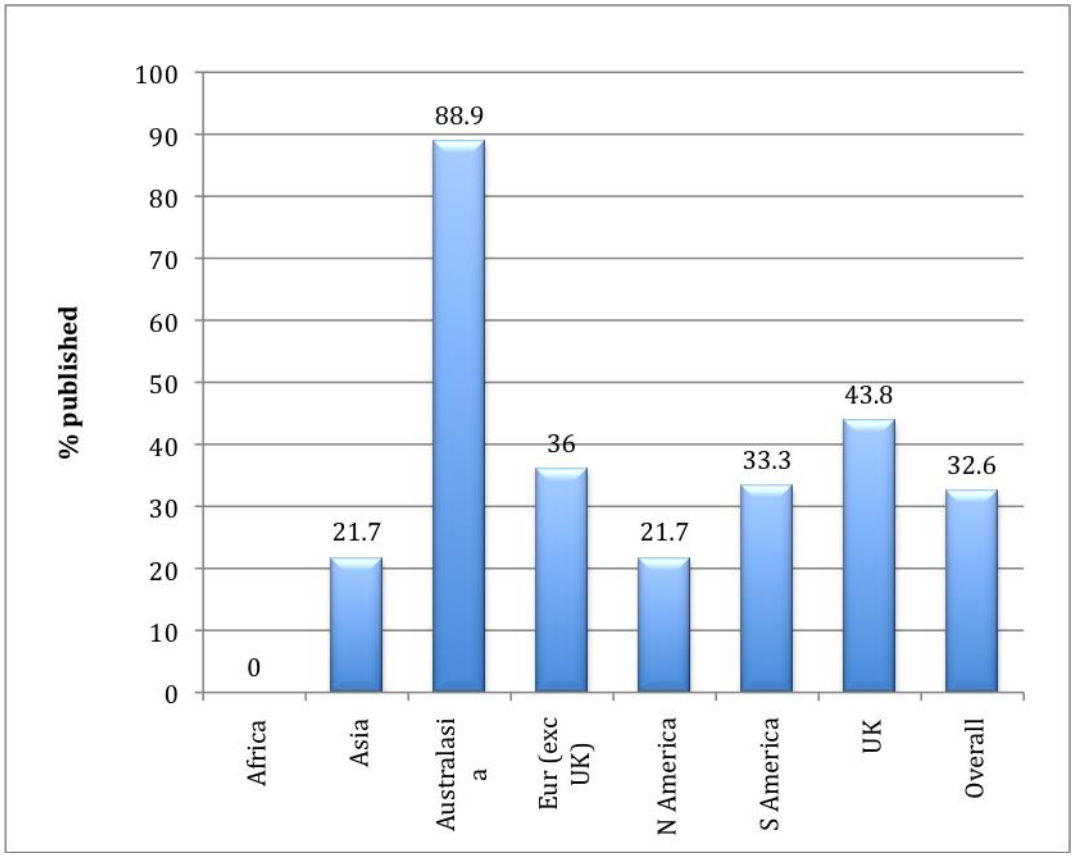

Figure 6.7: Percentage of published abstracts against continent of origin

However, as some categories (Africa and Australia) had low counts the results would not be reliable so these continents were grouped according to the CIA economic classification of developed and developing regions. See Figure 6.8. There was no statistically significant difference between publication rate of abstracts arising from developed and developing countries (OR = 0.65, 0.28 – 1.53). See table 6.7.

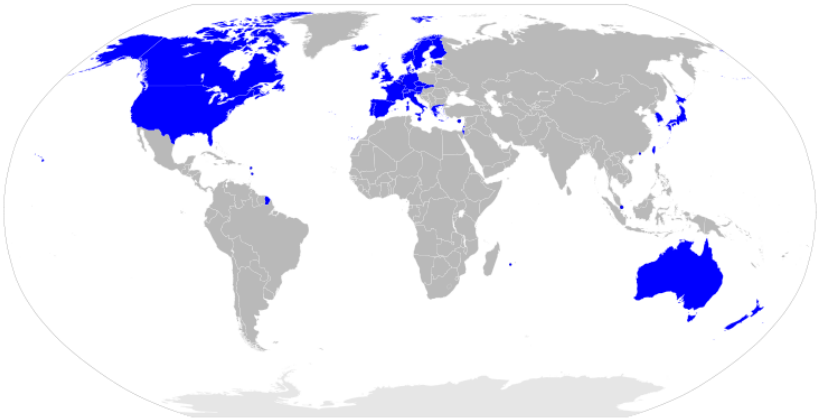

Figure 6.8: CIA classification of developed countries

Region	Unpublished	Published	Percentage published (%)
Developed	121	62	33
Developing	24	8	25
Total	145	70	32.6

Table 6.7: Publication against continent of origin

Gender and status of primary author

Difficulties in determining these factors meant that reliable data could not be obtained for

analysis. This will be dealt with in the discussion.

Factors affecting time to publication:

Result significance

There was no statistically significant difference between result significance and time to publication, hazard ratio (HR) 1.65, 95% CI 0.97, 2.8. See figure 6.9.

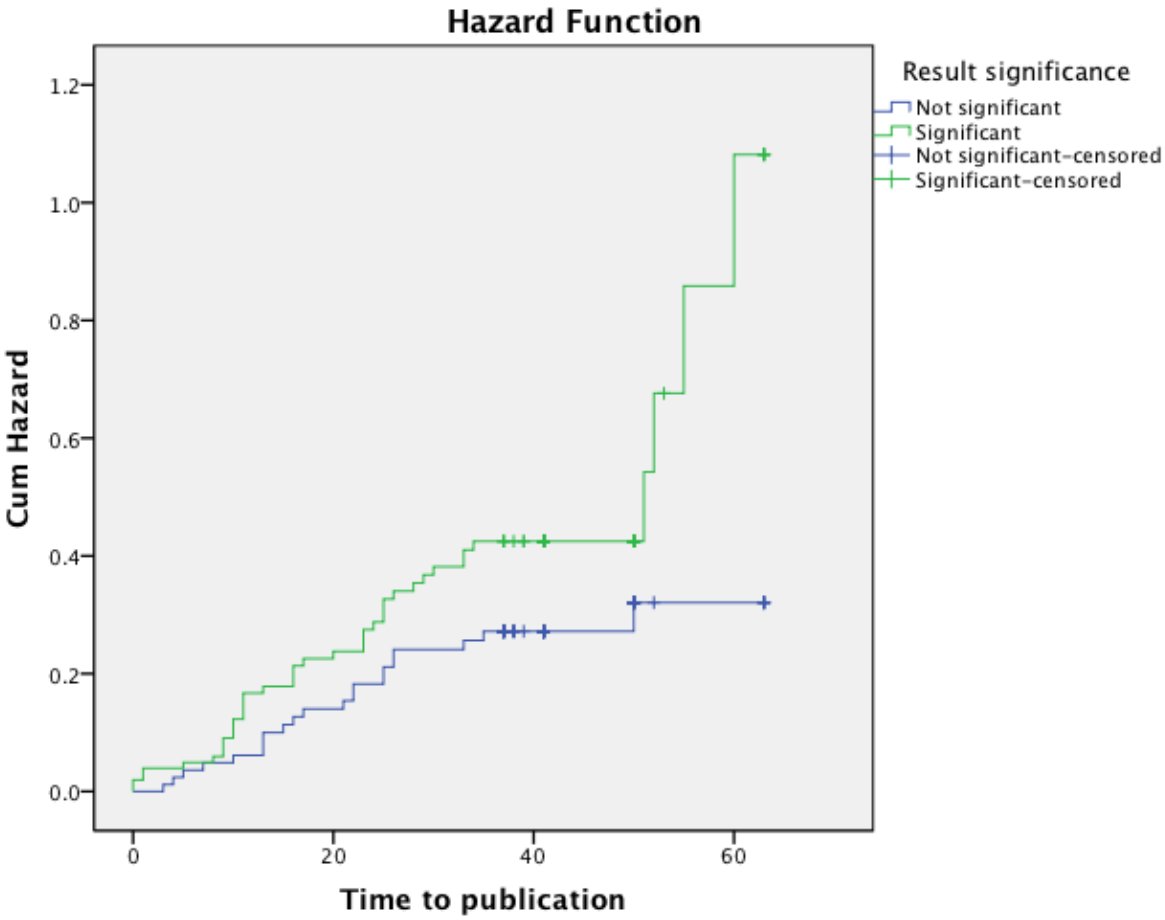

Figure 6.9: Hazard plot of result significance

Mode of presentation

There was no statistically significant difference between the mode of presentation and time to publication: HR 0.95, 95% CI 0.58, 1.53. See figure 6.10.

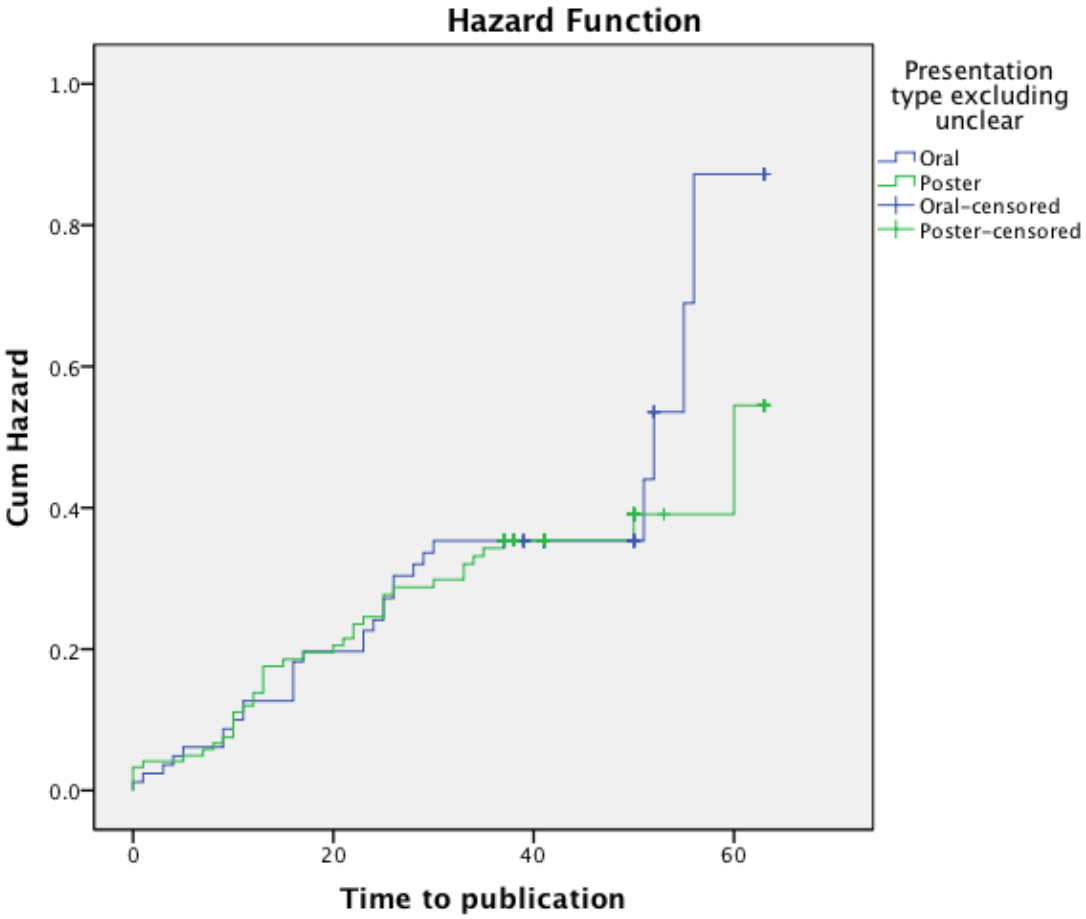

Figure 6.10: Hazard plot of presentation type

Study design

There was no statistically significant difference between the study design and time to publication: HR 1, 95% CI 0.77, 1.3. See figure 6.11.

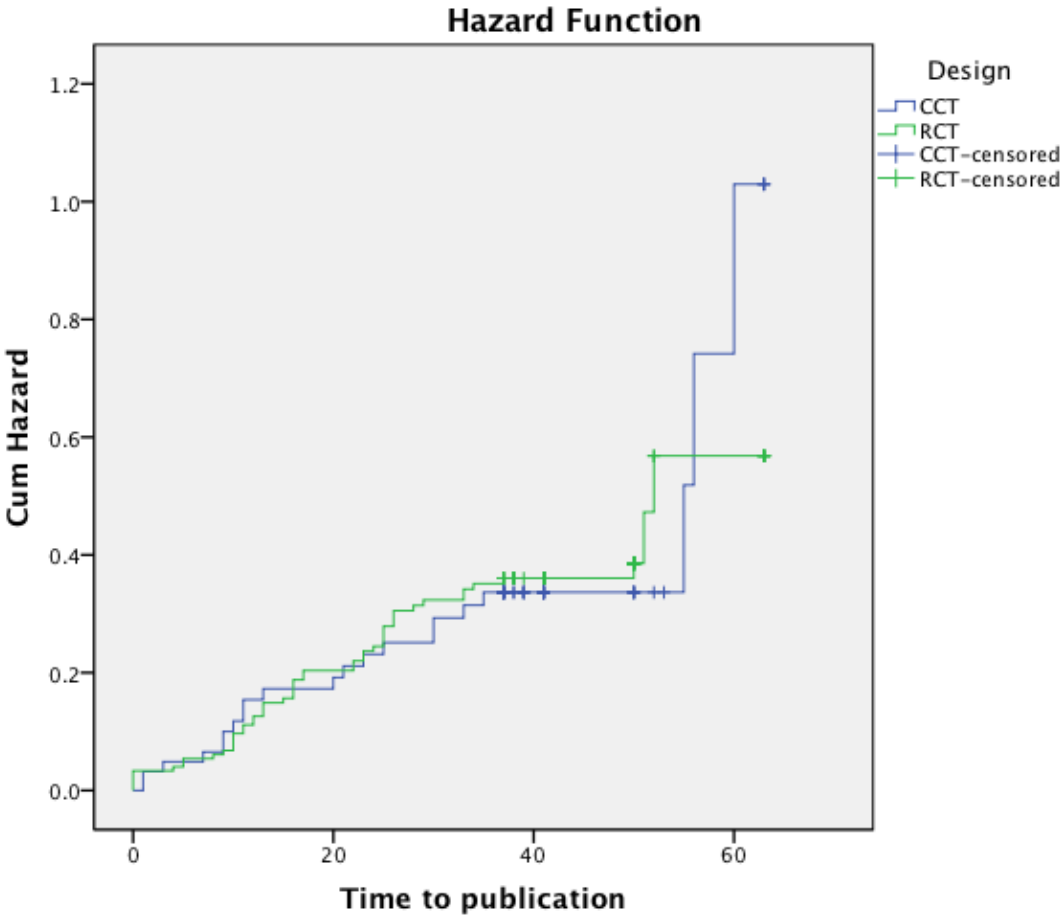

Figure 6.11: Hazard plot of study design

Sample size

There was no statistically significant difference between sample size and time to publication:

HR 1.26, 95% CI 0.78, 2.03. See figure 6.12.

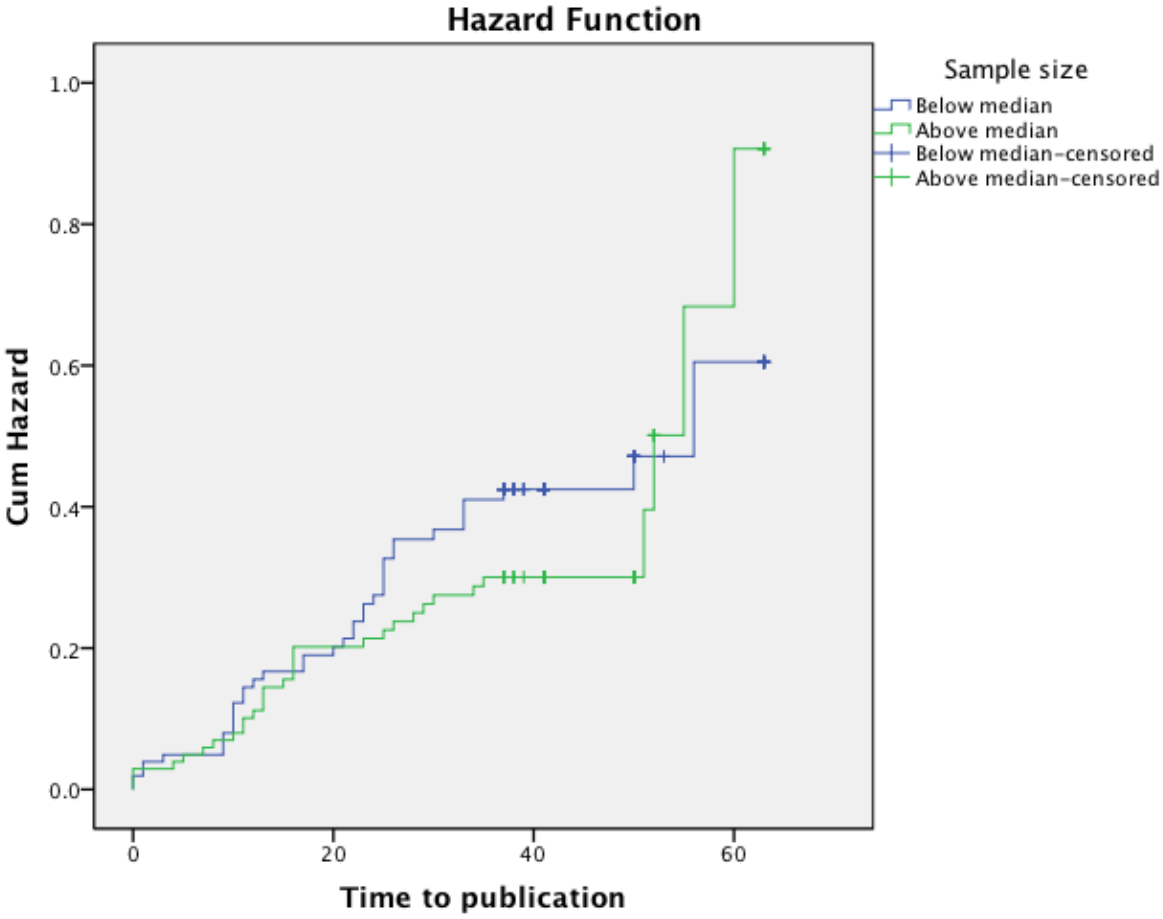

Figure 6.12: Hazard plot of sample size

Funding disclosure

There was no statistically significant difference between funding disclosure and time to publication: HR 0.75, 95% CI 0.45, 1.25. See figure 6.13.

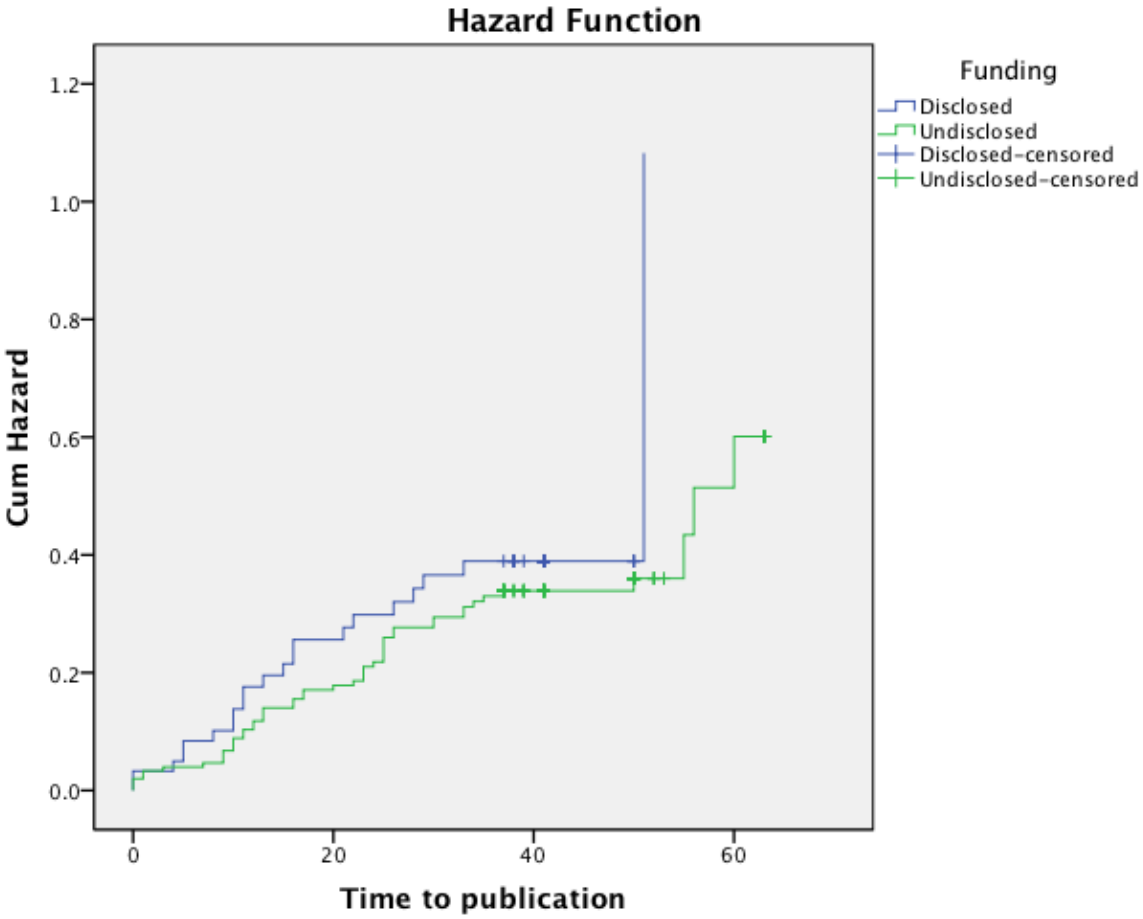

Figure 6.13: Hazard plot of funding disclosure

Continent of origin

There was no statistically significant difference between world region and time to publication: HR 0.6, 95% CI 0.3, 1.4. See figure 6.14.

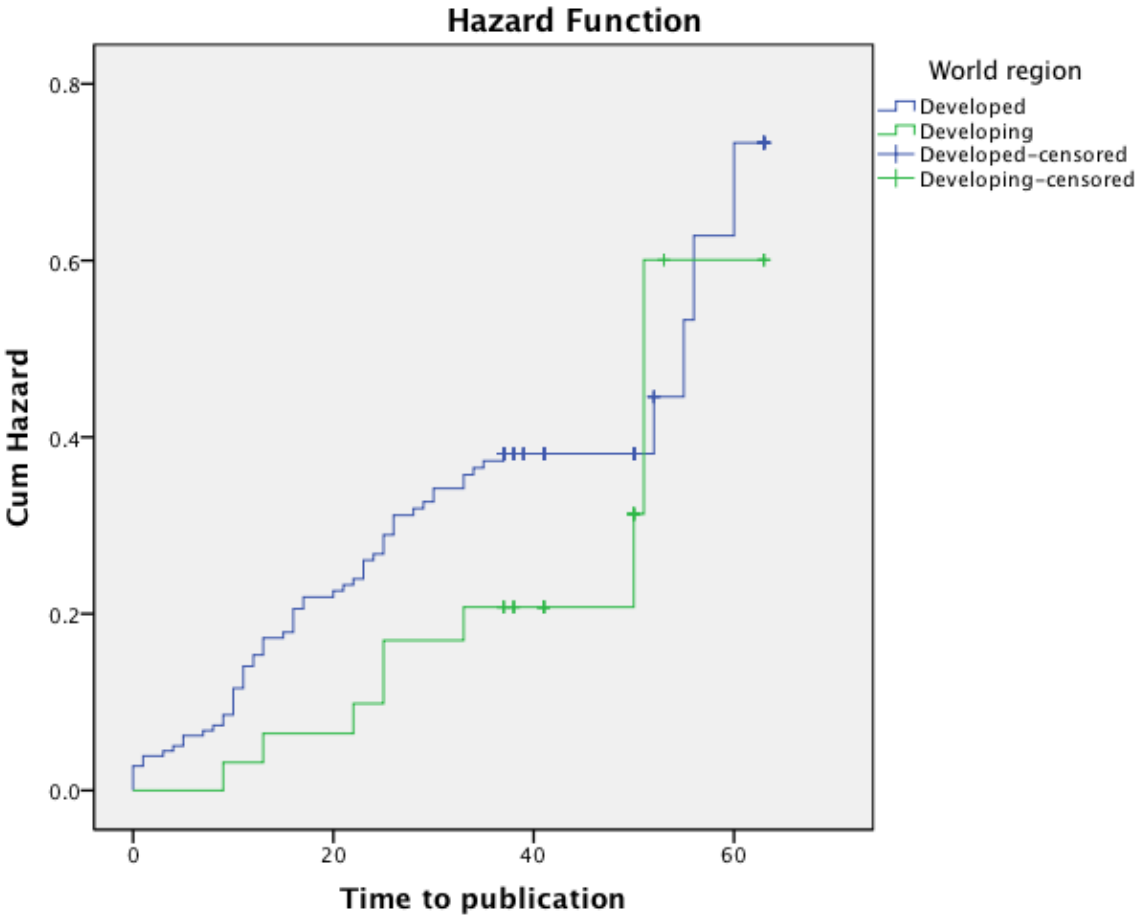

Figure 6.14: Hazard plot of continent of origin

Main Investigation 2005-2007 Sample: Qualititative data

This qualitative follow-up study had a response rate of 12.4% despite repeated attempts to contact authors. 'Lack of time' was the most commonly cited reason for failure to progress abstracts to full publication, followed by language, cultural issues, and lack of teaching. A lack of motivation, rejection and perceived editorial bias were also cited as reasons. This feedback is included in some of the responses included in Appendix 2. See table 6.8.

Reason for non-publication	Number	Percentage
Perceived editorial bias	1	0.7
Length of review process	1	0.7
Motivation	1	0.7
Rejection	1	0.7
Language, culture, lack of teaching	2	1.4
Time	12	8.3
Failed to contact	127	87.6
Total	145	100.0

Table 6.8: Author feedback on failure to publish

UTG sample:

Quantitative data

Publication rate

The publication rate was 34.5%. See table 6.9.

Publication	Number	Percentage (%)
Published	49	34.5
Unpublished	93	65.5
Total	142	100

Table 6.9: Proportion of abstracts published

Mean time to publication:

These data were normally distributed, (skewness 0.997). See Figure 6.15. The mean time to publication of UTG abstracts was 18.3 months. (95% CI 14.38, 22.19).

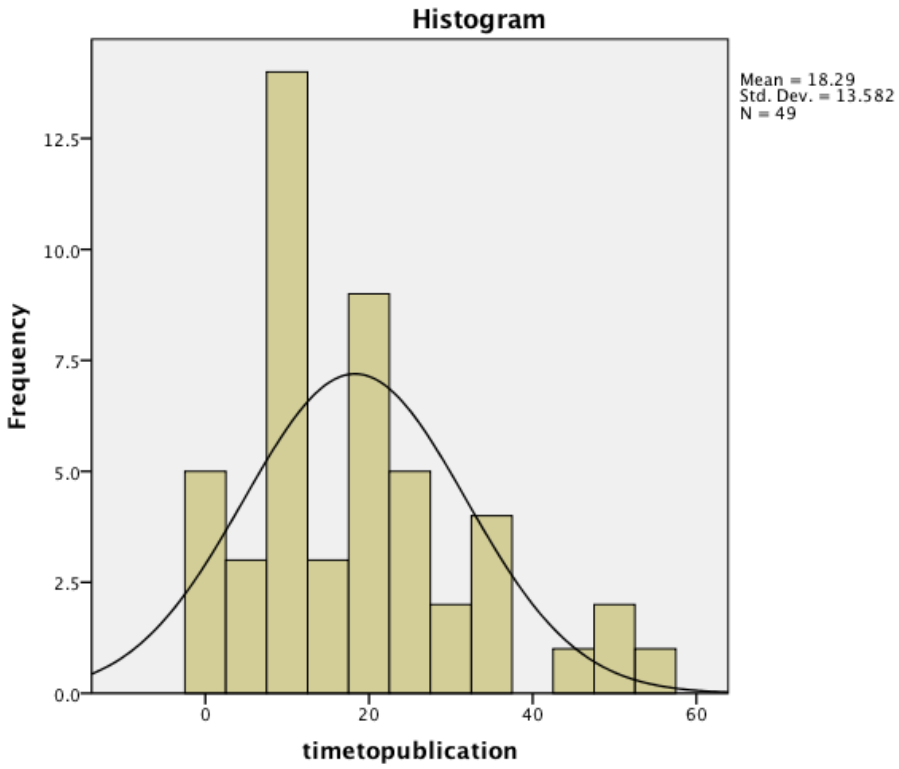

Figure 6.15: Histogram of time to publication distribution

Factors affecting publication

Funding disclosure

Finding disclosure	Unpublished	Published	Percentage published (%)
Disclosed	4	2	33
Undisclosed	89	47	34.6
Total	93	49	34.5

Table 6.10: Funding disclosure and proportion of abstracts published

Funding disclosure was not significantly associated with publication rate (OR = 1.06, 95% CI 0.19, 5.98). However, very few disclosures of funding were found in this sample. See table 6.10.

Dental hospital

Dental Hospital	Unpublished	Published	Total	% Published
Barts	2	0	2	0
Belfast	1	0	1	0
Birmingham	5	1	6	17
Bristol	4	7	11	64
Cardiff	3	0	3	0
Dublin	0	1	1	100
Eastman	27	12	39	44
Edinburgh	2	0	2	0
Glasgow	1	2	3	66
Guy's	0	1	1	100
KCL	5	5	10	50
Leeds	13	2	15	13
Liverpool	9	7	16	44
Manchester	5	1	6	16.7
Newcastle	2	1	3	33
QMUL	2	0	2	0
RLH	8	6	14	43
Sheffield	4	3	7	43
Total	93	49	142	142

Table 6.11: Dental hospital and proportion of abstracts published

These data had too many variables to allow meaningful statistical analysis. See table 6.11.

Abstracts per trainee

These abstract numbers were divided by the total number of trainees trained by a dental hospital in a decade, to calculate the mean abstract production per registrar over this decade (Figure 6.16). However, these results should be viewed with caution as intakes vary and information, gathered from current trainees, may not be reliable. See figure 6.16.

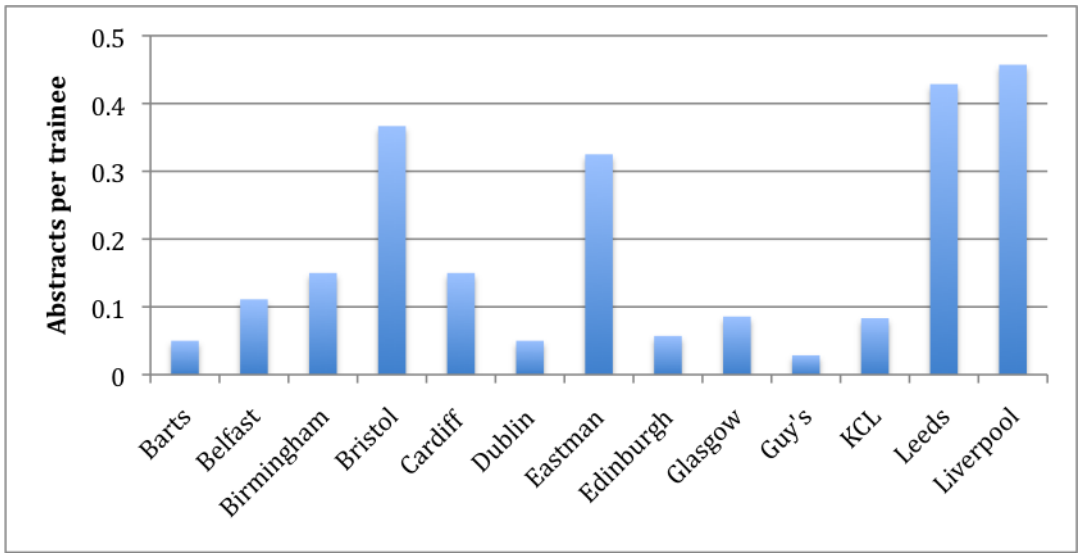

Figure 6.16: Bar chart showing number of abstracts presented per trainee

Gender and professional status

The gender and/or professional status of first authors were difficult to determine with any degree of certainty in many cases, for this reason they were excluded from the results. This will be discussed later.

Qualitative feedback UTG: Reasons for non-publication

Reason for non-publication	Unpublished	%
No response	29	31.2
Time	18	19.4
SpR uninterested	9	9.7
In press	7	7.5
Dealing with reviewer comments	4	4.3
To be published outside orthodontics	4	4.3
Part of larger project	2	2.2
With reviewers	2	2.2
22 month wait: Unhappy	1	1.1
Awaiting response from publishers	1	1.1
Being written	1	1.1
Consultant-statistician disagreement	1	1.1
Editor unhappy with format	1	1.1
Have not tried to publish	1	1.1
Main supervisor left	1	1.1
MDentSci not awarded	1	1.1
Non-significant results	1	1.1
Uninteresting result	1	1.1
Patent pending on material	1	1.1
Ready for submission	1	1.1
Rejected by AJO	1	1.1
Rejected from 4 journals	1	1.1
Rejection	1	1.1
Research team moved	1	1.1
Sick of reviewers at <name removed>	1	1.1
Trial unfinished	1	1.1
Total	93	100.0

Nearly a third of authors failed to respond but the main reasons of failure to proceed to full publication included time (19.4%) and lack of interest. However, a further 11 (11.8%) of authors responded that their papers were in the publication process.

Chapter 7 - Discussion

Summary of findings for 2005 – 2007 sample

This study found that 7069 abstracts were presented at dental conferences between 1st January 2005 and 31st December 2007 of which 215 were abstracts reporting the results of RCTs / CCTs.

Any abstracts identified as reporting an RCT or CCT, as a result of GW's hand searching, will be entered onto the Cochrane Oral Health Group's Trials Register and then become included in the Cochrane Controlled Trials Register (CCTR) and published as part of the Cochrane Library.

Publication rate

The overall publication rate was 32.6%.

Time to publication

The mean time to publication was 19.59 months 95% CI (16.13, 23.04).

Factors affecting publication rate

None of the factors investigated significantly influenced the publication rate.

Factors affecting time to publication

None of the factors investigated significantly influenced the time to publication.

Summary of findings for UTG sample

Publication rate

The publication rate was 32.5%.

Time to publication

The median time to publication for UTG abstracts was 16.00 months, IQR (10, 26).

Factors affecting publication rate

None of the factors investigated significantly influenced the publication rate

Factors affecting time to publication

None of the factors investigated significantly influenced the time to publication

Limitations

Hand searching of abstracts

A very large number of abstracts existed for one examiner to search. Although GW had recently passed a hand-searching test, this test was based on the searching of full papers rather than their abstracts. Errors of exclusion were deemed of less impact than those of inclusion, providing that the required sample size was achieved, as these abstracts were being analysed in aggregate rather than in isolation for one conference and exclusion would likely be from random error rather than bias. The decision was made to elicit all information from the abstract. Although this might introduce an element of random error towards exclusion, it would aim to eliminate bias against unpublished studies. It is also recognised that information has been shown to vary from abstract to paper.[61] It is also a valid question to ask when changes between abstract and publication are sufficient to categorise it as a new investigation.

Analysis of abstracts

Significant limitations presented in the analysis of the UTG abstracts. These were not dated in the document and the assumption was made that these were presented in the September of each year, as this is most usual time for the British orthodontic conference. All reasonable measures were taken to ensure that this was the case. The abstracts for the years 2000 and 2003 could not be located despite repeated contact with the British Orthodontic Society and National Library of Medicine and the Wellcome archive.

Study significance

The potential for misunderstanding abstract aims was present, especially in the field of orthodontics as GW had very limited experience in this field at the time of searching. It is likely that some errors were made in the interpretation of the relation between primary aims and significance, especially in those dental fields where the author held least experience. An example of this was where GW incorrectly categorised a study looking at the success of palatal implants as non-significant because no significance was mentioned as to the survival

of the implant. This error was spotted while performing a routine check of the data. It was changed to significant as the authors had noticed a statistically significant change in molar retraction with the implant. Although this was not clearly stated in lay terms in the primary aims, a reasonable body of orthodontists would recognise this study as significant. Another issue with study significance was that authors can use the term grammatically which can lead to confusion, whether by intention or otherwise. It is possible that this led to the benefit of the doubt being given towards result significance from the abstract.

Primary author gender and status

The classification of gender was seemingly straightforward and in very few cases obvious, if the authors were known. Further investigation to determine the primary author's gender and status using search engines (e.g. Google) would often elucidate further information or if there was still a lack of clarity, author contact, although this was often not possible. It has to be recognised however that some names are very common in different countries and it would be remiss to assume that no errors existed in the classification of gender; in fact this parameter is likely to have been subject to significant error. Most articles would cite the initial of an author's first name and a series of assumptions would have to be made to find a match. The first assumption would be that the initial matched a name given on a web search. The second assumption would be that the name had an innate gender, which is often an oversimplification. Other methods for determination of gender have been reported in the literature, including keyword searches, usage of Google images with a tally of the first presenting page's photographs, or statistical models based on probability determination of gender from first name. The latter model, whilst apparently impressive, takes no account of other parameters that affect the gender of a name, including country of origin and age. For example, Jan, a first name isolated in this investigation is more likely to be male in Swedish, Polish, Czech and Croatian, but female in English. In terms of age, a first name such as Lindsay is generally accepted as a predominantly female name, although in older age groups the reverse may be true. In summary, the difficulty of assessing this parameter was not the

lack of clarity in terms of the data, but the clarity and confidence in the results elicited, which could later be disproven by author contact, or a repeat search.

In terms of author status, difficulties existed in the classification, which was divided into Professor or non-professor. These titles have different meanings in different countries and the water is further muddied by the use of such titles as associate professor, assistant professor, clinical professor, emeritus professor or honorary professor. This made the accurate determination of author status difficult. Websites from foreign countries yielding search results would often have the status of the same surname and first initial but would be surrounded by foreign text, providing no context. There also exists a time lag between the status of the author at the time of presentation, time of publication and time of search. For these reasons, this result should also be interpreted with caution.

Ronald Coase is known for having written, *"If you torture the data long enough, nature will confess*".[85] This statement rings true in the analysis of both these criteria, and as such these results have been excluded from analysis.

Funding disclosure

Funding disclosure was relatively clear and usually either indicated in the text directly or with an asterisk (* or **) and later detailed. Difficulties were encountered when authors appeared to be from private companies but no funding was disclosed, and this was surprisingly common. In these cases, contact was attempted with both the journals and the private companies, neither of which clarified these issues. The decision was made to include these as funding undisclosed. This association between author background (e.g. Pharmaceutical companies including Procter and Gamble, Ivoclar Vivadent, Pfizer) and disclosure of funding would likely make an interesting topic for a future study.

Continent of origin

Continent of origin was straightforward to classify, although in reality many cases these abstracts are intercontinental, authors often using email for collaboration. Some complications were encountered in defining transcontinental countries. For the purposes of this investigation Turkey was assumed to lie wholly in Europe. Whilst this is both a geographic and political misrepresentations, this decision was made to simplify data analysis and to increase the transparency of the results.

The origin of the primary investigator was used to classify the continent of origin although the accuracy of this assumption is certainly questionable.

Abstracts per registrar

Information on the intake of registrars per year was sought from other registrars, and these numbers vary year on year. These data should be viewed with caution for these reasons. Some dental schools from the studied period are no longer accepting registrars.

Identification of abstracts

Hand-searching the individual conference reports identified abstracts meeting the inclusion criteria. Using library resources, personal back copies, Internet searches, and contact with the British Orthodontic Society, American Association of Orthodontists, The European Organisation for Caries Research and National Library of Medicine, most reports were obtained. It is acknowledged that some abstracts may have been falsely included or excluded due to human error, although all precautions possible were taken to avoid this. Missing pages in some of the conference abstracts made tracking a certain number of abstracts impossible.

Publication of papers

The publication of abstracts was assessed using MEDLINE as discussed in the methods. Ideally, the search could have been repeated at a later date, however searching is a time

sensitive procedure, and a search at a different time would have yielded different results due to the time lag in updating search engines with data. Ideally, multiple search engines could also have been used as each search engine has limitations. It is a shortcoming of this study that a proportion of these published papers might have been missed, although this error would, in part, be limited by the follow-up of unpublished authors. Despite this, a potential for error exists in this parameter. In retrospect, it was discovered that MEDLINE papers are delayed in updates over the September and November of each year due to the production of new MeSH terms. It is possible that this affected the assessment of this factor. It was unclear in many cases whether papers were e-published or published on given date, in these cases the earliest date was noted.

Quality

At no stage during the data collection process, was an attempt made to assess the quality of the individual abstracts involved within the selected sample. It was thought to be outside the scope of this investigation to evaluate quality.

Sample limitations and bias

The sample size was generated using a sample size calculation with information from previous work on this topic to show differences at the 5% level of significance. This ensured that sufficient articles could be assessed to yield inferences that were not simply due to chance. The sample consisted of 215 abstracts and therefore surpassed the number required in order to show, with 80% power, at the 5% significance level, a 50% rise in the proportion of randomised controlled trials published which was determined from previous studies.

The conferences selected were all English texts and this may have introduced some language bias into the study. Inclusion of non English-language conferences within this study would have required collaboration between other parties for purposes of translation. It is also

possible that the full papers might have proceeded to be published in non-English language journals. This was not felt appropriate within the remit of a Doctorate project and therefore non English-language conferences were excluded.

Follow-up of unpublished authors

This was achieved by emailing the author of the unpublished study at the first e-mail address available in the abstract. In many cases, an email address was not available. In some cases, the email would be returned indicating that the email address did not exist. Anecdotally, authors from Pharmaceutical companies were rarely contactable either by telephone or email. Feedback was sought by a standardised email, and if a reply was not received within a month then telephone contact would be attempted where possible. A better method would have been a validated questionnaire.

Comparisons with other published data

Significance of results

The results of this study do not concur with those of Hopewell *et al.* and others previously discussed in the literature review.[55,58,59,60]

Study design

The results of this study found no statistically significant difference in the publication rates or time to publication of RCTs or CCTs. This is in contrast to previous work by Spencer.[1]

Presentation at conferences

Scholey and Harrison[66] found oral presentations to be published more frequently than poster presentations at EOS, IADR and ORCA in 1993. This study found no statistically significant difference between the two. This suggests that studies presented in either format were just as likely to be published so it cannot necessarily be considered that work presented as a poster was less worthy of publication.

Country of origin

This study found no statistically significant difference in the publication of work from developed or developing countries. Pitak-Arnnop et al[67], in contrast showed a higher likelihood of publication in papers submitted from high-income countries. This study is supported by further American research[68] but this is complicated by so called "English language bias" which might have affecting this study less as all studies conferences were English language.[37]

Gender of primary author

A previous study, in the field of Oral and Maxillofacial Surgery, found a preferential for publishing work of male researchers.[67] This work does not support that finding due to shortcomings in the reliability of the data. Similar issues were encountered in the work of Pitak-Arnnop[67] who based their gender determination on first name, middle name or internet

searching as first utilised in a study by Kurichi[86]. These methods were criticised in both studies and yet conclusions were still drawn from them. It is this author's opinion that such conclusions should not be drawn from such unreliable datasets; therefore those conclusions have been withheld in this study.

Disclosure of funding

Lee *et al.*[17] found a positive association between the disclosure of funding and likelihood of publication in his paper. This work did not. There appeared to be little consistency in the disclosure of funding across these conferences, especially compared to those journals examined by Lee *et al.*[17], where disclosure of funding, details of funding and conflicts of interest where mandatory inclusions in the submission process. Across the journals looked at in this study, although the onus was placed on the author to disclose funding, this was merely a sentence to be added at the end of an abstract rather than a formal part of the submission process. This may have led to the generation of an inaccurate picture.

Sample size

Lee *et al.*[17] also demonstrated a positive association between sample size and successful publication. Pitak-Arnnop's work demonstrated the opposite, with studies of a smaller sample size ($n<100$) showing a higher rate of successful publication.[67] This study found no association in either direction. Lee's study defined a small sample size as $n<73$, while Pitak-Arnnop had it defined as $n<100$. This study generated the definition through a median split around $n<48.5$. These factors make comparisons of these studies difficult. Although this appears significant in Pitak-Arnnop's work, no multivariate analysis was undertaken to exclude confounding from the other factors. Lee's work demonstrated only a "non-significant trend" finding an odds ratio of (OR, 2.01; 95% CI, 0.94–4.32). This study did not look for trends as reliable reflections of data, only statistically significant associations.

Primary author's status

No evidence of previous research could be found in this field. However, due to the reasons discussed earlier, this study cannot unfortunately add a conclusion to this variable.

Publication rates

Scholey and Harrison[66] focused on three of the same conferences as this study and found the overall publication rate for abstracts from three dental conferences held in 1993 was 46.1%. This study found a lower publication rate for both the 2005-2007 sample and the UTG sample. Differences in these rates could have arisen as this study analysed conferences nearer to the date of searching (September 2010), giving authors less time to publish, compared with Scholey and Harrison's study[66] which censored abstracts at 1 year pre- and 5 years post publication. The findings of this study are most similar to the work of Cheng[29].

Time to publication

Scholey and Harrison[66] studied the time taken for full publication, following presentation of the work at the EOS, ORCA and IADR conferences in 1993 and found this to be a median time of 18 months. The median time to publication of the 2005 – 2007 group was 16.00 months, IQR (10, 26) and the mean time to publication for the UTG group was 18.3 months (95% CI 14.38, 22.19), which are both similar to each other and to the previous work cited[66]. This might reflect some consistency in this research field across time and conference.

Reasons for failure to progress to full publication

This work found similar issues to the work of Weber[41] who cited the most common reason given as a lack of time. De Bellefeuille *et al.*[40] also found that a lack of time or resources to be the major reasons for non-publication along with insufficient priority. Other studies concur with this finding.[53]

Generalisability

The generalisability of this study is reflected by the methodology used. This study was a retrospective observational study. A power calculation, based on previous work in the field, was undertaken to show with 80% power, a 50% rise in the proportion of randomised controlled trials published from previous studies at the 5% significance level. Accordingly an appropriate sample of 10% of published abstracts was chosen. Including all abstracts at each conference ensured that their selection was not subject to bias, and therefore produced results with a high level of generalisability within the dental literature.

The conference selected represented those easily accessible to the dental profession and as a result this should produce an unbiased sample of what sort of evidence is available from which to make clinical decisions.

It is acknowledged that the conferences chosen were all conducted in the English language. There were significant differences observed between the conferences regarding the articles' origin with 41 countries represented, spanning 6 continents. However, it is possible that the small number of articles from Africa and Australasia may not be representative of the work from those regions.

Implications for practice

This research, although clinically linked, may bear no direct impact upon clinical practice. However, it is useful for clinicians to be aware that not all research presented at dental conferences are published, and the factors governing their publication are not necessarily related to quality. Clinicians should also be aware of the difficulties encountered by authors being published, which are perceived to be multifactorial. The most important finding of this paper however was the lack of publication bias found towards statistically significant results. This is heartening but on the other hand, clinicians need to be aware that the research that they read as full papers does not paint the full picture as over two thirds of RCTs and CCTs

fail to reach full publication. This will have an impact on systematic reviews of competing interventions and any guidelines on which they are based.

Implications for research

This study has highlighted many shortcomings of a retrospective external observational approach and likewise elucidated the relative benefits of the converse, a prospective internal approach.

For researchers undertaking systematic reviews of the treatment effects of competing interventions, this study does have strong implications. The finding that only a third of RCTs and CCTs reach full publication means that reviewers need to extend their searches to include conference abstracts and that every effort should be taken to obtain relevant data from the abstracts and / or the authors to ensure that as complete a set of studies on a particular intervention are included in systematic reviews.

Different point of view

Future research could investigate prospectively the number of abstracts presented at a conference, and store their details electronically. These could then be analysed at the end of a given time frame. This might shift the paradigm of this question from research-based to audit-based but nonetheless this study, whilst not finding any factors of significance, shows a qualitative perception that would merit further investigation.

Future qualitative investigations

The qualitative aspect could be improved in future studies, perhaps by initiating contact with potential authors at conferences and following them up to publication. Anecdotal findings would be interesting to investigate further, including difficulties of author contact with pharmaceutical companies.

Funding disclosure

The validity of non-funding claims with authors from pharmaceutical companies was a topic that became very salient during this investigation. Despite repeated contact with authors and conference organisers, a clear picture did not emerge as to whether certain abstracts had

been funded. This has previously been investigated in the medical field but has had sparse interest in the field of dentistry.[87,88]

Reviewer blinding

Whilst it is assumed that author names are concealed from article reviewers, the qualitative part of this investigation would suggest that is not the case, at least in terms of the investigators' perceptions. An interesting future investigation could look at whether reviewers are aware of the authorship of papers by looking at other parts of pertinent information in their articles. The American Journal of Public Health has practiced blind review since 1977, and Yankauer investigated its effectiveness in 1992. This has not been investigated in the dental field as yet.[89,90] On the other hand, the Cochrane Collaboration operates an open review process whereby reviewers know who the authors of the review are and the authors know who have reviewed their review.

Author feedback

It was noted in this research that feedback from different authors regarding non-publication varied depending on the author responding. Multiple authors from each abstract could be contacted, to see if the perceived reasons for non-publication were the same for each author.

Duplicate reports

This study found numerous examples of duplicate abstracts, with varying degrees of inconsistency between each. "Salami slicing" of research also appeared to be a factor, especially at larger conferences. The proportion of articles that have duplicate reports would be interesting to investigate as a future project, as this holds repercussions for the quality of evidence available at these conferences. This has been researched previously by Pop *et al.* in 2009 who found that approximately a fifth of clinical research abstracts on prostate cancer presented at the American Urological Association annual meeting were also presented at the European Urological Association. They also found inconsistencies between duplicate abstracts that raised "concerns about the integrity of the underlying studies". [91]

Time in Press

Reasons for variation in the time scales from submission to revision, acceptance and publication could be investigated by contacting journals directly.

Authorship studies

Author contact in this study often elucidated confusing findings regarding authorship of papers, especially when attempting to contact Private Companies. These issues often remained unclarified, but raised some questions that would be a salient topic for a future study. Two interesting fields of investigation would include those of "ghost authorship" (defined as when an individual substantially contributes to the research but is not listed as an author)[92] and honorary authorship (defined as authorship given to those who had no significant role in the research).[93] These topics have been investigated outside the dental field by Wislar *et al.* in 2011 who found evidence of honorary and ghost authorship in 21% of articles published in major medical journals in 2008.[94] Similar work has not yet been conducted in the dental field.

Chapter 8 - Conclusions

2005 – 2007 Sample: Quantitative

Null Hypotheses

2005 – 2007 sample

There was no difference between the publication rates or time to publication of abstracts presented at four Dental / Orthodontic conferences from 2005-2007, with respect to the following factors:

- Result significance: (Significant, Non-significant, or Unclear)
- Mode of presentation (Oral or Poster)
- Study design (RCT / CCT)
- Sample Size: (Absolute number)
- Funding disclosure: (Yes / No)
- Journal of publication (Mother / Other)
- Continent of origin: (North America, South America, Europe, UK, Asia, Africa, Australasia).
- Primary author:
    - Gender (Male / Female / Not clarified)
    - Professional status (Professor / Non-professor)

This hypothesis cannot be rejected at the 5% level.

UTG sample

There was no difference between the publication rates or time to publication of abstracts presented at the UTG over a decade, with respect to the following factors:

- Dental school of origin
- Primary author:

- Gender
- Status

This hypothesis cannot be rejected at the 5% level.

Chapter 9 - Recommendations

Improvement of Publication Rates

All clinical trials should seek ethical approval, and this in part should be contingent on efforts to publish. Ethics committees should also request updates on progress and closely follow progress of the trial, providing assistance as required.

Approval should be granted by committees that include researchers knowledgeable in the particular research field and statistical methods. The cost of this provision would likely be offset by the opportunity cost of wasted, poorly designed inconclusive studies.

Reducing Dual publication

To overcome the problems resulting from dual publication, it has been suggested that all journals have a centralised register of submitted articles. This register could then be amended when an article was accepted, so that other journals could check that they are not accepting the same paper. This database would likely have a large initial outlay and smaller but continuous revenue costs for updating. These costs could, however, be further dispersed amongst participating journals, leading to a large cost-benefit for the scientific community. This is reported to have been suggested by Professor K O'Brien at the World Orthodontic Conference 2005.[1]

Improvement in Availability of Access to RCTs and CCTs

Klassen *et al.* in 2002 suggested international registration at time of ethical approval for all RCTs and CCTs.[33] There has also been an amnesty for unpublished trials, most notably in the medical literature, although the success of this is currently questionable.[95,96]

The Cochrane database currently registers RCTs and CCTs currently being undertaken.

Duplication of research

It is often found that the same subject has been studied by more than one research group. It could be helpful, therefore, for all researchers undertaking a study to perform a comprehensive literature review before embarking on the work. Some large funding agencies e.g. the Medical Research Council, now request systematic reviews to be undertaken before funding new trials.

If similar studies are to be undertaken then it may be advantageous to adopt a similar protocol so that the findings are comparable. This was suggested with regards to material testing for orthodontic research in the Cochrane Review by Mandall *et al,* 2002.[97]

Changes between Abstract and Publication

It was found during this study that there were many changes between the abstract and subsequent published article with regards to authors, title and results. This has been previously noted in the literature, most notably with reference to changes in the data but not aims or conclusions. Associations were drawn between longer times to publication and higher probabilities of identifying differences in the corresponding data presented.[98] It would be advantageous if there was closer control of changes in studies at abstract and subsequent publication so that an accurate trail could be followed.

Publication of "negative" findings

Although this research found no evidence of publication bias in this sample, numerous examples of publication bias have been found in other works. Some measures for those authors who have perceived difficulty publishing due to negative findings could consider publishing in one of many journals dedicated to providing an outlet for negative findings[26].

i) Journal of Negative Results in Biomedicine[99] (www.jnrbm.com/)

ii) Journal of Negative Results in Speech and Audio Sciences[100] (journal.speech.cs.cmu.edu/)

iii) Journal of Articles in Support of the Null Hypothesis[101] (www.jasnh.com/)

iv) The Journal of Spurious Correlations[102] (www.jspurc.org/main2.htm)

v) Journal of Negative Results[103] (www.jnr-eeb.org)

Publishing in these journals would raise the journal profiles, and possibly affect a paradigm shift in attitudes towards negative results.[27]

Research Consortia

The Encyclopedia of DNA Elements (ENCODE) is a public research consortium launched by the US National Human Genome Research Institute (NHGRI) in September 2003.[104–107] Their goal is to find all functional elements of the human genome, following successful completion of the Human Genome Project. All data generated is planned for rapid release onto public databases.

On 5 September 2012, initial results of the project were released in a coordinated set of 30 papers published in the journals Nature, Genome Biology, and Genome Research.[108,109]

A very recent article in Nature by Ewan Birney[110], lead analysis coordinator for ENCODE, explains how the Encode community have, for the past 5 years, been constructing an encyclopaedia of DNA functional elements to be used as a reference for the entire scientific community. This scientific undertaking has inspired new publishing models such as the interweaving of topic threads between papers in different journals

Typically scientists in most of the scientific community presently attempt to perform good science with a limited set of collaborators, seek grants, and publish papers with an understandable consideration for their own careers and institutions.

ENCODE focuses on community resource rather than individual success. This requires a shift in perspective to data production rather than individual publication - the goal becomes the common good. There are, however, pitfalls to be negotiated, for example, standardised analysis methods, sharing responsibilities between many investigators, decision making.[110]

Nevertheless this might point the way to future developments in producing scientific data for furthering the cause of science making the concerns regarding publication bias less significant with time.

Discontinuation of journals

Discontinuation of conventional journals is a movement that is gaining more momentum in recent online discussions. The perceived drawbacks of current paper journal systems have previously been discussed in this literature review. A German language paper by Heller and Pampel[111] discuss the shortcomings of the current system and suggest criteria for a journal of the future, which have been subsequently translated into English with contributions from participants at Friendfeed[112] and Wikiversity[113], a project (currently in beta form) of the Wikimedia Foundation. These criteria are outlined on the Wikiversity website as:

1. ***Dynamics****: Research is a process. The scientific journal of the future provides a platform for fast and continuous publishing of . . . information pertaining to a research project, and for updating any such content.*
2. ***Scope****: The scientific journal of the future interoperates with databases and ontologies by way of open standards and concentrates itself on the contextualization of new knowledge acquired through research.*
3. ***Access****: Free access to scientific knowledge, and permissions to re-use and re-purpose it, are an invaluable source for research, innovation and education. The*

scientific journal of the future provides . . . barrier-free access to its contents, along with clearly stated options for re-use and re-purposing.

4. ***Replicability**: The open access to all relevant core elements of a publication facilitates the verification and subsequent re-use of published content. The scientific journal of the future requires the publication of detailed methodologies, including all data and code, which form the basis of any research project.*
5. ***Review**: The critical, transparent and impartial examination of information submitted by the professional community enhances publication quality. The scientific journal of the future supports peer review, and qualified reviews of submitted content shall always be made public.*
6. ***Presentation**: Digitisation opens up new opportunities to provide content, such as through semantic and multimedia enrichment. The scientific journal of the future adheres to open Web standards and creates a framework in which . . . digital media can be exploited by authors, readers and machines alike.*
7. ***Transparency**: Disclosure of conflicts of interest creates transparency. The scientific journal of the future promotes transparency by requiring its editorial board, editors and authors to disclose existing and potential conflicts of interest with respect to a publication and to make explicit their individual contributions to any publication.*
8. ***Sustainability**: Resources are limited. Ecological considerations are reflected in the design and production of the scientific journal of the future.*

References

1. Spencer M, J E Harrison. Publication Bias of Clinical Trials in Dental Research (MDentSci, University of Liverpool). 2006.

2. Sackett DL, Rosenberg WM, Gray JA, Haynes RB, Richardson WS. Evidence based medicine: what it is and what it isn't. *BMJ*. 1996;312(7023):71–72.

3. Cochrane AL. *Effectiveness and efficiency*. RSM Press; 1999.

4. Eddy DM. Evidence-Based Medicine: A Unified Approach. *Health Aff*. 2005;24(1):9–17.

5. Carey BJ. Medical Guesswork. *BusinessWeek: Online Magazine*. 2006. Available at: http://www.businessweek.com/magazine/content/06_22/b3986001.htm. Accessed July 5, 2010.

6. Eddy DM, Schlessinger L. Archimedes A trial-validated model of diabetes. *Dia Care*. 2003;26(11):3093–3101.

7. Green SB, Byar DP. Using observational data from registries to compare treatments: the fallacy of omnimetrics. *Stat Med*. 1984;3(4):361–373.

8. Harrison J. Evidence based orthodontics: the way forward or an unrealistic dream? (PhD, University of Liverpool). 2002.

9. Burden D. Selective reading. *J. Orthod.* 2003;30(1):1–2.

10. Dickersin K. The existence of publication bias and risk factors for its occurrence. *JAMA*. 1990;263(10):1385–1389.

11. Anon. TFFYthirdeditionfinal1.pdf. Available at: http://www.gdc-uk.org/NR/rdonlyres/B7C2479E-61A4-4962-B109-26928C0E8034/91355/TFFYthirdeditionfinal1.pdf. Accessed January 31, 2010.

12. Anon. fileview.pdf. Available at: http://www.rcsed.ac.uk/rcsed/rcsedvbcontrols/examsdb/fileview.aspx?ID=6d24a745-b18a-4978-81ae-6fe29562501d&from=geninfo. Accessed August 8, 2010.

13. Greco PM. "Publish or perish"—Who publishes and who perishes? *Am J Ortho Dentofac Orthop.* 2012;141(1):4.

14. Turpin DL. Ethics: Publish or perish. *Am J Ortho Dentofac Orthop.* 2012;141(3):256.

15. Rosenthal R. The file drawer problem and tolerance for null results. *Psychological Bulletin*. 1979;86(3):638–641.

16. Peterson I. Publication Bias: Looking for Missing Data. *Science News*. 1989;135(1):5.

17. Lee KP, Boyd EA, Holroyd-Leduc JM, Bacchetti P, Bero LA. Predictors of publication: characteristics of submitted manuscripts associated with acceptance at major biomedical journals. *Med J Aust.* 2006;184(12):621.

18. Anon. The Cochrane Collaboration open learning material. Available at: http://www.cochrane-net.org/openlearning/HTML/mod15-2.htm. Accessed January 31, 2010.

19. Cope MB, Allison DB. White Hat Bias: Examples of its Presence in Obesity Research and a Call for Renewed Commitment to Faithfulness in Research Reporting. *Int J Obes (Lond)*. 2010;34(1):84.

20. Anon. AskOxford: bias. Available at: http://www.askoxford.com/concise_oed/bias?view=uk. Accessed February 6, 2010.

21. Song F, Parekh-Bhurke S, Hooper L, et al. Extent of publication bias in different categories of research cohorts: a meta-analysis of empirical studies. *BMC Med Res Methodol*. 2009;9:79.

22. Wikipedia contributors. Publication bias. *Wikipedia, the free encyclopedia*. 2012. Available at: http://en.wikipedia.org/w/index.php?title=Publication_bias&oldid=508204504. Accessed September 4, 2012.

23. Easterbrook PJ, Berlin JA, Gopalan R, Matthews DR. Publication bias in clinical research. *Lancet*. 1991;337(8746):867–872.

24. Dubben H-H, Beck-Bornholdt H-P. Systematic review of publication bias in studies on publication bias. *BMJ*. 2005;331(7514):433–434.

25. Anon. Ben Goldacre: Battling bad science | Video on TED.com. Available at: http://www.ted.com/talks/ben_goldacre_battling_bad_science.html. Accessed September 5, 2012.

26. Goldacre B. Academics are as guilty as the media when it comes to publication bias – Bad Science. Available at: http://www.badscience.net/2006/06/academics-are-as-guilty-as-the-media-when-it-comes-to-publication-bias/. Accessed September 5, 2012.

27. Goldacre B. Bad Science: Academics are as guilty as the media when it comes to publication bias | Science | The Guardian. Available at: http://www.guardian.co.uk/science/2006/jun/10/badscience.uknews. Accessed September 5, 2012.

28. Castillo J, Garcia-Guasch R, Cifuentes I. Fate of abstracts from the Paris 1995 European Society of Anaesthesiologists meeting. *Eur J Anaesthesiol*. 2006;19(12):888.

29. Cheng K, Preston C, Ashby D, O'Hea U, Smyth RL. Time to publication as full reports of abstracts of randomized controlled trials in cystic fibrosis. *Pediatr Pulmonol.* 1998;26(2):101–105.

30. Hopewell S, McDonald S. Full publication of trials initially reported as abstracts in the Australian and New Zealand Journal of Medicine. *Internal Medicine Journal*. 2003;33(4):192–194.

31. Scherer RW, Dickersin K, Langenberg P. Full Publication of Results Initially Presented in Abstracts: A Meta-analysis. *JAMA*. 1994;272(2):158–162.

32. Evers JL. Publication bias in reproductive research. *Hum. Reprod.* 2000;15(10):2063–2066.

33. Klassen TP, Wiebe N, Russell K, et al. Abstracts of randomized controlled trials presented at the society for pediatric research meeting: an example of publication bias. *Arch Pediatr Adolesc Med*. 2002;156(5):474–479.

34. Krzyzanowska MK, Pintilie M, Tannock IF. Factors associated with failure to publish large randomized trials presented at an oncology meeting. *JAMA*. 2003;290(4):495–501.

35. Jorge C. PHD Comics: Nature vs. Science, pt. 2. 2009. Available at: http://www.phdcomics.com/comics/archive.php?comicid=1200. Accessed September 6, 2012.

36. Lin T. Researchers Boycott Elsevier Journal Publisher. *The New York Times*. 2012. Available at: http://www.nytimes.com/2012/02/14/science/researchers-boycott-elsevier-journal-publisher.html. Accessed September 5, 2012.

37. Gowers T. Elsevier — my part in its downfall « Gowers's Weblog. Available at: http://gowers.wordpress.com/2012/01/21/elsevier-my-part-in-its-downfall/. Accessed September 5, 2012.

38. Anon. elsevierstatementfinal.pdf. Available at: http://gowers.files.wordpress.com/2012/02/elsevierstatementfinal.pdf. Accessed September 5, 2012.

39. Ingram M. Why do we need academic journals in the first place? *GigaOM*. 2012. Available at: http://gigaom.com/2012/02/22/why-do-we-need-academic-journals-in-the-first-place/. Accessed September 5, 2012.

40. Kevin B. The Future of Science Publishing – We Beasties. Available at: http://scienceblogs.com/webeasties/2012/02/21/the-future-of-science-pub/. Accessed September 7, 2012.

41. Anon. Thomson Reuters | Introducing the Impact Factor | Science. Available at: http://thomsonreuters.com/products_services/science/academic/impact_factor/. Accessed September 6, 2012.

42. Anon. Impact factor - Wikipedia, the free encyclopedia. Available at: http://en.m.wikipedia.org/wiki/Impact_factor#section_6. Accessed September 6, 2012.

43. Richard M. The Number That's Devouring Science - Research - The Chronicle of Higher Education. 2005. Available at: http://chronicle.com/article/The-Number-That-s-Devouring/26481. Accessed September 6, 2012.

44. Arnold DN, Fowler KK. Nefarious Numbers. *arXiv:1010.0278*. 2010. Available at: http://arxiv.org/abs/1010.0278. Accessed September 6, 2012.

45. Anon. 10.2.2.3 Citation bias. Available at: http://www.mrc-bsu.cam.ac.uk/cochrane/handbook/chapter_10/10_2_2_3_citation_bias.htm. Accessed September 7, 2012.

46. Anon. MMR doctor struck from register. *BBC*. 2010. Available at: http://news.bbc.co.uk/1/hi/health/8695267.stm. Accessed August 16, 2012.

47. Deer B. MMR doctor Andrew Wakefield fixed data on autism. *The Times (UK)*. 2009. Available at: http://www.timesonline.co.uk/tol/life_and_style/health/article5683671.ece. Accessed January 31, 2010.

48. Anon. Climategate: the final nail in the coffin of "Anthropogenic Global Warming"? – Telegraph Blogs. 2009. Available at: http://blogs.telegraph.co.uk/news/jamesdelingpole/100017393/climategate-the-final-nail-in-the-coffin-of-anthropogenic-global-warming/. Accessed January 31, 2010.

49. Anon. Journal stem cell work "blocked." *BBC*. 2010. Available at: http://news.bbc.co.uk/1/hi/sci/tech/8490291.stm. Accessed February 2, 2010.

50. NICE. How we work. *NICE*. Available at: http://www.nice.org.uk/. Accessed September 5, 2012.

51. Kassirer JP, Campion EW. Peer review. Crude and understudied, but indispensable. *JAMA*. 1994;272(2):96–97.

52. Koletsi D, Karagianni A, Pandis N, et al. Are studies reporting significant results more likely to be published? *Am J Orthod Dentofacial Orthop*. 2009;136(5):632.e1–5; discussion 632–633.

53. Timmer A, Hilsden RJ, Cole J, Hailey D, Sutherland LR. Publication bias in gastroenterological research – a retrospective cohort study based on abstracts submitted to a scientific meeting. *BMC Med Res Methodol*. 2002;2:7–7.

54. Kiroff GK. Publication bias in presentations o the Annual Scientific Congress. *ANZ Journal of Surgery*. 2001;71(3):167–171.

55. Hopewell S, Loudon K, Clarke MJ, Oxman AD, Dickersin K. Publication bias in clinical trials due to statistical significance or direction of trial results. *Cochrane Database Syst Rev*. 2009;(1). Available at: http://www.ncbi.nlm.nih.gov/pubmed/19160345. Accessed February 6, 2010.

56. Marx WF, Cloft HJ, Do HM, Kallmes DF. The Fate of Neuroradiologic Abstracts Presented at National Meetings in 1993: Rate of Subsequent Publication in Peer-Reviewed, Indexed Journals. *AJNR Am J Neuroradiol*. 1999;20(6):1173–1177.

57. Gibson RM, Harrison JE. What are we reading now? An update on the papers published in the orthodontic literature (1999-2008). *J Orthod*. 2011;38(3):196–207.

58. Hopewell S, Clarke M, Stewart L, Tierney J. Time to publication for results of clinical trials. *Cochrane Database Syst Rev*. 2007;(2). Available at: http://www.ncbi.nlm.nih.gov/pubmed/17443632. Accessed February 6, 2010.

59. Callaham ML, Wears RL, Weber EJ, Barton C, Young G. Positive-outcome bias and other limitations in the outcome of research abstracts submitted to a scientific meeting. *JAMA*. 1998;280(3):254–257.

60. Timmer A, Hilsden R, Cole J, Hailey D, Sutherland L. Publication bias in gastroenterological research - a retrospective cohort study based on abstracts submitted to a scientific meeting. *BMC Medical Research Methodology*. 2002;2(1):7.

61. Toma M, McAlister FA, Bialy L, et al. Transition from meeting abstract to full-length journal article for randomized controlled trials. *JAMA*. 2006;295(11):1281–1287.

62. Blackwell SC, Thompson L, Refuerzo J. Full publication of clinical trials presented at a national maternal-fetal medicine meeting: is there a publication bias? *Am J Perinatol*. 2009;26(9):679–682.

63. Eloubeidi MA, Wade SB, Provenzale D. Factors associated with acceptance and full publication of GI endoscopic research originally published in abstract form. *Gastrointest. Endosc.* 2001;53(3):275–282.

64. Elvik R. Publication bias and time-trend bias in meta-analysis of bicycle helmet efficacy: a re-analysis of Attewell, Glase and McFadden, 2001. *Accid Anal Prev*. 2011;43(3):1245–1251.

65. Attewell RG, Glase K, McFadden M. Bicycle helmet efficacy: a meta-analysis. *Accid Anal Prev*. 2001;33(3):345–352.

66. Scholey JM, Harrison JE. Delay and failure to publish dental research. *Evid Based Dent*. 2005;6(3):58–61.

67. Pitak-Arnnop P, Sader R, Rapidis AD, et al. Publication bias in oral and maxillofacial surgery journals: An observation on published controlled trials. *J Craniomaxillofac Surg*. 2010;38(1):4–10.

68. Lynch JR, Cunningham MRA, Warme WJ, et al. Commercially funded and United States-based research is more likely to be published; good-quality studies with negative outcomes are not. *J Bone Joint Surg Am*. 2007;89(5):1010–1018.

69. Egger M, Zellweger-Zähner T, Schneider M, et al. Language bias in randomised controlled trials published in English and German. *Lancet*. 1997;350(9074):326–329.

70. Reyes MM, Panza KE, Martin A, Bloch MH. Time-lag bias in trials of pediatric antidepressants: a systematic review and meta-analysis. *J Am Acad Child Adolesc Psychiatry*. 2011;50(1):63–72.

71. Takeda A, Loveman E, Harris P, Hartwell D, Welch K. Time to full publication of studies of anti-cancer medicines for breast cancer and the potential for publication bias: a short systematic review. *Health Technol Assess*. 2008;12(32):iii, ix–x, 1–46.

72. Harris P, Takeda A, Loveman E, Hartwell D. Time to full publication of studies of anticancer drugs for breast cancer, and the potential for publication bias. *Int J Technol Assess Health Care*. 2010;26(1):110–116.

73. Stern JM, Simes RJ. Publication bias: evidence of delayed publication in a cohort study of clinical research projects. *BMJ*. 1997;315(7109):640–645.

74. Ioannidis JP. Effect of the statistical significance of results on the time to completion and publication of randomized efficacy trials. *JAMA*. 1998;279(4):281–286.

75. Decullier E, Lhéritier V, Chapuis F. Fate of biomedical research protocols and publication bias in France: retrospective cohort study. *BMJ*. 2005;331(7507):19.

76. Juzych MS, Shin DH, Coffey JB, et al. Pattern of publication of ophthalmic abstracts in peer-reviewed journals. *Ophthalmology*. 1991;98(4):553–556.

77. De Bellefeuille C, Morrison CA, Tannock IF. The fate of abstracts submitted to a cancer meeting: factors which influence presentation and subsequent publication. *Ann. Oncol*. 1992;3(3):187–191.

78. Weber EJ, Callaham ML, Wears RL, Barton C, Young G. Unpublished Research From a Medical Specialty Meeting: Why Investigators Fail to Publish. *JAMA*. 1998;280(3):257–259.

79. Hartling L, Craig WR, Russell K, Stevens K, Klassen TP. Factors influencing the publication of randomized controlled trials in child health research. *Arch Pediatr Adolesc Med*. 2004;158(10):983–987.

80. Sprague S, Bhandari M, Devereaux PJ, et al. Barriers to full-text publication following presentation of abstracts at annual orthopaedic meetings. *J Bone Joint Surg Am*. 2003;85-A(1):158–163.

81. Landis JR, Koch GG. An Application of Hierarchical Kappa-type Statistics in the Assessment of Majority Agreement among Multiple Observers. *Biometrics*. 1977;33(2):363–374.

82. Landis JR, Koch GG. The measurement of observer agreement for categorical data. *Biometrics*. 1977;33(1):159–174.

83. Pocock SJ. *Clinical Trials: A Practical Approach*. Wiley-Blackwell; 1983.

84. Anon. Search cochrane oral health group handsearching manual. Available at: http://search.conduit.com/ResultsExt.aspx?ctid=CT2504091&SearchSource=3&q=cochrane+oral+health+group+handsearching+manual. Accessed September 4, 2012.

85. Tullock G. A Comment on Daniel Klein's "A Plea to Economists Who Favor Liberty." *Eastern Economic Journal*. 2001;27(2):203–207.

86. Kurichi JE, Kelz RR, Sonnad SS. Women authors of surgical research. *Archives of Surgery*. 2005;140(11):1074–1077.

87. Colombo C, Mosconi P, Villani W, Garattini S. Patient Organizations' Funding from Pharmaceutical Companies: Is Disclosure Clear, Complete and Accessible to the Public? An Italian Survey. *PLoS ONE*. 2012;7(5):e34974.

88. Robertson J, Moynihan R, Walkom E, Bero L, Henry D. Mandatory Disclosure of Pharmaceutical Industry-Funded Events for Health Professionals. *PLoS Med*. 2009;6(11). Available at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2764857/. Accessed September 7, 2012.

89. Liebeskind DS. The Fallacy of Double-Blinded Peer Review. *AJR*. 2003;181(5):1422–1423.

90. Yankauer A. How blind is blind review? *Am J Public Health*. 1991;81(7):843–845.

91. Pop GH, Fesperman SF, Ball DA, et al. Duplicate presentations on prostate cancer at American Urological Association and European Association of Urology annual meetings. *J. Urol.* 2009;182(2):674–678; discussion 678–679.

92. Gøtzsche PC, Hróbjartsson A, Johansen HK, et al. Ghost Authorship in Industry-Initiated Randomised Trials. *PLoS Med*. 2007;4(1):e19.

93. Anon. Credit where credit's due. *Nature*. 2006;440(7084):591–592.

94. Wislar JS, Flanagin A, Fontanarosa PB, DeAngelis CD. Honorary and ghost authorship in high impact biomedical journals: a cross sectional survey. *BMJ*. 2011;343(oct25 1):d6128–d6128.

95. Roberts I, Hoey J. An amnesty for unpublished trials. *CMAJ*. 1997;157(11):1548.

96. Roberts I. An amnesty for unpublished trials. One year on, many trials are unregistered and the amnesty remains open. *BMJ*. 1998;317(7161):763–764.

97. Mandall NA, Millett DT, Mattick CR, et al. Orthodontic adhesives: a systematic review. *J Orthod*. 2002;29(3):205–210; discussion 195.

98. Rosmarakis ES, Soteriades ES, Vergidis PI, Kasiakou SK, Falagas ME. From conference abstract to full paper: differences between data presented in conferences and journals. *FASEB J*. 2005;19(7):673–680.

99. Anon. Journal of Negative Results in BioMedicine. Available at: http://www.jnrbm.com/. Accessed September 5, 2012.

100. Anon. Medical guide of Creutzfeldt-Jakob disease (CJD). Available at: http://www.jnrsas.org/. Accessed September 5, 2012.

101. Anon. Journal of Articles in Support of the Null Hypothesis. Available at: http://www.jasnh.com/. Accessed September 5, 2012.

102. Anon. The Journal of Spurious Correlations. Available at: http://www.jspurc.org/. Accessed September 5, 2012.

103. Anon. Journal of Negative Results. Available at: http://www.jnr-eeb.org/index.php/jnr. Accessed September 5, 2012.

104. Maher B. ENCODE: The human encyclopaedia. *Nature*. 2012;489(7414):46–48.

105. Wikipedia contributors. ENCODE. *Wikipedia, the free encyclopedia*. 2012. Available at: http://en.wikipedia.org/w/index.php?title=ENCODE&oldid=511262227. Accessed September 7, 2012.

106. Anon. ENCODE whole-genome data in the UCSC genome browser (2011 update). Available at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3013645/. Accessed September 7, 2012.

107. Anon. Identification and analysis of functional elements in 1% of the human genome by the ENCODE pilot project. *Nature*. 2007;447(7146):799–816.

108. Anon. ENCODE Project at UCSC. Available at: http://genome.ucsc.edu/ENCODE/. Accessed September 7, 2012.

109. Anon. Detailed map of genome function. *BBC News*. Available at: http://www.bbc.co.uk/news/health-19202141. Accessed September 7, 2012.

110. Birney E. The making of ENCODE: Lessons for big-data projects. *Nature*. 2012;489(7414):49–51.

111. Heller L, Pampel H. Konzeptstudie: Die informationswissenschaftliche Zeitschrift der Zukunft. 2010. Available at: http://eprints.rclis.org/handle/10760/14894?mode=full&submit_simple=Show+full+item+record#.UEftCL9y_Ip. Accessed September 6, 2012.

112. Anon. Eight criteria for a Journal of the Future #OA - Daniel Mietchen - FriendFeed. Available at: http://friendfeed.com/danielmietchen/47d86807/eight-criteria-for-journal-of-future-oa. Accessed September 6, 2012.

113. Anon. Wikiversity: Journal of the future - Wikiversity. Available at: http://en.wikiversity.org/w/index.php?title=Wikiversity:Journal_of_the_future&oldid=715268. Accessed September 6, 2012.

Appendix 1: Cochrane handsearching guidelines

Classification of Eligible Trials

The term "trial" is used in its broadest sense: it includes any prospective study that compared two or more interventions concurrently and was performed in humans. When searching journals for clinical trials, four aspects of the study design are essential:

i. The study compares ***healthcare*** *treatment/interventions in* ***human beings,***

ii. The study is ***prospective*** *in nature, that is, the treatments/interventions are planned prior to the experiment taking place, and exposure to each intervention is under the control of the study investigators,*

iii. ***Two or more*** *treatments/interventions are compared to one another (or one may be a no treatment control group),*

iv. The most important aspect is that assignment to a particular treatment/intervention is intended to be ***random,*** *that is, not deliberately selected in any way. Units of randomisation may be individuals, groups (communities, schools, or hospitals), organs or other parts of the body (such as teeth).*

Studies meeting these four criteria are further classified according to the degree of certainty that random allocation was used to form the comparison groups. There are only three possibilities for classification.

1. ***RCT (Randomised Controlled Trial):*** *if the trial meets the four eligibility criteria and the author(s) state* ***explicitly*** *(usually by using some variant of the term "random" to describe the allocation procedure used) that the groups compared in the study were established by random allocation.*

2. ***CCT (Controlled Clinical Trial):*** *if an eligible trial has not been explicitly described by the author as "randomised" then there is less certainty that it is, in fact, an RCT. This*

uncertainty is reflected in a different classification: "CCT". The classification "CCT" is also applied to quasi-randomized studies where the method of allocation is known but is not considered strictly random. The classification is based solely on what the author has written, not on the reader's interpretation. Examples of quasi-random processes for assigning treatments are, odd-even numbers, patient social security numbers, days of the week, or patient record numbers.[84]

Appendix 2: Examples of feedback from authors

Example email sent to authors

From: Gareth Williams [mailto:williamsga1@hotmail.com] **Subject:** Publication of abstracts presented at 54th ORCA Congress, July 4–7, 2007, Helsingør, Denmark.

Dear Sir / Madam,

I am conducting research into predictors of publication success in Dental Research for abstracts presented at the ORCA 2007 Congress. I am trying to identify factors that may impede an author's progression from abstract presentation to the publication of a paper, and work on minimising any difficulties for future publications.

I have sent you this email because it seems from searching that an abstract you presented at this Congress has not yet been published. If you have a few spare seconds, please click reply and let me know some reasons for this. Whatever the reason, I would be very interested to know. All results are of course anonymised and the data will be analysed in aggregate form so that no individuals are identifiable.

I hope that this research will highlight and minimise any problems that individuals have with proceeding to publication after abstract presentation.

Many thanks in anticipation,

Gareth Williams,

Specialist Registrar in Orthodontics

Royal Liverpool Hospital

Examples of replies (Author names removed)

Example 1:

Dear Gareth Williams:

Congratulations on your initiative attempting to assist authors who present abstracts at the General Session of the IADR in order to have the respective paper published.

The first problem is cultural, where in some countries the addressing of an idea is not presented directly as it is done in an Anglo-Saxon community.

There is also a lack of preparation in writing scientific papers.

Above all, there is barrier of language.

Following you can see another example of barrier established by editors, which have been provided by one of my PhD student.

Please, I would appreciate it very much if you could keep me informed on the resulting outcomes of your investigation.

Example 2:

Dr. Williams,

Thanks for the email. The research that I used in my Master's thesis was data from the University of North Carolina, while I was attending U of Southern California. The largest reason that it was not published is that there was little pressure to get it done.

Another reason is that many dental students aspiring to become orthodontic residents had used this research and other theses to gain some experience in publication composition...and to pad their CV's. I thought that it would ultimately get published by one of these go-getters.

Thanks!

Example 3

Hi Gareth

Happy to help. Both these papers are now quite old and so I hope my recollection is correct. Taking each in turn:

1. CLP paper this was published in the CLP journal and I do not recall any specific problems.

<Paper name removed>.

2. <Paper name removed>. We encountered considerable difficulty getting this one published and we tried very hard. We sent it to Angle, EJO and AJODO. I cannot prove it but I have a suspicion that one of the referees was involved in all 3 rejections. The main reason for rejection was the method we used to assess <removed>. We only had DPT radiographs and so we used the method reported by <paper name removed>. Which interestingly had previously been published in the AJO. This technique uses a 4 point grading system where: <removed>. I seem to remember the main reason for rejection was

that this method was not valid and the only valid way to assess <removed> was using <removed>. We were a bit annoyed with this because <removed> are more commonly taken in orthodontics and if we are to get a better understanding of <removed> we should embrace this qualitative assessment method. With ethics committees less likely to agree to <removed> we felt that our speciality should not stymie the potential value of this approach. However, our view did not prevail. If there is a key message here it is one of orthodontic journals being more comfortable with quantitative data and more uneasy with qualitative data.

Kind Regards

Example 4

Dear Gareth

Regarding our research on <removed>, we tried to publish it in all four orthodontic journals and we were turned down each time. We were really annoyed about this and we suspected (but of course, we could not prove) that certain reviewers working in this area did not want anyone else muscling in on their turf.

I have presented the data on <removed> at one or two other meetings but we have not yet been able to publish it.

Regards

Example 5

Hello, Gareth,

I'm sure <name removed> will respond to you about our abstracts, but if it's the 5 year results for the Hall Technique, then they are being written up now for publication.

What a brilliant idea for a project!! I remember an academic saying to me at some BSDR meeting on some windswept campus somewhere in the North of England 25 years ago, that he doubted if 1% of abstracts made it into publications, and it's because mostly they are just not good enough, and that someone really ought to do a study on it. And here you are!

For many, though, no abstract, no funding for attendance. Also, an abstract is a nice way of testing the water, or flying a kite. Some conferences make at least a stab at some form of quality control. I'll be interested to read the results of your research; only as a paper, of course; just too busy to plough through abstracts these days!!!

regards

Example 6

Congratulations on your initiative attempting to assist authors who present abstracts at the General Session of the IADR in order to have the respective paper published.

The first problem is cultural, where in some countries the addressing **of an idea is not presented directly as it is done in an Anglo-Saxon community.**

There is also a lack of preparation in writing scientific papers.

Above all, there is barrier of language.

Following you can see another example of barrier established by editors, which have been

provided by one of my PhD student.

Please, I would appreciate it very much if you could keep me informed on the resulting outcomes of your investigation.

Best regards,

Example 7

From: <email removed>

Date: 17 de agosto de 2010 11:09:39 BRT

To: <email removed>

Subject: Submission Swedish Dental Journal

Dear <name removed>,

Thank you for your interest of submitting an article to Swedish Dental Journal. Swedish Dental Journal is the scientific journal of the Swedish Dental Association and it is distributed free of charge to all Swedish dentists. The main goal of the journal is to present research from the members of the Swedish Dental Association but also to communicate this research with the rest of the world. Therefore the editorial board has to give priority to papers written by Swedish researchers/authors. Hope you can find other publishing possibilities.

Good luck to you, this is an important project. Kind regards, <name removed>

Example 8

Thank you very much, Gareth.

That ORCA Abstract is part of a cohort study of 7 years of duration - 1997 - 2004.

The final report was just finished in June 2010.

During autumn we are going to prepare two or three papers in international cowork (Southamericas, Switzerland and Germany)and try to place them in well accepted journals.

Mean reason for the long duration are lack of resources and time. (I am working fulltime in dental public health service. Datacontrol and datanalysis (sic.), report writing, literature review and publication issues of the ORCA-Topic / the cohort study are possible only at weekends or on holidays.

International co-work is really exiting and fruitful but needs plenty of time.

Have a good luck and forthcoming with Your work.

Example 9

Dear Gareth,

. . . I did write up my project for publication but the paper was never published. My supervisor and statistician had a disagreement and this went on for so long that I eventually gave up.

I regret this, and always say in interviews that this experience taught me a lot about managing people!

I hope this helps.

Best wishes

<Name removed>

Example 10

Garett (sic.)

No real difficulty publishing, the two unpublished ones are currently being written up. Hope this is the information you require

<Name removed>

Example 11

Sorry I have been out of the office the past couple of days and just got your phone message. I was involved in the below project but not as PI. This was <Name removed>. The project was undertaken by a student on our own Orthodontic Masters course in <Dental school name removed>, which was written up and submitted by the student mid 2010. The work is now in preparation for publication. Perhaps the major hurdles (although they are not that major) are

1. the student, who is keen and taking the lead in the preparation of the manuscript, is now back in <Country name removed>. Communication is via e-mail which is not as easy as face to face discussions.

2. the time pressures due to other academic commitments of the PI in reading through the various versions of the manuscript. This is the first manuscript the student has prepared and therefore there are the expected errors occurring - such as too many figures, too long for the journal we wish to submit - all results put in when we can be a bit more selective.

3. Through my experience, dissertations and thesis submitted as part fulfilment of the Higher degree have a totally different writing style compared with paper publications. It is a challenge that this style is changed to produce more concise, yet still informative written narrative. All students present all results in their thesis, whether they work or not. For example, development of methodology trying this method and an alternative method may go into a thesis, but not into a journal publication.

Hope this is of help. The plan is submit the paper for publication in the next 3-6 months

Regards

<Name removed>

Example 12

Hi Gareth, it is nice to hear from you. At the moment this paper is in its first draft and I am about to make comments on it. The reason for the delay is that it is being written by <Name removed> and there have been some delays because he has changed posts.

I am not being cricital of him, but if I had decided to write this up as a paper, I would have done it about 9 months ago. The fact that supervisors tend to leave it to their students to write something up is a common reason for delays. But, in my view, supervisors should not write the papers, otherwise the students will not learn how to write up.

If you have any other questions, just get back in touch

Beset wishes: <Name removed>

Example 13

Dear Gareth

One of these has been published: <Paper name removed>

One is with the editor of the <Journal name removed>. Despite winning the <prize name removed> it has taken over 22 months since submission of this article to the <Journal name removed> to get it reviewed. This is unacceptable and way below the standards of other

journals:

<Paper name removed>

One has been rejected by the <Journal name removed> and is being submirred (sic.)

elsewhere:

<Paper name removed>

The last one is just about to be submitted: <Paper name removed>

The main reason for failure of publication/research is lack of

time/support in job plan given to DGH consultants, the ridiculous processes for ethics, R&D and MHRA, and lack of motivation/interest from

SpRs who do not see any benefit in publishing when they are going into practice.

I hope this is helpful

<Name removed>

Example 14

Gareth

where does one start?

delays/non publication are due to

<Paper name removed>

1. short termisim of MSc and then students focus on MOrth and their new job

<Paper name removed>

2. reviewers that keep changing their minds over changes to a paper that you just give up the will to live. to the extent i refuse to submit to <Journal name removed> or referee now as their process is sooooo negative

also i have left academia so less pressure from me (and on me) to publish

hope that helps

<Name removed>

Example 15

Hi Gareth, I know all about publication bias I did my masters and published 2 papers on it with <Name removed>!

Just finishing the write up for submission now so no rejections as yet, the file draw issue is still the biggest problem for most people.

All the best with the research and I will let you know if we have any problems publishing.

Regards

<Name removed>

Example 16

Gareth

Thanks – the first was published some time ago, the second in press (both CPCJ) and the third isn't me – I think there is another <Name removed> around – if not three of us! But yes, the publications took an embarrassing length of time to happen.

Hope this helps

<Name removed>

Example 17

Dear Gareth

<Name removed> has not come back to any of us with her research and is currently about to go on maternity leave.

I am finding that students are not very motivated about writing up their research for publication. When I did my orthodontic training (1987-90) we were expected to have at least one paper ready at the end of our training for submission to a journal.

Regards

<Name removed>

Example 18

Dear Gareth,

The subject of scientific misconduct is huge and I couldn't cover everything by any stretch. I did not cover publication bias. In any case one of the aims of the talk was simply to raise awareness as there is very little literature dealing with this in dentistry - never mind orthodontics. This seems to be in stark contrast to the medical literature where researchers seem far more aware of the issues as are many dealing with the physical sciences. Another aim was to draw attention to the definitions of scientific misconduct which exist but which are moving away from the US definition (comprising only FFP) and towards a much wider definition - encompassing poor scientific and /or ethical practice regardless of intent. Unfortunately it's easy for people to dismiss all this as of no consequence; nothing that will affect clinical practice and that they don't need to worry about it. My point was quite the opposite.

Anyway, there are no published examples of scientific misconduct within the orthodontic literature that I know of - at least in part I suspect because no one has investigated it because many are not aware of these things going on. It would be even more worrying if, as some have suggested, there is a level of tolerance and of course this may also apply.

As a former Journal Editor there were some issues which cropped up which made me investigate this subject but the specific matters were dealt with in accordance with guidelines and also procedures in place at the Journal; they did not get published. Of course there could be others that didn't get spotted we won't know about.

By the way, my talk was based on (and was an expanded version of) a paper which is literally about to be published in the <Journal name removed> with the same title as the talk so that might be of interest (in the <section name removed>).

As regards what major pharmaceutical companies get up to, one only needs to Google "ghost authors in pharmaceutical studies" or "pharmaceutical authors and financial misconduct" and you will turn up lots of things! In addition, I attach an article that might be of interest on this subject as well as the link below.

http://www.elsevier.com/wps/find/editorsinfo.editors/editors_update/issue13b

With regards to pharma and ortho there are not the same links that I know of as can apply in medicine as we don't deal much with drugs. On the other hand there are probably a number of undeclared conflicts of interest with regard e.g. to bracket manufacture etc but again unless journals specifically ask and/or check, I suspect there will be some undeclared conflicts we don't know anything about...

Finally, I attach a very cut down version of my talk which gives a hint towards what was covered.

I hope this helps and good luck,

<name removed>

Telephone feedback

Knowing the editors helps.

Papers are reviewed pre-review by editors and discarded if they are unkeen. This is done in Angle.

Appendix 3: Conference abstracts used in advertising

Above is one of many examples of studies that are used for advertising purely from conference abstracts. Publication of this study has not been sought and hence this article is not peer reviewed.

Appendix 4: JO Submissions Data

	2008	2009	2010
Number of submissions	105	98	170
Submission to first decision (days)	99	65	49
Days for reviewer to complete review	27	28	26
Rejected papers	53%	63%	78%

It can be seen from the data above (kindly provided by Dr Phillip Benson) that the number of submissions increased in 2010 and the time from submission to first decision has reduced from 99 days to 49 days.

The number of days taken by reviewers to complete the reviews appears relatively consistent over the 3 years.

The number of rejected papers have increased from 53% to 78% over these years. From the first and last row it is possible to deduce the number of accepted submissions per year which has remained relatively consistent from 49 in 2008, to 36 in 2009, to 37 in 2010 inspite the increasing number of submissions.