University of Alberta

Analysis of the Methodological Quality of Published Prosthodontic-related Systematic Reviews and their Impact on Clinical Practice, Research and Teaching According to the Correspondent Authors.

by

Tehnia Aziz

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Abstract

Ideally, health care systematic reviews (SRs) should be beneficial to practicing professionals in making everyday clinical decisions. However, the conclusions drawn from SRs are directly related to their quality. An exploratory analysis was completed to determine the current quality of prosthodontics related SRs, and their potential impact on the careers of it's authors.

First, key descriptive characteristics and methodological quality features of published SRs related to prosthodontics were gathered and assessed. Descriptive and inferential statistical testing was performed on both components. Overall, the methodological quality of the SRs was limited.

Finally, an online survey was conducted to ascertain if there was a perceived impact of SRs on their author's clinical practice, teaching and/or research. However, response rate from the survey was poor (14%). Most authors that responded to the survey reported a significantly positive impact of SRs on their careers, whether it was for application of SR findings in clinical practice, research and/or teaching.

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List of Abbreviations

ADA	American Dental Association
AMSTAR	Assessment of Multiple Systematic Reviews
CONSORT	Consolidated Standards of Reporting Trials
DARE	Cochrane Library's Database of Abstracts of Reviews of Effectiveness
EBD	Evidence Based Dentistry
EMBASE	Database (Excerpta Medica Database)
EPOC	Cochrane Effective Practice and Organization of Care Group
ESOMAR	European Society for Opinion and Marketing Research
MEDLINE	Database (Medical Literature Analysis and Retrieval System Online)
OQAQ	Overview of Quality Assessment Questionnaire
PICO [S]	Population, Intervention, Comparators, Outcome and (Study Design)
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta analysis
QUOROM	Quality of Reporting of Meta-analyses
RCT	Randomized Controlled Trials
SR	Systematic Review
SCOPUS	Elsevier Database
URL	Uniform Resource Locator
WS	Database (Web of Science)

Chapter One

Introduction

1.1 Current literature production

Scientific research in health care has been growing exponentially over the past few years. It has been estimated that there are more than 34,000 references (i.e. articles) being published in 4,000 journals indexed in MEDLINE each month; in fact, this is only a small sample of the 100,000 journals currently in existence[1]. In dentistry, there are roughly 500 journals publishing approximately 43,000 research studies a year[2]. For medicine it has been reported that a clinician would have to regularly read an average of 17 to 20 articles per day to keep up his knowledge on a specific subject[3]. Systematic reviews (SRs) were proposed as a solution to remain current with the exponential growth of the scientific literature[1].

1.2 Systematic Reviews

A systematic review (SR) is a publication that consolidates the results from appropriate studies to answer a specific research question. SRs utilize a methodological approach to evaluating the quality of individual studies and in combining them to obtain valid and minimally biased conclusions[4]. In health care, SRs are essentially summaries of available evidence that have been consolidated in a reproducible fashion, which can answer a specific query, for example, regarding the efficacy of a particular therapy or a drug. They allow clinicians to apply the best available knowledge for improved patient care[5]. Therefore, they are considered the foundation to evidence-based practice[5].

1.3 Systematic Review Protocol

A clear understanding of the protocol involved in the conduction of a SR is necessary before applying its findings to make informed health care decisions. Failing to adhere to the well-defined protocol of conducting a SR may have a detrimental impact on its quality, and on the conclusions that may be drawn from it. The following is a summary of the steps in conducting a SR in

chronological order (adapted from references[6,7]):

1. Define question of interest for the review: Developing a clearly formulated question is the key to a successful review. PICO [S] format {population, intervention, comparators, outcome and (study design)} is often used to develop a concise question, although it only applies in SRs regarding treatment outcomes.

2. Develop a protocol for the systematic review: It is important to outline a background to justify the study, have clearly defined objectives, and well detailed search strategies.

3. Define inclusion and exclusion criteria: The inclusion and exclusion criteria should be formulated prior to selecting articles to minimize any bias. This means that studies with negative or undesirable results cannot be removed due to author's bias of wanting to strengthen the evidence for a desired outcome. If a study with negative results meets the inclusion criteria, it should be included as part of the SR. Inclusion and exclusion criteria should be created for multiple categories including study participants, interventions, study designs, and methodological quality.

4. Literature search to identify studies: This includes searches of popular electronic databases such as, but not limited to, MEDLINE, EMBASE, and Cochrane Controlled Trials Register. Databases with other geographic coverage should also be combed. A hand search of journals that cover the area of interest for relevant articles can also be executed. Furthermore, by perusing the references of included articles, further studies may be identified. Lastly, the abstract publications of pertinent conference proceedings may be an untapped resource of further studies.

   Studies with clinically or statistically insignificant findings, or even negative findings, are less likely to be published by editors. One must carefully peruse the grey literature to seek out unpublished studies to improve the scope of the SR. In essence, the presence or absence of

extensive literature searches will have a major impact on the validity of a SR.

5. Select articles based on inclusion and exclusion criteria: Since inclusion and exclusion of studies can be a subjective process, especially the interpretation of the criteria, the selection of primary studies should be performed independently by at least two reviewers. Any discrepancies between the reviewers should be settled through discussion and debate. Failure to achieve a consensus may necessitate a third party reviewer. All excluded studies should be accounted for and their reasons for exclusion must be mentioned. A flow chart that clearly demonstrates the number of articles considered at each inclusion/exclusion criteria step should be included in the SR.

6. Methodological quality assessment of included studies: This should be performed by at least two independent reviewers. There are several assessment tools that have been developed for this purpose in the form of checklists and quality scales. Blinding of reviewers to the journal, author names and respective affiliations can be important in quality assessment of individual articles.

7. Gather and extract information from included studies: At least two reviewers should extract information to ensure accuracy in data collection. A standardized peer reviewed data extraction form should be developed prior to data collection.

8. Analyze and present findings from the included studies: Once information from the included studies has been collected, the findings are tabulated. Results from each individual study can be displayed in the form of graphs such as a forest plot, while other results may be standardized to enable comparison between various studies. Meta-analysis of individual study results can be employed. A meta-analysis is a statistical technique that involves combining the results of independent studies to produce an overall estimate of result[4]. If the studies vary widely in terms of patient

selection, baseline characteristics of participants, management, and follow up, then a meta-analysis should not be used due to study heterogeneity. Furthermore, any SR that employs meta-analysis needs to assess publication bias through the use of funnel plots and sensitivity analysis. This process is limited when no meta-analysis has been conducted.

9. Interpretation and discussion of results: This includes the assessment of the quality and strength of available evidence and its applicability to practice. Any limitations and biases should be explicitly stated and explored. From the findings, relevant economic implications, benefits, risks, and complications of therapies should be mentioned. Based on the conclusions of the SR, recommendations for future research directions should be noted.

1.4 Advantages of Systematic Reviews Compared to Narrative Reviews

SRs can overcome the limitations that plague narrative reviews: subjectivity and bias[6]. Narrative reviews may fail to detail the sources from which they obtained their information[6]. There can be a proclivity towards including studies that tend to support the author's opinions[8]. When compared to SRs, the major drawbacks of narrative reviews can be incomplete identification of all existing studies due to lack of extensive database(s) search for a predefined question, absence of a systematic approach in selection of primary studies by at least two independent reviewers, and lack of critical appraisal of the methodological content of included studies. Therefore, the conclusions drawn from narrative reviews should be approached with caution. Often narrative reviews ignore the quality of the research methodologies of the included studies, and the principles of effect and sample size[5,6]. Narrative reviews may produce conflicting results on a similar topic because of the reviewers' bias towards their own preferences and area of expertise[9]. On the contrary, if conducted properly, authors of SRs can

exert minimal influence on the results of their SRs based on personal preference.

1.5 Growth of Systematic Reviews

There has been an increasing shift towards conducting and publishing SRs. For example, only three SRs were published on the Database of Abstracts of Reviews of Effectiveness (DARE) in 1993, which increased significantly to 484 SRs in 1999[5]. Latest tabulations suggest that as of April 2011, 14,602 peer reviewed abstracts of SRs appeared in DARE[4]. A recent study[10] proposed that there are close to 11 SRs in health sciences published each day and the progress has not tapered off. Currently, the American Dental Association Center for Evidence-Based Dentistry (ADA EBD) contains a database of over 1,600 SRs that could be applied chairside[11]. Their popularity is not only due to their use in providing consensus statements regarding a treatment or prognosis, but also in supporting policy making and identifying gaps for future research[4].

1.6 Impact of Systematic Reviews

SRs have been routinely utilized in healthcare for treatment and improvement of patient outcomes. There have been instances where individual studies for a certain therapy have reported inconclusive results. However, when the studies were combined using a meta-analytical technique in SRs, new evidence emerged making the therapy a definitive treatment choice. Case in point was the sudden widespread use of beta-blockers in patients with a history of prior myocardial infarction to prevent further heart attacks. Conversely, the harmful effects of a routine, previously perceived innocuous treatment were unmasked after conduction of a SR. For example, from the conduction of a SR, the routine practice of the prophylactic administration of lidocaine in patients with heart disease was abandoned after discovering its deleterious effects from the conduction a SR.[6]

SRs frequently contain recommendations for practitioners in the form of evidence based clinical guidelines. The US Agency for Healthcare Research and Quality and the Canadian Medical Association are some notable resources for these guidelines[7]. The ADA EBD website currently contains evidence based recommendations for practicing dentists such as the prevention of infective endocarditis in certain patients receiving dental treatment, oral cancer screening, non fluoride based caries preventative agents, and in office topical fluoride treatment[11].

1.7 Features and Quality of Prosthodontics Research

Features of Prosthodontics Research: Prosthodontics is a subset of dentistry that deals with the diagnosis, treatment planning, rehabilitation and preservation of oral function in patients afflicted by disease states associated with missing teeth[12]. Prosthodontic research areas may include the planning, fabrication, and delivery of dental and maxillofacial prosthesis. A recent publication[13] reporting trends in prosthodontic research during three time periods (1998, 2003, and 2008) revealed that there has been a tremendous amount of focus on research into dental materials. In addition, this publication highlighted the significant decrease in SRs in prosthodontics, while there was a commensurate increase in case reports over the years.

Quality of Prosthodontics Research: It is hypothesized that there is lack of prosthodontics research in this area, as only two[14,15] studies related to quality of research in prosthodontics could be located. One study[14] concluded that most common clinical practices in prosthodontics were guided by expert personal opinion rather than rigorous scientific evidence. Although, this study[14] was a SR, it had several methodological flaws. In addition, only one author selected primary studies for selection in the SR, which introduced significant bias and subjectivity. Another study[15] assessed the quality of randomized controlled trials (RCTs) in dental implant surgery and arrived at the conclusion that they were of poor quality due to presence of both

methodological and statistical flaws. Therefore, the implementation of practice guidelines generated from poorly conducted research would be ill advised. Based on the aforementioned information, an investigation into the methodological quality of SRs published in prosthodontics would be beneficial.

1.8 Statement of Problem

Before integrating the vast information that can be gleaned from escalating supply of published SRs into evidence based practice, one needs to be aware of the methodological limitations of SRs that might compromise the integrity of its findings. It has been found that less than 15% of SRs published in some evidence based medicine journals had enough information to allow practitioners to select a certain therapy[16]. Findings from SRs may not represent the best possible evidence if the necessary steps to conduct unbiased SRs are not performed. Several studies have been conducted in the medical[17-19] and dental literature[20-22] to examine the methodological quality and characteristics of SRs. However, we are not aware of a study of this nature to be reported in prosthodontics. This information would be useful in determining if a practitioner should apply the results of a prosthodontic SRs into clinical practice, especially when the ultimate goal is improved patient outcomes.

There have been numerous publications written on the impact of SRs, especially the major influence they have had in creating and supporting practice guidelines and identifying gaps in research. Going forward, we want to examine if the experience of conducting and publishing SRs has had a perceived impact on respective authors' teaching, research, and clinical practice. Such information could be useful in our understanding of knowledge translation. In other words, are authors who are publishing prosthodontic SRs, utilizing its findings to improve their own teaching, research, and clinical practice?

1.9 Objectives

Objective 1. To analyze the descriptive characteristics and methodological quality of published SRs related to prosthodontics.

Specific Objectives:

1. To summarize the key descriptive characteristics of SRs related to prosthodontics.
2. To assess the methodological quality of SRs related to prosthodontics by utilizing the AMSTAR measurement tool.
3. To investigate if there was an association between the number of times the SRs were cited and the journal in which they were published.
4. To investigate if there was a difference between the number of citations for SRs published in specialty versus general dentistry journals.
5. To explore the degree of association between the number of citations and the journal's impact factor.
6. To investigate if experience with authoring prior SRs was associated with a different number of citations.
7. To investigate the study design (for example, Randomized Control Trials, Prospective, Retrospective) included in the SRs was associated with the number of citations?
8. To investigate if number of citations were associated with negative, positive or inconclusive results of SRs, as reported by its authors.
9. To investigate if total AMSTAR scores were associated with the number of citations received.
10. To investigate if citation numbers were associated with Cochrane versus non-Cochrane Studies.
11. To investigate if there was a difference in total AMSTAR scores between authors who had prior experience with SRs versus novice SR authors.
12. To investigate if there was a difference in total AMSTAR scores over three time periods.
    a. 1990-2000 (OQAQ developed and available)

b. 2001- 2006 (Other checklists available)
c. 2007-2011 (AMSTAR developed and available)

Objective 2. To explore the impact that conducting SRs (from objective 1) have had on its respective authors.

Specific Objectives:

1. To investigate the background/evidence based dentistry (EBD) training of authors prior to the execution of the selected SR.
2. To investigate the limitations that the authors perceived during the process of SR conduction.
3. To assess the impact of SRs on it's respective authors in terms of teaching, research and clinical practice.
4. To assess the overall significance of SRs as perceived by it's authors.

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Chapter Two

Assessment of Methodological and Key Descriptive Characteristics of Prosthodontics Related Systematic Reviews

2.1 Introduction

The Cochrane handbook describes systematic reviews (SRs) as a summary of available evidence to answer a clearly defined research question from predetermined eligibility criteria[1]. SRs are essentially summaries of published and unpublished research studies that employ a reproducible and systematic approach in searching the medical literature, integration of the available evidence, and critical appraisal of each included study[2]. They have been proposed as a solution to remain current with the increasing volume of scientific literature[3].

The use of an explicit and methodological approach reduces bias and aids in providing more reliable recommendations that would assist a clinician in making evidence-based decisions [2,4]. Therefore, SRs not only provide summaries of available evidence, but they are also critical for development of practice guidelines and to guide research directions[5].

Although, the protocol of the SR is to have a transparent approach towards identifying, reviewing, analyzing, critically appraising, and synthesizing the relevant results of individual studies, they can still be biased if they are not conducted objectively[6]. The quality of SRs is directly related to the quality of the included studies. Appropriate results can be integrated in practice only if an objective approach is followed in amalgamating research findings. Hence, it is imperative to assess the quality of a SR before their results/conclusions are utilized for making evidence based decisions.[7-9]

2.2 What does the quality of a systematic review mean?

Quality of the SR can be twofold: defined as methodological quality and reporting quality. Methodological quality is how well the SR was performed in terms of its key components, such as, but not limited to, extensive literature searches, at least two independent reviewers to select studies, inclusion of studies with high levels of evidence and appropriate integration of data etc. Reporting quality involves how well the authors have reported their research methods and

their respective deductions regarding the subject of their SR.[7,10]

2.3 AMSTAR measurement tool.

Several methodological quality assessment tools have been developed. It has been reported that there are now more than 24 assessment tools available to investigate the quality of SRs[11]; however, not all of these tools have been validated[12]. Most of them are lengthy, their use is cumbersome and recent research has shown that they do not address the issues of language and publication bias in SRs[13,14]. Therefore, the Assessment of Multiple Systematic Reviews (AMSTAR, Appendix A) tool was recently developed to analyze the methodological quality of SRs[7,12,13]. It is a refined combination of the OQAQ (Overview of Quality Assessment Questionnaire) developed by Oxman and Guyatt[15,16] and the checklist developed by Sacks for meta analyses[17]. Since its development in 2007, two studies have been conducted to test the external[7] and internal validity[12] of this tool. Both publications concluded that this tool has good agreement, reliability, feasibility and construct validity in comparison with the original assessment tools (OQAQ and checklist by Sacks). It also addresses issues such as publication bias, status of publication (if grey literature was included), language restriction, and conflict of interest[12,13]. AMSTAR is reported as less tedious, yet more comprehensive in use than its original assessment tools according to its developers[12]. It is designed so that each individual item on the list is not related to the others so each item can be scored individually. In addition, due to lack of overlap between each item, an overall score can also be computed to assess methodological quality[13]. This tool has gained popularity since its inception. In fact, the Canadian Agency for Drugs and Technologies in Health and the Cochrane Effective Practice and Organization of Care Group (EPOC) are amongst some of its users[12]. This tool was therefore used in this study to assess the methodological quality of included SRs related to prosthodontics.

2.4 Objective

Since the methodological quality of SRs is directly related to the quality and strength of the final conclusions drawn, the purpose of this chapter is to investigate descriptive characteristics and methodological quality of published SRs related to prosthodontics.

Specific Objectives:

1. To summarize the key descriptive characteristics of SRs related to prosthodontics.
2. To assess the methodological quality of SRs related to prosthodontics by utilizing the AMSTAR assessment tool.
3. To investigate if there was an association between the number of times the SRs were cited and the journal in which they were published.
4. To investigate if there was a difference between number of citations for SR published in specialty versus general dentistry journals.
5. To explore the degree of association between number of citations and journal's impact factor.
6. To investigate if experience with authoring prior SRs was associated with the number of citations.
7. To investigate if study design (for example, Randomized Control Trials, Prospective, Retrospective) included in the SRs were associated with the number of citations.
8. To investigate if number of citations were associated with negative, positive or inconclusive results of SRs as reported by its authors.
9. To investigate if total AMSTAR scores were associated with number of citations received.
10. To investigate if citation numbers were associated with Cochrane versus non-Cochrane Studies.
11. To investigate if there was a difference in total AMSTAR scores between authors that had prior experience versus novice SR authors.

12. To investigate if there was a difference in total AMSTAR scores over three time periods.
    a. 1990-2000 (OQAQ developed and available)
    b. 2001- 2006 (Other checklists available)
    c. 2007-2011 (AMSTAR developed and available)

2.6 Materials and Methods

An extensive literature search of the MEDLINE, EMBASE and Web of Science (WS) was conducted with the help of a senior librarian specializing in medical sciences database searches. The search included indexed SRs from 1950 (1980 for EMBASE) to the fourth week of October 2011(week 44). Additionally, all SRs under "prosthodontics" section from American Dental Association's Center of Evidence Based Dentistry (ADA EBD) were also searched. Search terms were mainly combinations of the terms "prosthodontics" and "systematic review" (see Table 1 for detailed search strategy).

For initial screening, abstracts were reviewed. Topics dealing with tooth prosthesis such as, but not limited to, dentures, crowns, bridges, dental materials, and cements were included. Studies specific to implantology such as bone grafting and implant site preparation without any reference to prosthetic components were excluded. After selection of abstracts to be included (and full text of two studies that did not contain abstracts), the following inclusion and exclusion criteria was applied to the articles retrieved. Only the author of this thesis study screened the abstracts and full text of articles. Selection process is outlined in Figure 1.

2.6.1 Inclusion criteria:

SRs that focused on:

a. Mechanism, design, and survival/ complication rates of removable and fixed dental prosthesis.
b. Fracture rates (longevity) of material used for dental prosthesis.

c. Mechanism, complications and survival of prosthetic components (crowns, bridges, overdentures) of implants.
d. Loading times of implants with dental prosthesis in relation to survival of dental prosthesis.
e. Longevity of computer generated prosthesis.
f. Effectiveness and longevity of dental cements.

2.6.2 Exclusion criteria:

SRs that focused on *(exclusion criteria "h" does not relate to SR):

a. Primarily osseointegration, periodontal health, bone grafting and/or site preparation for implant without any reference to loading/survival of implant and its prosthetic component.
b. Surgical procedures for prosthetic placement in the future. Examples include crown lengthening, bone augmentation techniques, gingival recontouring, alveoloplasty for dentures and sinus lifts for implant placement.
c. Mainly chemistry of prosthetic materials and cements, without any reference of clinical application of these materials/cements.
d. Components of implant or implant systems without any reference to the prosthetic component.
e. Techniques for making computer generated prosthesis without reference to clinical application of the prosthesis.
f. Techniques for fabrication of removal/fixed dental prosthesis, without any mention of clinical application of the prosthetic component.
g. Dosage and use of medications (e.g. antibiotics, pain killers) for prostheses placement/surgery were not included.
h. * Meta analysis only, without a systematic review of the literature were not considered SRs, and therefore they were not included.
i. Language other than English.

2.7 Descriptive data extracted.

The following study descriptive characteristics were extracted from the selected SRs; however, not all information was used for the descriptive or inferential statistical analysis:

1. Journal
   a. Name
   b. Year of publication
   c. Impact factor obtained from ISI Web of Knowledge[SM]
   d. Specialty or general dentistry.
2. Author information
   a. Contact information of primary author.
   b. Primary author affiliation, including whether academic or private practice setting.
   c. Country and continent of primary author.
   d. Total number of publications to date for primary author, including SRs. (Information about prior SR authorship was obtained mainly from Web of Science, SCOPUS was only utilized if an author could not be located in Web of Science, which was the case for very few authors).
   e. Number of authors
3. External Funding (if any) for the SR.
4. Number of citations that the study received up to the fourth week of October 2011 were retrieved from Web of Science. SCOPUS was searched for citation numbers if the SR could not be found in Web of Science. Google Scholar was searched as an alternative if the SR could neither be located in Web of Science or SCOPUS.
5. Database(s) searched, start and end date of searches.
6. Whether a flow chart for study selection was included.
7. Total number of studies finally included in the SR.
8. Study design (RCT, Prospective, Retrospective etc) of included studies in the SR.

9. If meta-analysis was performed in the SR.
10. Whether results of the SR were positive, negative or inconclusive as reported by the authors.
11. Topics of interest of SRs. These included fixed dental prosthesis, complete dentures, overdentures, partial dentures, implant supported prosthesis and dental materials.
12. Fulfillment of the 11 components of the AMSTAR measurement tool. Both individual (each of the 11 components is given a score, whether for full or partial fulfillment of criteria) and total (sum of scores of all 11 components) scores were assessed.

2.7.1 Retrieval of Citations

Web of Science was employed as the primary database for citation scores as it is commonly used for citation analysis studies[18,19]. SCOPUS was used when an article could not be located in Web of Science; Google Scholar was used as final alternative when a study could not be located in either of the other two databases. Both SCOPUS and Web of Science include articles from peer reviewed journals and conference proceedings, but SCOPUS also covers books and web sources and usually includes older publications, such as those before 1996[20]. SCOPUS has a strong coverage (more than half) of research from European, Asian and Latin American origins [18,21]; whereas, Web of Science has mostly North American (English language) coverage[22]. Google Scholar is used internationally and tends to include citations from non-peer reviewed sources such as websites, student handbooks, administrative proceedings and theses[23].

2.7.2 Retrieval of Impact Factors

Impact factors were retrieved from Journal Citation Reports from ISI Web of Knowledge^{SM} (Published by Thomas Reuters) from the University of Alberta library. Current impact factor as opposed to the 5-year impact factor was used. Current impact factor is the average number of times that each article from a particular published journal has been cited in past two years; whereas, 5 year impact factor is the average number of times that each article (per journal) has

been cited for the past 5 years. The five-year impact factor is useful when there are not enough citations in the past two years due to various reasons such as delays in the publication schedule, or a slowly evolving field[24]. This was not the case for research published in prosthodontics, as all the journals had current impact factors.

2.7.3 Quality Assessment

Both individual (each of the 11 components were given full or partial score) and total (sum of scores of all 11 components) scores were tabulated. Although, this approach has not been validated, each component that was completely addressed was given a score of 2, partial scores were given a score of 1, and no/ can't answer were give a score of 0. For example, a SR with a score of 22 would have fulfilled all criteria on the AMSTAR tool and would have high methodological quality.

Reasons for assigning partial score to each AMSTAR component: Item 1 (Was an "a priori" design provided?) was given partial score when inclusion /exclusion criteria were not given, but objective/ reasons for conducting the study were given. A partial score for question 3 (Was a comprehensive literature search performed?) was given when only two resources were searched. For example, only one electronic database was searched along with hand searches; or no supplementary searches such as hand searches were done, but at least two electronic databases were searched. Reason for giving partial score for item 4 [Was the status of publication (i.e. grey literature search performed?)] was mostly due to grey literature not being searched, but language/study design preference being mentioned. List of excluded studies not given was the most common reason for receiving partial score on item 5 [Was the list of studies (included and excluded) provided?]. A partial score was also given when quality of studies was assessed; however no conclusions or recommendations were made for item 8 (Was the scientific quality of the included studies used appropriately in formulating conclusions).

2.8 Statistical Analysis

Statistical analysis was employed using SPSS software (Chicago, IL; IBM version 19). Both descriptive and inferential statistical measures were applied. Descriptive statistics were carried out on scores obtained from individual components of AMSTAR tool (Table 3) and on various SR characteristics [Table 4 and (Figures 1-17, Appendix B).

Inferential testing was done through non-parametric statistical analysis. Citation numbers and its relationship with other variables such as: journal name (journals with two or more SRs in this sample were used), type (specialty versus general dentistry), impact factor, prior experience of authors with SRs, types of studies included in the SR, Cochrane versus non Cochrane SRs, conclusions of the SR, and total AMSTAR scores from each SR were investigated. Association between total AMSTAR scores obtained from SRs (methodological quality) and authors possessing SR experience were investigated. In addition, changes (if any) in total AMSTAR scores over the years were also explored.

Non-parametric tests such as Mann-Whitney U test (two independent sample test) and Kruskal-Wallis (three or more independent sample test) were used since the data violated both underlying assumptions of normality and equal variance. Moreover, the sample sizes of most grouping variables were unequal. Spearman as opposed to Pearson's correlation was used as a measure of association between different variables since the data obtained in this study was not normally distributed. In addition, the relationship between the variables was non-linear.

2.9 Results

Both EMBASE and Web of Science yielded 16 hits, there were 200 hits for MEDLINE. Seventy four SRs were identified on the ADA website. After initial inclusion and exclusion criteria were applied, MEDLINE search resulted in 49[25-73] articles from which 18 were excluded (see Table 2 for list of excluded studies, along with its corresponding references). Initial inclusion and exclusion criteria could not be applied to two articles[27,66], as they did not contain abstracts.

Therefore, full studies were retrieved, however, these articles[27, 66] were not included as they were not SRs. Eight studies[25,74-80] were initially selected from reading the abstracts on EMBASE, of which, two studies were excluded after full article retrieval. Eleven articles[51, 56,68,76,77, 81-86] were selected initially from Web of Science from which two were excluded. Only the most recent update of the SR was included in this study when multiple updates were retrieved. There were 74 SRs[32, 33, 39, 46, 48, 50, 56, 57, 68, 76-78, 82, 84, 85, 87-145] on ADA EBD website under the heading of SRs in prosthodontics. All except two SRs from this website fulfilled inclusion criteria. This resulted in a total of 72 SRs from the ADA EBD website. Ten more SRs[146-155] were located during retrieval of full text of SRs. These SRs were found during collection of other SRs from the hard copies of journals located at the University of Alberta library. All of these SRs[146-155] were included after application of inclusion/exclusion criteria. More than two thirds (66%) of the SRs were located from the ADA EBD website, MEDLINE contained a little less than half (41%), hand search yielded 9 percent of SRs, and EMBASE and Web of Science only accounted for 6 percent. See Appendix 2 for list of included studies (corresponding references from this chapter are included in the list).

One full text of a SR[117] could not be retrieved from the library at the time of statistical analysis since that issue was missing. We were able to gather most of the descriptive information of this SR from the abstract except for the AMSTAR scores.

Two non-English SRs, one was in Chinese[80], and other in German[83] were excluded. The final purpose of this study is to follow up on the quality of SRs with a survey in English. Language would be a barrier even if information on methodology was collected, but could not be assessed for purposes of knowledge translation.

To establish consistency for citation scores between different databases, 15 articles were randomly selected and their citation numbers were obtained from Web of Science, SCOPUS, and Google Scholar. There was not a notable

difference in citation scores between Web of Science and SCOPUS. However, Google Scholar had inflated citation scores when they were compared to numbers obtained from Web of Science and SCOPUS. To note, only 3 articles in our sample had citation scores extracted from Google Scholar.

2.9.1 Descriptive statistics of study characteristics (Table 4, Figures 2-17)
Country/ Continent: Eighteen percent of publications (according to their first authors' country of residence) were from USA followed by UK (15%) [See table 4 for detailed information]. European continent contributed to almost two thirds (62%) of publications in our sample followed by North America (21%), Australasia (6%), Asia and Australia (5%), South America (2%), and Africa (1%).

Authorship/Affiliations: Almost half of the SRs in this sample were done by two authors (27%), and three authors (20%). More than one-third were done by 4 or 5 (18% and 17% respectively) authors. Ten percent of SRs were reported as completed by only one author. Most authors had prior experience authoring SRs (77%), and majority of authors were from a university or academic setting (93%). More than two thirds of SR authors had only one affiliation (65%), whether of academic or private practice nature. Remaining authors had two to four affiliations.

Financial support: Most of the SRs received no external grant or financial support (76%). Seventeen percent received financial support from which 5% of SRs (5 SRs) were industry funded. Seven percent were supported by Cochrane Collaboration.

Database searches: One third of SRs searched two resources including either two electronic database(s) or one electronic database/hand search combination, 19% searched five resources and the rest used either one, three, four, six, or more than six resources. However, 2% did not report the names and numbers of resource(s) utilized.

Journals characteristics: Publication in specialty (prosthodontics as opposed to general dentistry) journals was the choice for 78% of authors and the most common journal utilized was Clinical Oral Implants Research (23%) followed by International Journal of Prosthodontics (14%), International Journal of Oral and Maxillofacial Implants (9%), Journal of Prosthetic Dentistry and Cochrane Database of Systematic Review (8%). Half of the journals in our sample had an impact factor between 1 and 2 (46%) and one third (31%) were in the 2 to 3 range. Eighteen percent of journals in our sample had no impact factor.

Meta-analysis/Flow diagram: Almost half of the SRs (49%) did not employ any meta analytic tests and more than half (63%) did not use a flow diagram to depict study selection.

Systematic review results: Half of SR findings were positive (50%) and less than half were inconclusive (45%) with only 5 percent reporting negative/harmful results. Only four percent were updates of previous SRs; they were all part of the Cochrane database of SRs.

2.9.2 AMSTAR results.

Descriptive statistical analysis on AMSTAR measurement tool (Table 3) revealed a huge variation in the fulfillment of various components. Both question 1("a priori" design) and question 6 (characteristics of the included studies) rated fairly well with 81 percent (question 1) and 73 percent (question 6) of SRs satisfying the criteria. Almost half of the sample of SRs fulfilled questions 2 (duplicate study selection/ data extraction), 3 (comprehensive literature search), 5 (Was the list of studies, included/excluded) and 9 (findings of studies combined appropriately) on the checklist. The rest of the criteria on the AMSTAR tool were poorly adhered to, especially for questions 4 (status of publication), 7 (scientific quality of studies assessed), 8 (scientific quality used in formulating conclusions), 10 (publication bias assessed), and 11(conflict of interest). Roughly one third of the SRs fulfilled the criteria for items 4,7,8, and 11 of the AMSTAR measurement tool. Likelihood of publication bias (item 10) was most poorly

addressed component with only 6 percent of publications addressing this criterion.

In addition, total scores from the 11 components of AMSTAR tool were tabulated from 105 SRs (full text of one SR[117] could not be retrieved for application of AMSTAR scores). Mean total AMSTAR scores were 11 (SD=5) out of 22, minimum score was 4/22 and maximum score was 22/22. Twenty-four SRs had total AMTSAR scores below 25th percentile, 29 SRs had scores between 25th and 50th percentile, 28 SRs had scores between 50th and 75th percentile and 24 SRs scores above 75th percentile.

2.9.3 Inferential Statistical Analysis.

Non-parametric tests such as Mann Whitney, Kruskal-Wallis, and Spearman correlation were used for inferential statistical tests (Table 5). Citations counts were utilized as response variables for several tests, Significant level was set at alpha=0.05 (95% two tailed confidence interval).

1. Were number of citations' associated with the journal in which the SR was published?

An initial p value of less than 0.001 from the Kruskal Wallis test for the eight most popular journals suggested that there was a significant difference in citations numbers between different journals. Mann Whitney U test was then used to further investigate as to which journals had the greatest difference in median citation numbers. Median citations as opposed to raw citation scores were utilized, since non-parametric testing methods were used. Median number of citations in decreasing order are; J Prosth Dent (median citation=27), Clin Oral Implants Res (14), Int J Oral Maxillofac Implants (11), Int J Prosthodont (10), Eur J Prosthodont Restor Dent (7), other journals (3.50), Cochrane Database Sys Rev (1.5), and J Oral Rehab (0). Greatest difference came from: J Prosth Dent and Cochrane Database of SRs (Mann Whitney Z= -2.83, p=0.005), J Prosth Dent and J Oral Rehab (Mann Whitney= -2.88, p=0.004), and Cochrane Database of systematic reviews and Clin Oral Implants Res (Z=-2.73, p=0.006).

2. *Where there differences in number of citations between publications in specialty versus general dentistry journals?*

There was a statistically significant difference in citations scores (p= 0.007, Mann Whitney test) between the two groups. General dentistry had a median of 2 citations and specialty journal had significantly more i.e. 10 citations.

3. *Was there an association between number of citations and Journal Impact factors?*

No significant correlation (Spearman correlation) was found between both citation numbers and impact factors (Rho 0.045, p=0.678). This correlation explains less than 0.2% of variability.

4. *Were the number of citations associated with authors that had previously published SRs versus novice SR authors?*

No difference was found between citation numbers for experienced (median citations=10) versus novice authors (7). Mann Whitney U test, Z= -1.38, (p=0.167).

5. *Was study design (RCT, Cohort, Case control etc) of studies included in SRs associated with number of citations?*

Different study designs that were part of each SR were pooled into 8 most popular types. These include:

1. All included studies are Randomized Controlled Trials (RCT)
2. All included studies are Prospective (P)
3. All included studies are Retrospective (R)
4. Included studies are RCT, P and R.
5. Included studies are P and R (no RCT)
6. Included studies are P and RCT (no R)
7. Included studies are R and RCT (no P)

8. Others (included lab studies, quasi experimental studies, cross sectional studies, SRs, animal studies, in vitro studies).

The median number of citations for SRs that only included randomized controlled trials (RCT's) was 7, for only prospective study design was 5, and only retrospective design was 23.50. Included studies that were a combination of randomized controlled, prospective and retrospective was 11, included studies that were prospective and retrospective (no RCT) was 32, both prospective and randomized controlled trials included was 1, both retrospective and randomized controlled trials was 40, and other study designs (for example; lab studies, quasi experimental studies, cross sectional studies, SRs, animal studies and in vitro studies) was 5 median citations. Kruskal Wallis test yielded significant p-value= 0.022, H (7)= 16.37. The biggest difference within the groups came from studies that were RCT versus no RCT (only prospective and retrospective) p value =0.05 (Mann Whitney test).

6. *Were number of citations associated with negative, positive or inconclusive results of SRs?*

There was no evidence for difference in median number of citations for different study results (p=0.223, Kruskal Wallis) i.e. positive (median citations =9.5), negative (14.5), and inconclusive (7).

7. *Were AMSTAR scores associated with citation numbers?*

Weak association was found between total AMSTAR scores and citation numbers (Spearman Correlation; Rho -0.112, p= 0.253). Only 1% of variability was explained by this correlation.

8. *Were number of citations related to Cochrane versus non-Cochrane studies?*

Moderate evidence was detected for difference between median citations for Cochrane (2 citations) versus non-Cochrane studies (9 citations), Mann Whitney, Z= -2.21, p=0.027 (significant value).

9. *Was there a difference in total AMSTAR scores for authors with prior SR experience versus novice SR authors?*

There was a strong evidence of difference in median AMSTAR scores for publications with authors possessing prior SR experience compared to novice SR authors. Median AMSTAR scores for authors with prior experience were 12 (higher AMSTAR score) as opposed to 7 for no experience, Mann Whitney; $Z = -4.17$, $p < 0.001$.

10. *Was there a difference between total AMSTAR scores over time periods?*

Although, the median AMSTAR scores were the highest for SRs published in the last 5 years, there was no statistically significant difference [Kruskal Wallis; $p=0.142$, $H(2)= 3.90$] between the median AMSTAR scores for SRs published between the three time periods 1990-2000 (median AMSTAR scores=9.5), 2001-2006 (11), and 2007-2011(12).

2.10 Discussion

The purpose of this study is to identify key descriptive and methodological characteristics of published SRs related to prosthodontics. Some areas of concern were identified and future recommendations were made after gaining insight into trends that existed. SRs if performed properly, possess the advantage of being unbiased summaries of available evidence that can assist practicing healthcare professionals in decision-making. They can potentially eliminate the uncertainty a single study may report regarding a specific intervention. However, findings of these reviews are questionable if the methodological quality of a SR is limited or bias was introduced due to failing to adhere to standardized protocols and processes. Similar studies have been conducted in medicine[10, 156,157], and in dentistry for orthodontics[158], endodontics[159], and for different dental specialties

simultaneously[4]. However, to our knowledge no study of this nature has been reported in prosthodontics specifically.

Four different databases were searched, namely MEDLINE, EMBASE, Web of Science and ADA's EBD website. The ADA EBD website contains a comprehensive list of SRs related to dentistry that is inclusive in its own definition. In other words, although the ADA EBD website has a SR section, in reality, the section contains many other reviews which do not meet the defined criteria of a SR. A major goal of this website is to serve as a reference for oral health practitioners and educators in making clinical decisions. MEDLINE and EMBASE databases were used to complement each other since MEDLINE usually includes journals with North American coverage and EMBASE has higher reporting for European Journals[160]. Web of Science was included since it covers international journals from various disciplines[22].

In this sample the highest number of SRs came from first authors from the United States of America followed by United Kingdom. However, the most publication intensive continent was Europe. This finding is similar to a recent paper on assessment of orthodontic methodology[158]. It was suggested that there could be a vested interest of the National Health Services (UK), or other government agencies in Europe, in promoting research in the utilization of SRs to translate findings into a socialist health/dental care system.

Only seven percent of SRs were authors in a private practice setting. It can be extrapolated that requirements of conducting research and publishing papers to enhance professional resumes and secure tenure positions at university settings could be the reason for most publications from academic institutions. In addition, lack of time and resources for a private practice practitioner could be another reason for limited number of publications from the latter source.

Two or more reviewers were involved in selection of studies for most SRs in this cohort. This is the minimal standard to eliminate subjectivity and personal bias.

The accepted protocol is the following: independently, two authors perform the selection of individual studies for a SR and any disagreement among them, is settled through discussion; failing this, a third party mediator, whether another author or a reviewer, makes the final selection choice [6]. Interestingly, single authors who did not report utilization of another reviewer, conducted ten percent of the SRs in our cohort. Not unexpectedly, bias tarnishes the evidence that these SRs provide, as it allows personal preference to influence the selection of studies from the inclusion/ exclusion criteria[6]. Roughly one-third of those authors came from private practice settings and may have not had adequate exposure or proper training in performing SRs. However, the other two-thirds of authors who were also implicated in failing to follow protocol, happened to be faculty members at academic institutions. Two of these academic single authors had previous experience publishing SRs; yet, they still failed to follow the two-reviewer protocol.

The current results propose that authors who had previously conducted a SR are likely to fare better on total AMSTAR scores. This could be due to familiarity with the tool from previous experiences in publishing a SR. After submission, reviewers may have requested further revisions using the AMSTAR tool. Furthermore, authors who are inclined to publish more than one SR may have had formal training courses in SR writing where they were explicitly taught the AMSTAR tool. Cochrane SRs did well on AMSTAR scores possibly due to enforcement of strict protocol; however, they did not receive more citations than non-Cochrane studies. A possible reasoning for this could be that most clinicians/researchers do not place much emphasis on the quality of the research article when compared to its conclusions; for example, even a poorly conducted SR could be cited several times if the results are contrary to what was expected.

Two thirds of the included SRs did not present the search and selection of primary studies by means of a flow diagram. Exclusion of the flow diagram depicting the inclusion/exclusion strategy may be due to ignorance of proper SR

methodology on the author's part or more likely due to space restrictions imposed by the journal [5].

The AMSTAR measurement tool can be applied universally to SRs; however, it has only been validated for SRs of randomized control trials of treatment studies[7,12]. In addition, QUORUM (Quality of reporting of meta-analyses) or its later counterpart PRISMA (Preferred reporting items for systematic reviews and meta analysis) was not utilized to assess reporting quality. Both methodological and reporting quality are interrelated; that is, it is possible that a well conducted (methodologically sound) SR can reflect poor reporting quality if its key details were removed due to journal space limitations or during the peer review process[5]. Conversely, SRs with poor methodological quality can have a reasonable or even a good reporting quality[7]. It has also been stated that tools used for assessment of meta analyses can give faulty results when used for assessment of SRs[12]. Future research needs to address the broader use and validity of AMSTAR for SRs of studies of diagnostic, prognostic, and etiological nature[7]. In addition, the purported high reliability of AMSTAR measurement tool may be due to familiarity of this tool and it's original assessment tools to its developers who performed reliability testing on it[12]. Finally, areas of future research as recommended by the developers of AMSTAR would be for the rating scores to be sensitive enough to distinguish between poor and high methodological quality SRs[7].

The number of times a reference is cited is a measure of how many times a published study is being read referenced by other researchers/authors[161]. It has been stated that citation scores can be used as a quantitative measure of the popularity of a published article[161]. This implies that the cited study is either similar or somehow related to the article in which it is being cited, or the citing author is using it as a reference to support or negate a view regarding a subject. Citation numbers can also echo the importance and impact of a particular research subject in the scientific community[162]. High citation scores do not necessarily translate into high quality research. In fact, the results of a recent

publication[161] demonstrated that citation numbers are not associated with the quality and completeness of a research question posed, proper statistical tests performed, and/or final conclusion. High citation scores are more likely to result from studies published in prestigious journals or one with higher impact. Another study[163] reported that the impact factor of the journal was positively correlated with citation frequency; however, in this study no association was found between the two. Research has shown that low-impact journals tend to have a less thorough review process[164]. It is possible that the citing authors believe that the strict review process of a well-established and prestigious journal will likely remove poor quality articles and therefore the conclusions drawn from studies within such journals are more valid. It should be noted that meta-analyses (whether of randomized or nonrandomized studies) are one of the most cited study designs and SRs are more likely to be cited than its original studies[165]. However, an article with a high citation score does not necessarily mean it is being utilized in a positive manner; for example, the cited study could be controversial and is in fact being criticized for its scientific merit.

Web of Science was mostly used for citation numbers and SCPOUS and Google Scholar were used if an article was not found in Web of Science. Citation accuracy, which is defined as the percentage of citing sources that truly cite the article in question, was 98% for Google Scholar and 100% for both Web of Science and SCOPUS from a sample of 328 medical articles published in three reputable journals[18]. Although this has not been validated specifically for articles in dentistry, it was assumed that this was the case for the citations reported in this study. The lack of citation accuracy for Google Scholar could be attributed to the fact that it is not a validated resource like Web of Science and SCOPUS claim to be[18].

The significance found between number of citations amongst different journal names and types (general/specialty) could be due to the fact that authors of similar studies are more likely to cite from sources they believe to be valid or

reputable such as journals with a higher impact factor. However, no association was found between numbers of citations and impact factors for the SRs in this study. Journals tend to publish studies that they believe will be popular, such as those with significant breakthroughs, or those that are controversial to increase their visibility in the scientific community. The results of the SRs in our study were not related to citations, which suggests that inconclusive results from SRs are just as likely to be cited as positive or negative results.

Impact factor is a measure of how well a journal is recognized as a reputable and prestigious source of knowledge in the scientific community as reflected by its citations[166]. It was established in 1963 when the first ranking report was published with the Institute for Scientific Information (ISI)[167]. This report was modified over the years and now impact factors exist for close to 8,000 journals citing about 12 million references per year[167]. Most impact factor ratings range between 0.500 to 3.000[168]. Two-thirds of journal impact factors in this sample are between 1 and 3, which is usually an accepted range, although values less than 0.500 and over 40 are possible[168]. Although impact factors are useful in assessing the influence of a journal in the scientific community, they have limitations. Very few non-English journals have an impact factor score since ISI mostly covers English journals[168]. Furthermore, journals publishing mostly review articles are at an advantage since these publications tend to receive more citations than their original studies[169]. Slow changing scientific disciplines such as mathematics and physics, have lesser publications and may also retrieve fewer citations than a fast paced one like health sciences[170]. Therefore, a two-year as opposed to five-year impact factor was utilized in this study. A previous paper[168] stated that dental specialty journals tend to have impact factors of more than two below that of general dentistry journals. It was hypothesized that most of the specialty journals attract interest from clinicians, but not from researchers and scientists. Another explanation could be that these journals include articles on techniques of appliance fabrication or contain case reports, which would be more applicable to the clinician[168]. In addition, many researchers may not want to publish their

studies in low impact journals in which their findings are not likely to be cited; instead, they may prefer to publish in high impact journals due to their presumably impressive status. Finally, it is important to note that impact factors mostly attract interest in the research community, but does not hold much value for clinicians.

Findings from SRs can only be valid if they are current; therefore it is possible that a particular intervention or therapy would be rendered obsolete, or in fact harmful, with accumulation of new evidence over time[6]. Updating SRs would also be beneficial since it would enable inclusion of new research such as published studies and grey literature that were not available at the time of the original SR submission[171]. Search and location of new evidence requires significant consumption of time, energy, and expenditure of resources[171]; this is why many authors lack the motivation to update their SRs. Additionally, absence of accountability of journals in inviting authors to update their SRs, and lack of transparent updating systems in place by journals, could be other explanations of why SRs are not kept current. It has been reported that the median time it takes from search dates listed in SR to its publication is roughly 61 weeks and it takes another 13 weeks before the review is indexed in an electronic database [172]. Electronic journals are faster when it comes to publication times. They allow research to be readily available without waiting for the printing process to occur, or space to become available in a particular issue[172]. Time setback in the final access of research is problematic, but updating is proposed as one of the solutions. In addition, repeating electronic database searches just before submission of SR for publication (to include recently indexed SR's) and adhering to the selected journal's submission guidelines to avoid "mandatory" revisions would be some proposed solutions to eliminate the time delays on the author's part. Only four (from 106) SRs in this cohort were updated and they were all part of the Cochrane database. Only the most recent update was included in this study to avoid repetition of study characteristics. The fact that all the updates are part of the Cochrane collaboration suggests that there may be a need for a central

registry much like the Cochrane register for controlled trials, whereby updates could be potentially traced to the original study[5]. In addition, journal editors could invite authors to update their SRs periodically, and journal websites could be utilized as a resource to locate updated SRs. Knowing the need for updating with emergence of new evidence and /or having guidelines for updating according to the pace of a scientific discipline could be some strategies employed for updating procedures[171].

Publication bias was the least addressed component on the AMSTAR measurement tool. It was addressed in six percent of SRs (using funnel plots or other statistical means), even though half of the SRs in this cohort included meta-analyses. In fact, studies on methodological quality assessment in orthodontics[158] and endodontics[159] reported similar percentages when reporting the likelihood of publication bias. Like our study, publication bias was only addressed in six percent for SRs in endodontics[159]. Percentage of SRs in orthodontics addressing publication bias was even lower; only two percent in a recent orthodontic paper [158]. Publication bias can manifest at several levels[173]. Either authors are less inclined to publish insignificant results, as they are less likely to gain prestige from peers or be cited, or journals and reviewers refrain from accepting submissions with negative or insignificant results[173]. In fact, it has been found that there is a difference of close to 40% in the acceptance of duplicate manuscripts that were only dissimilar in their results; it was non-significant findings that fell short of being accepted[174]. This was not the case in our sample. Inconclusive findings from SRs in our sample were just as likely to be reported as positive results; however, the negative findings only constituted 5% of total SR results. Publication bias can be a serious problem since it can mislead the truth. This implies that one may never know whether an intervention is as effective as shown by research. This may affect results of meta-analyses, jeopardize future research efforts, and have major ramifications on health care systems [175].

Some limitations of this thesis/study were subjectivity during data extraction, as only the author conducted data collection and analysis. This introduced

subjectivity and bias, especially in application of the AMSTAR tool to SRs. In addition, scoring method used in this study for tabulating total AMSTAR scores has not been validating. However, based on a prior study[176] with similar scoring system, it can be concluded that the quality of SRs in this sample was limited. It was noted there[176] that any SR with average/near average total AMSTAR scores would have methodological limitations and findings from such SRs should be approached with caution. This was the case for most SRs in our sample.

Both authors and journal editors should address issues of poor methodological quality. It is imperative that the authors of SRs have exposure to the assessment tools available. This implies either formal training in performing SRs or seeking guidance of more experienced SR authors before venturing on to conduct one. A recent study reported that even updates of SRs could have poor methodological quality[177]. It supports the notion that authors are either not cognizant of the tools available to improve quality or are only interested in reporting new findings while ignoring the proper protocol involved. All journals should have a universal checklist or protocol that should address all key characteristics of an unbiased SR process. Any key component that is missing should be addressed before submission for the peer review process. In fact, Public Library of Science Journal (Plos One) has adapted an extensive checklist from QUOROM that is a requirement to be followed by its prospective authors[178]. It is anticipated that it would eliminate studies of lesser quality to be sent for peer review and possibly being published. Quality of both meta-analyses and randomized controlled trials has been enhanced from the application of checklist such as QUOROM and CONSORT (Consolidated Standards of Reporting Trials)[156,179]. Possibly, AMSTAR will have the same effect on SRs.

2.11 Conclusions

The methodological quality of prosthodontics related SRs was limited. The pertinent findings for specific objectives are the following:

1. *To summarize key descriptive characteristics of SRs related to prosthodontics.*

- United States (18%) and United Kingdom (15%) had a similar number of prosthodontic SR publications. However, Europe was the most publication intensive continent followed by North America, Australasia, Asia, Australia, South America and Africa.
- Two to four authors published a significant portion of the SRs in our study. One tenth of the sample reported a single author selecting studies to perform the SR.
- More than two thirds of authors (77%) had prior SR experience.
- Most publications had all authors with a single affiliation (65%), either from an academic institution, or private practice setting. The remainder had two to four affiliations. In addition, over 90% of publications came from full time faculty members in university settings while the rest of the authors originated from private practice settings.
- Approximately 80% of studies came from specialty dental journals. Clinical Oral Implants Research was the most popular journal; in fact implant or implant related topics comprised two thirds of the topics on interest in our cohort.
- Most of the SRs in our study were published in journals with impact factors between 1-3; the other one fifth of SR in our cohort were published in journals that had no impact factor.
- More than two thirds of the SRs were found on the ADA EBD website and less than half were on found on MEDLINE. Roughly one tenth of studies were part of the Cochrane Collaboration.
- A vast majority of SRs (76%) did not report receiving any external funding. However, 5 SRs disclosed industry funding.

- Two to six resources, whether electronic databases or hand searches of journals/ bibliography were performed in majority of SRs (80 %). However, roughly one tenth utilized only one resource.

- Almost half of the SRs contained meta analyses, but publication bias was only addressed in six percent of SRs that included a meta analysis.

- A flow diagram depicting the inclusion/ exclusion process of studies was present in roughly one third of SRs.

- Almost half of the studies had positive findings, 5% had negative findings, and the remainder had inconclusive results (as reported by its authors).

2. *To assess methodological quality of SRs related to prosthodontics by utilizing the AMSTAR assessment tool.*

- Item 1 ("a priori" design) on AMSTAR checklist and Item 6 (characteristics of included studies) had the highest scores of all 11 components.

- Almost half of the authors fulfilled Item 2 (duplicate study selection and data extraction), Item 3 (comprehensive literature search), Item 5 (list of included and excluded studies), and Item 9 (methods used to combine the findings of studies appropriate).

- Item 7 (scientific quality of the included studies assessed and documented), Item 8 (scientific quality of the included studies used appropriately in formulating conclusions), and Item 11 (conflict of interest stated) was fulfilled by roughly one third of the sample.

- Item 4 (status of publication/ grey literature search) and Item 10 (likelihood of publication bias assessed) were the most poorly fulfilled

components. Eighty percent of the SR authors did not search grey literature, and only six percent addressed publication bias.

- Mean total AMSTAR scores was 11 (SD=5). Only 24 SRs had total scores over the 75th percentile.

3. *To investigate if the numbers of citation were associated with the journal that published the SR.*
    - Significant test results were found between citation numbers amongst different journals. Greatest difference was mostly between journals that had no impact factor versus those that did.

4. *To investigate if there was a difference between citation numbers in specialty versus general dentistry journals.*
    - There was a statistically significant difference in citation numbers between general and specialty dental journals. Specialty journals received more citations.

5. *To explore the degree of association between citation numbers and journal impact factor.*
    - No meaningful correlation was identified between numbers of citation and journal impact factor from this study.

6. *To investigate if experience with authoring prior SRs was associated with citation numbers.*
    - There was no statistically significant difference in citation numbers between experienced versus novice authors.

7. *To investigate if type of studies included in a SR was associated with numbers of citation?*
    - Different study designs such as RCT, Prospective, Retrospective, or different combinations of them included in each SR had a difference

in citation scores. Most significant difference was for studies that included RCT in their SRs versus those that did not.

8. *To investigate if citation numbers were associated with negative, positive or inconclusive findings.*
    - Results of the studies were not related to numbers of citation in our cohort.

9. *To investigate if total AMSTAR scores were associated with numbers of citation.*
    - No significant relationship was identified between citation numbers and AMSTAR scores.

10. *To investigate if numbers of citation were associated with Cochrane versus non-Cochrane SRs.*
    - There was moderate evidence of difference in citation numbers between Cochrane versus non-Cochrane studies; median citations were in fact higher for non-Cochrane SRs.

11. *To investigate if there was a difference in total AMSTAR scores between authors that had prior experience versus novice SR authors.*
    - Authors with prior SR experience performed better on total AMSTAR scores.

12. *To investigate if there was a difference in AMSTAR scores over three time periods*
    - There was no statistically significant difference between AMSTAR scores in the last 2 decades even though the median citation scores did increase slightly over the years.

Table and Figures

Table 1. Search Strategy for Electronic Databases

Database	Search Terms
MEDLINE	exp Prosthodontics/or exp tooth prosthesis/or exp tooth occlusion/exp biomedical and dental materials/or exp dental care/or exp dental surgery/or exp tooth implantation/or exp tooth crown/ or exp denture/or exp dental education AND exp review literature as topic/or exp systematic review(s).
EMBASE	exp "systematic review(s) AND exp tooth prosthesis"
Web of Science	topic={systematic review(s)} and topic=(prosthodontics)

Figure 1. Flow Chart of Systematic Review Selection

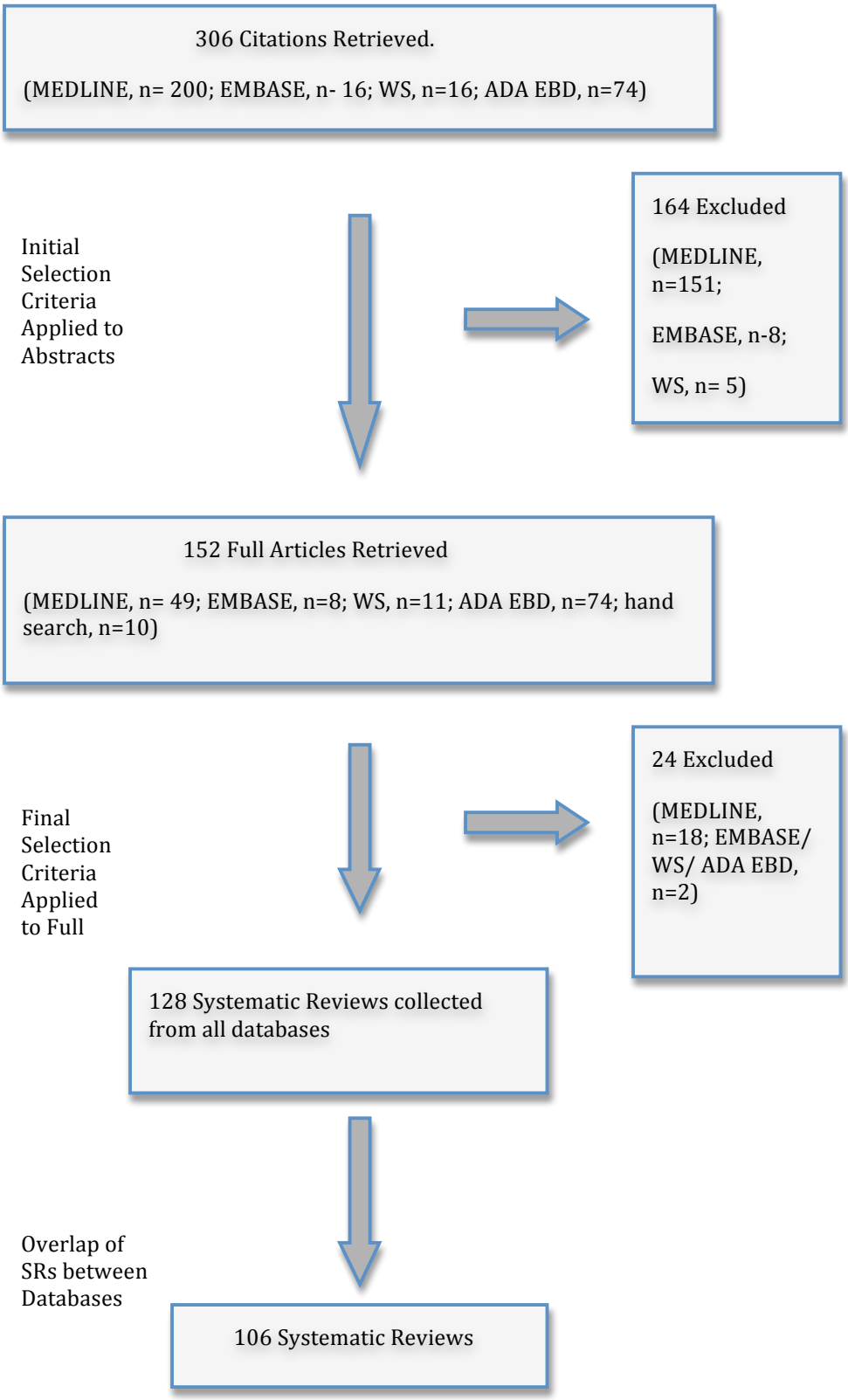

Table 2. Excluded SRs and Reasons for Exclusion

Database	Study Excluded	Reason for Exclusion
MEDLINE (18 studies excluded)	1. Byrne (2010)[27]	Not a systematic review.
	2. Palmquist et al (2010)[28]	Not a systematic review.
	3. Esposito et al (2010)[29]	Duplicate of SR[30] in another journal.
	4. Esposito et al (2009)[34]	Duplicate of SR[36] in another journal.
	5. Esposito et al (2008) [41]	Duplicate of SR[40] in another journal.
	6. Proskin et al (2007) [52]	Strictly a meta analysis(not SR).
	7. Esposito et al (2007)[53]	Update of SR[40]
	8. Esposito et al (2007)[55]	Update of SR[36]
	9. Esposito et al (2007)[58]	Update of SR[40]
	10. Esposito et al (2006)[59]	Update of SR[30]
	11. Esposito et al (2005)[62]	Update of SR[54]
	12. Albrektsson et al (2004)[64]	Not a systematic review
	13. Esposito et al (2004) [65]	Update of SR[40]
	14. Creugers et al (2003)[66]	Not a systematic review
	15. Esposito et al (2003) [67]	Update of SR[54]
	16. Esposito et al (2003)[69]	Update of SR[40]
	17. Esposito et al (2002)[71]	Update of SR[54]
	18. Locker D (1998) [73]	Not a systematic review

EMBASE (2 excluded)	1. Serrano-Sanchez et al (2011)[74] 2. Jia S (2010)[80]	Discussed abutment diameter of implants without any reference to prosthetic component. Only abstract in English, whole article in Chinese.
Web of Science (2 excluded)	1. Layton D (2011)[81] 2. Pieger et al (2008)[83]	Not a systematic review Only abstract in English, text was in German.
ADA EBD Website (2 excluded)	1. Abduo et al (2011)[114] 2. Ortorp et al (2004)[134]	Both discussed fabrication techniques of implant framework without any reference to the prosthetic component.

Table 3. Analysis of Methodological Quality from AMSTAR Tool*

AMSTAR CHECKLIST	YES	NO	PARTIALLY	CAN'T ANSWER	N/A
1. Was an "a priori" design provided?	81(87)	7(7)	9(10)	2(2)	-
2. Was there duplicate study selection and data extraction?	59(64)	17(18)	-	23(24)	-
3. Was a comprehensive literature search performed?	52(56)	27(29)	19(20)	1(1)	-
4. Was the status of publication (i.e. grey literature search) performed?	21(22)	22(23)	48(52)	8(9)	-
5. Was the list of studies (included and excluded) provided?	49(52)	20(21)	31(33)	-	-
6. Were the characteristics of the included studies provided?	73(78)	24(26)	-	1(1)	1(1)
7. Was the scientific quality of the included studies assessed and documented?	38(41)	57(61)	2(2)	2(2)	-
8. Was the scientific quality of the included studies used appropriately in formulating conclusions?	31(33)	50(53)	16(17)	3(3)	-
9. Were the methods used to combine the findings of studies appropriate?	51(55)	44(47)	-	-	4(4)
10. Was the likelihood of publication bias assessed?	6(6)	93(99)	-	1(1)	-
11. Was the conflict of interest stated?	34(36)	65(69)	-	1(1)	-

*Key:
The numbers outside of the brackets are percentages and ones inside are raw scores.
Yes= fully fulfilled criteria
No= did not fulfill
Partially= only fulfilled criterion partially
Cant tell= no clear indications given whether criterion fulfilled or not
N/A= does not apply to the question of interest.
{Not all percentages add up to 100 (some to 99) since we were not able to obtain full text of one article to tabulate AMSTAR scores}

Table 4. Analysis of Key Descriptive Characteristics

Key Descriptive Characteristics		**Percentages in descending order**
Number of Authors	2 authors 3 authors 4 authors 5 authors 1 author >6 authors	27 20 18 17 10 9
Number of Affiliations for each study according to its authors	1 affiliation 2 affiliations 3 affiliations 4 affiliations	65 22 11 2
Country of first author	USA UK Switzerland Germany and Netherlands New Zealand Australia Greece, Sweden and Japan Canada, Norway and Liechtenstein Turkey, Iceland, Lithuania and Brazil Belgium, South Africa, Singapore, China, France, Spain	18 15 9 7 6 5 4 each 3 each 2 each 1 each
Continent of first author	Europe North America Australasia Asia and Australia South America Africa	62 21 6 5 2 1
Prior systematic review by at least one author	Yes No	77 23
Academic/Non-Academic Source of publications	Academic Non-academic (private practice)	93 7

Article in Specialty or general dentistry	Specialty Journal General Dentistry Journal	78 22
Journals	Clin Oral Implants Res Int J Prosthodont Int J Oral Maxillofac Implants J Prosth Dent /Cochrane Database Sys Rev J Oral Rehab Eur J Prosthodont Restor Dent Others	23 14 9 8 each 7 3 <2
Impact Factor of Journals	Journals with no impact factor Impact Factor between 3 to 4 Impact Factor between 2 to 3 Impact Factor between 1 to 2 Impact factor between 0 to 1 Maximum IF: J Clin Periodont (3.93) Minimum IF: Int Dent J (0.74)	18 3 31 46 2
Studies found in database	ADA website for EBD MEDLINE Hand search Web of Science and EMBASE [Percentages do not add to100 since some systematic reviews are found in more than one database(s)]	66 41 9 6
Studies part of Cochrane Database of Systematic Reviews	No Yes	92 8
Financial support/External Grant or Funding	No Yes (external funding/grant) Cochrane Oral Health Group Industry funded	76 12 7 5

Resources searched (including electronic databases and hand search)	2 Resources searched 5 Resources searched 1 searched 4 searched 3 searched 6 searched More than 6 Resource not mentioned	30 19 13 12 11 7 6 2
Whether meta analysis was performed in the systematic reviews	Yes No	51 49
Whether flow diagram was used for inclusion of studies.	No Yes	63 37
Results of Studies	Positive Inconclusive Negative	50 45 5
Review Updates	Updates (All Cochrane reviews)	4
Major topics of Systematic Reviews	Implants/Implant supported prosthesis Fixed Dental Prosthesis (FDP) Dental materials Overdentures Complete Dentures Crowns Removable Partial denture (percentages do not add up to a 100, since some reviews discuss 2 or more topics in conjunction.)	64 29 22 13 11 9 5

Figure 2. Academic (university)/ Non-Academic (private practice) Setting

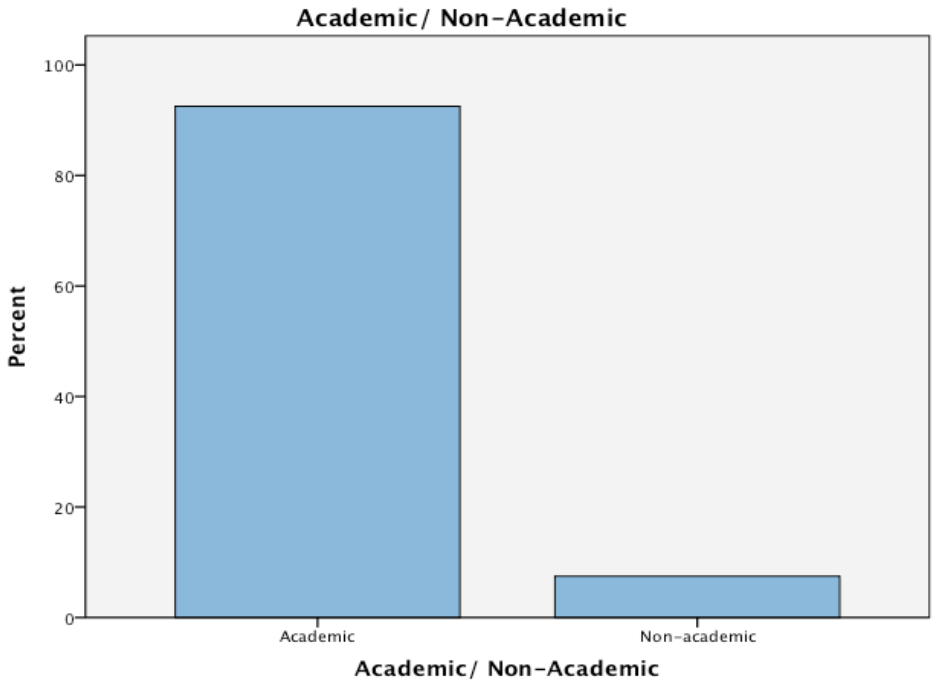

Figure 3. Cochrane versus Non-Cochrane Studies

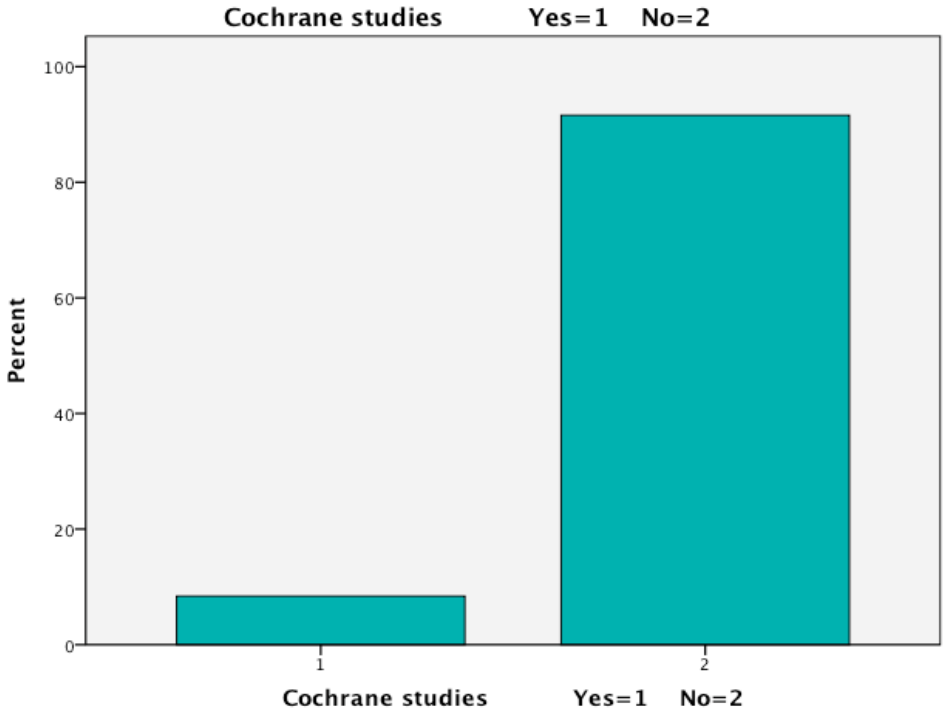

Figure 4. Financial Support

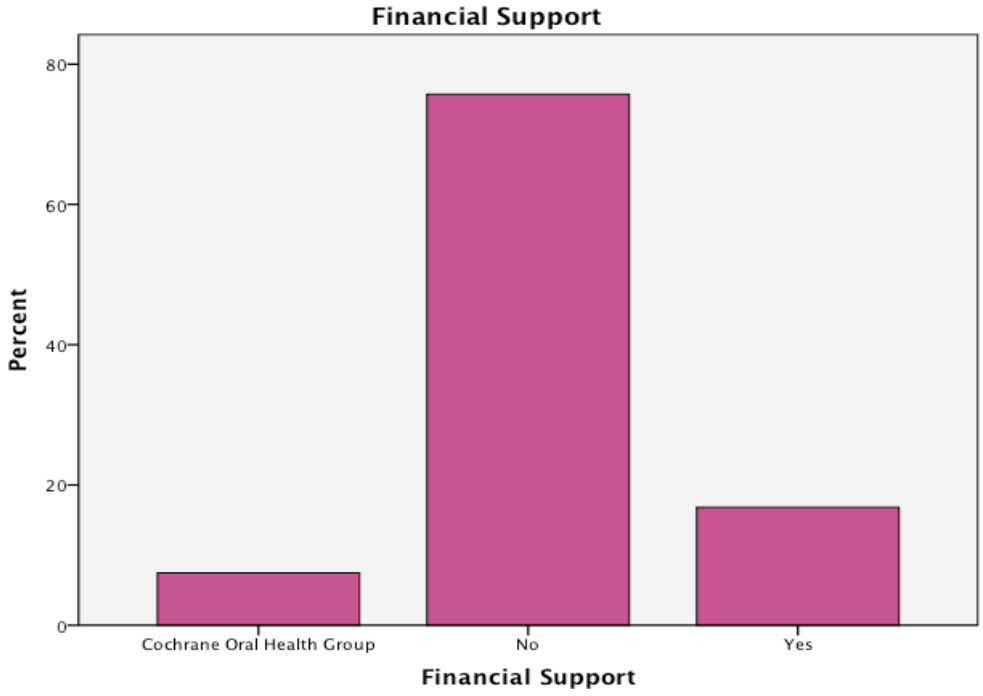

Figure 5. Number of Resources Searched

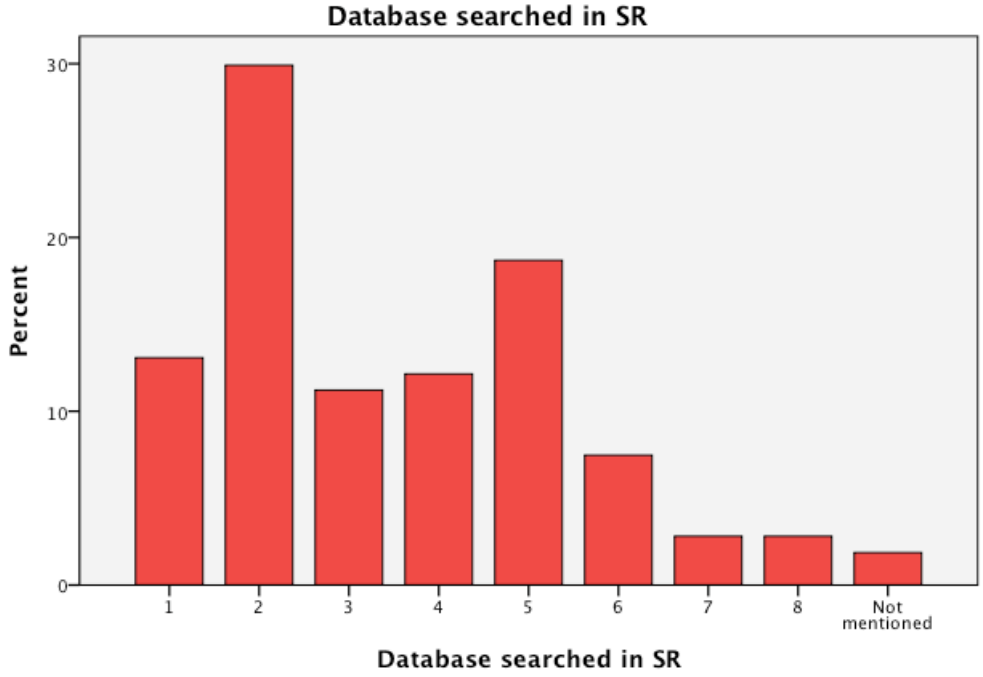

Figure 6. Number of Authors

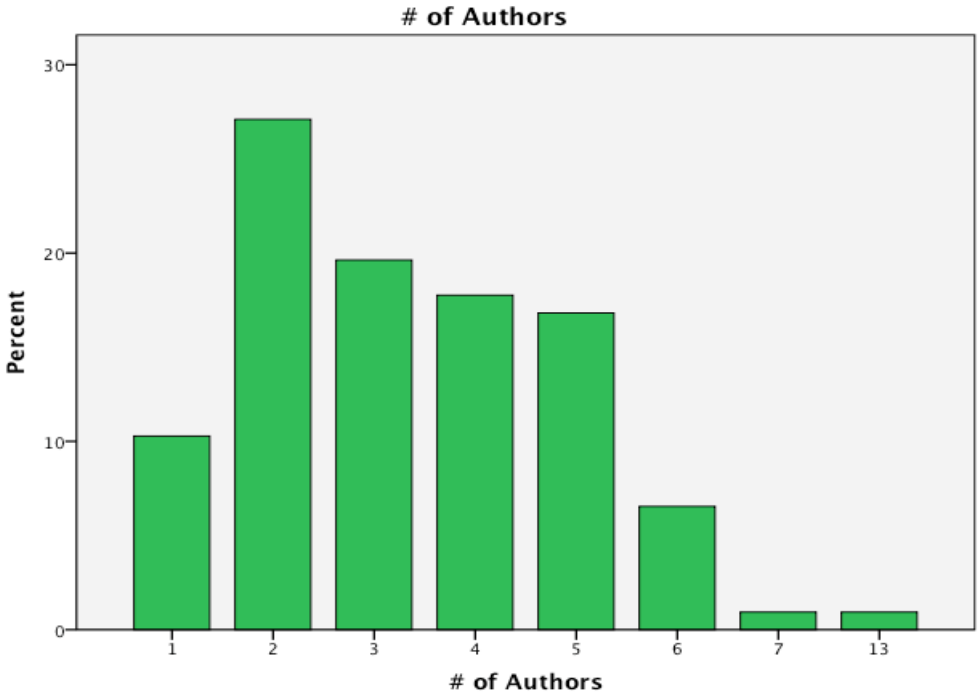

Figure 7. Professional Affiliations of Authors

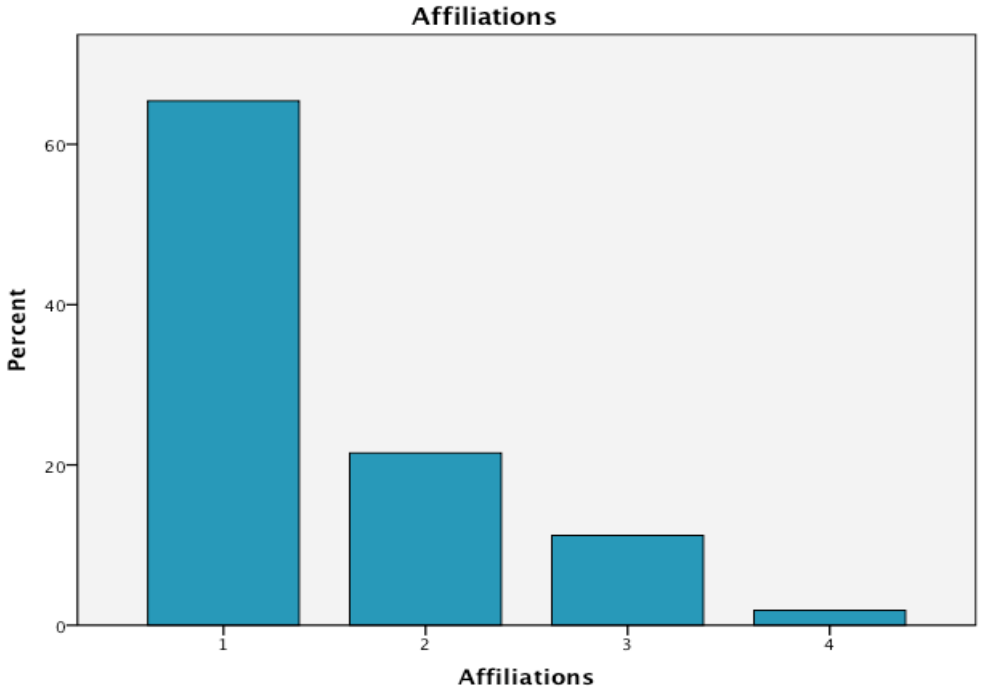

Figure 8. Country of First Author

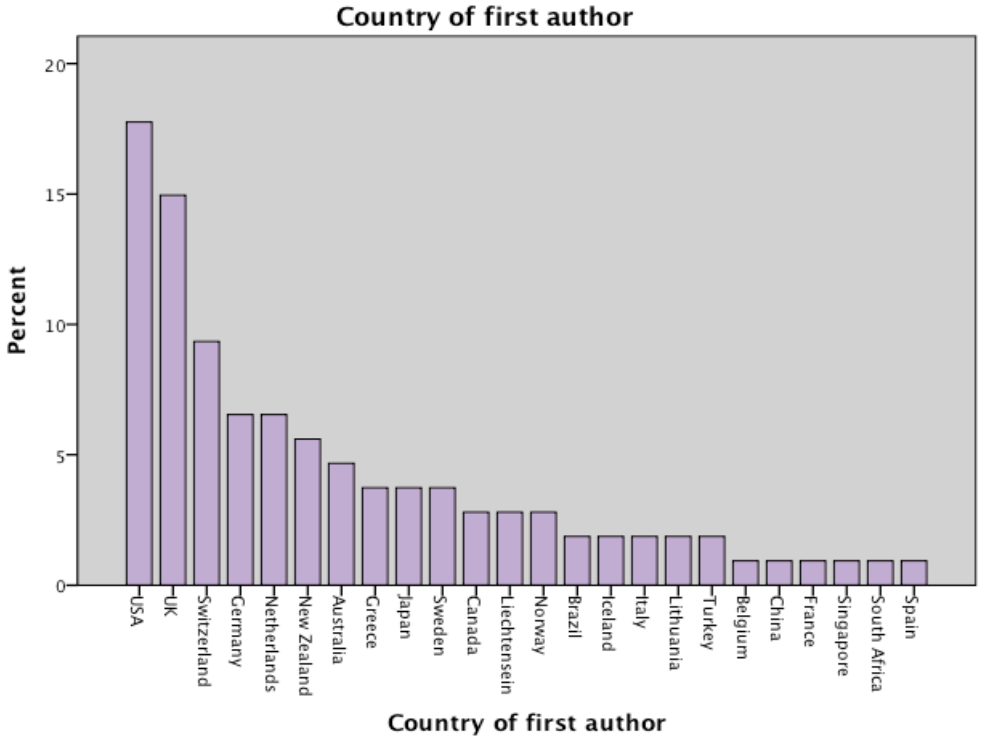

Figure 9. Continent of First Author

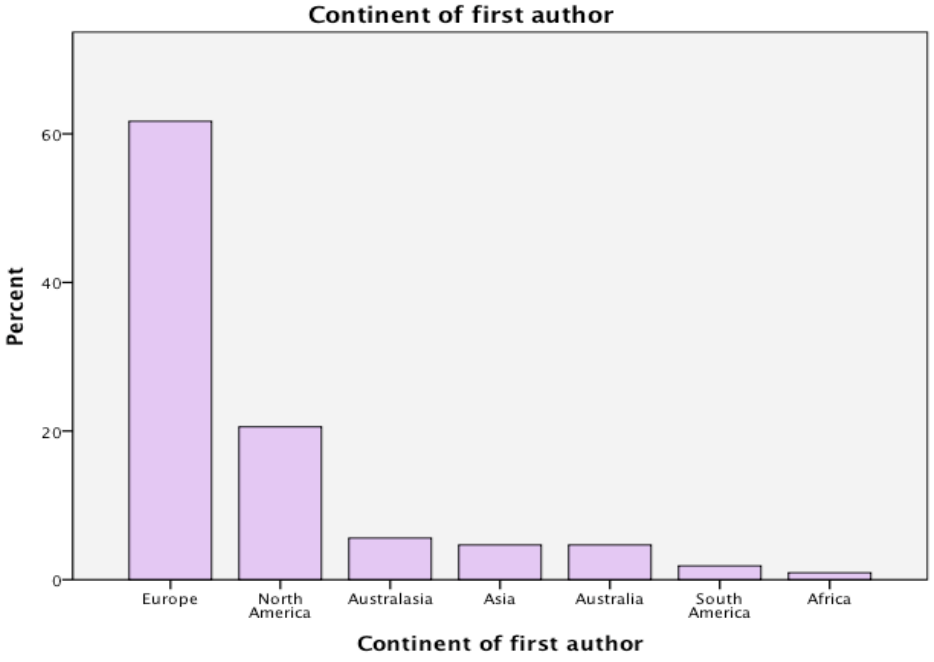

Figure 10. Prior Systematic Review by Authors

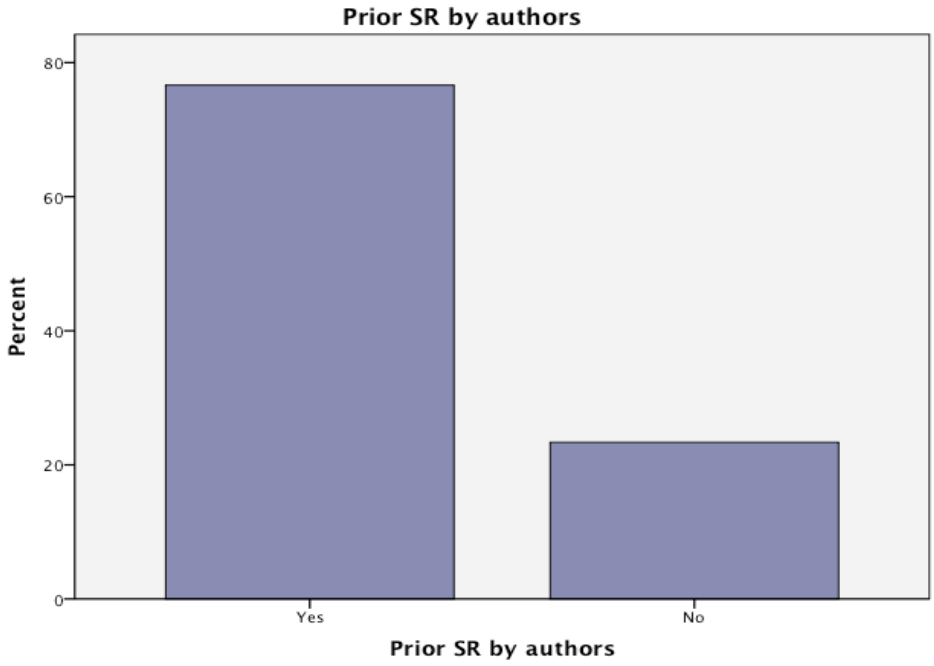

Figure 11. Specialty versus General Dentistry Journals

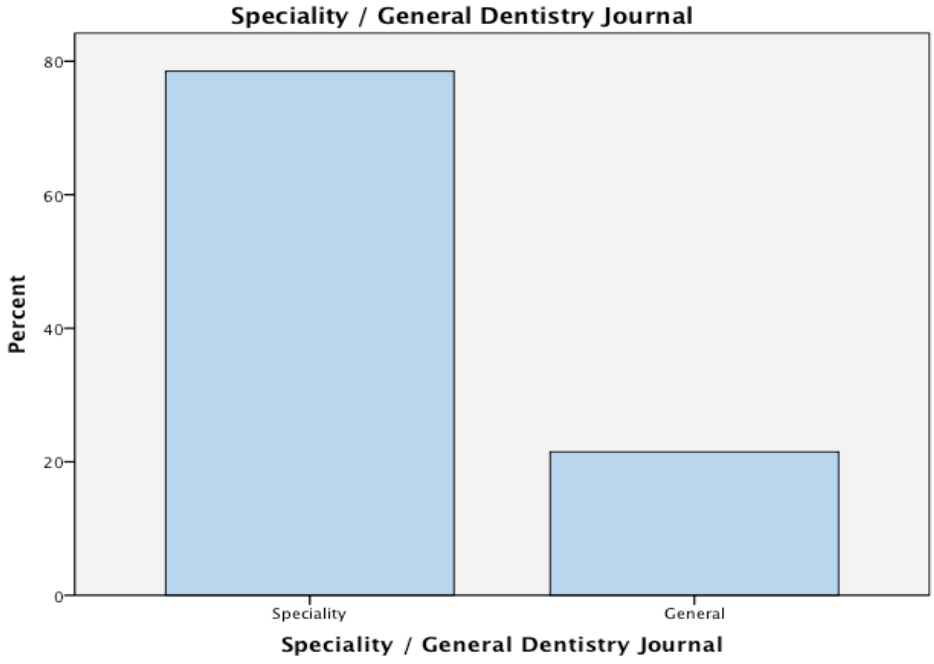

Figure 12. Journal Name

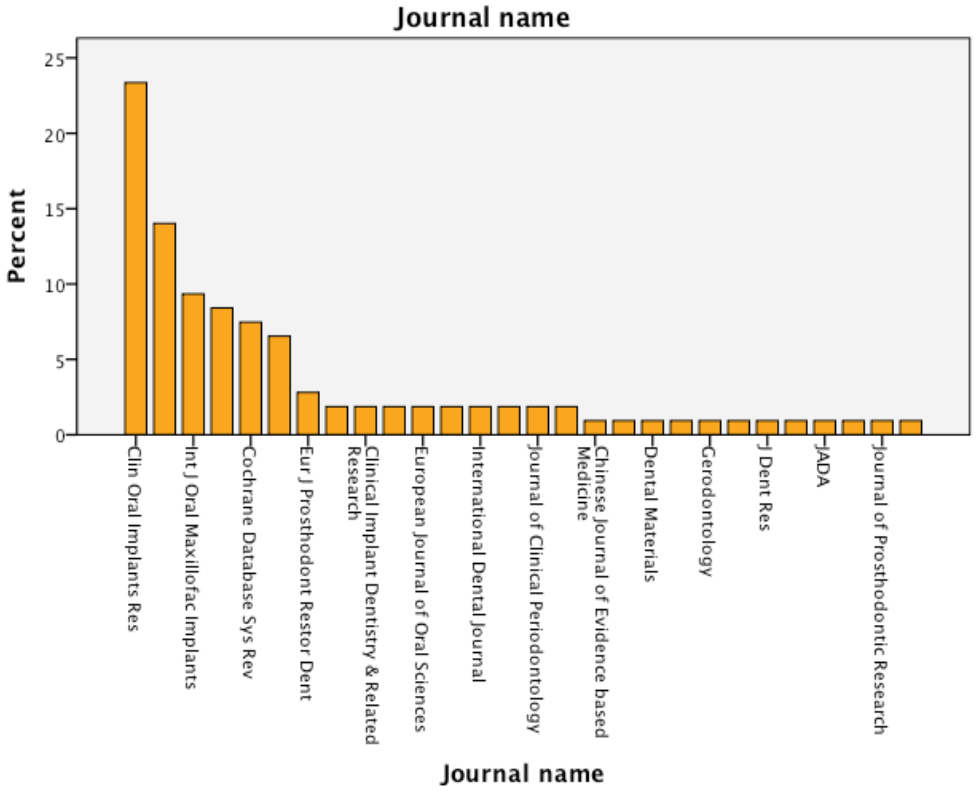

Figure 13. Journal Impact Factor

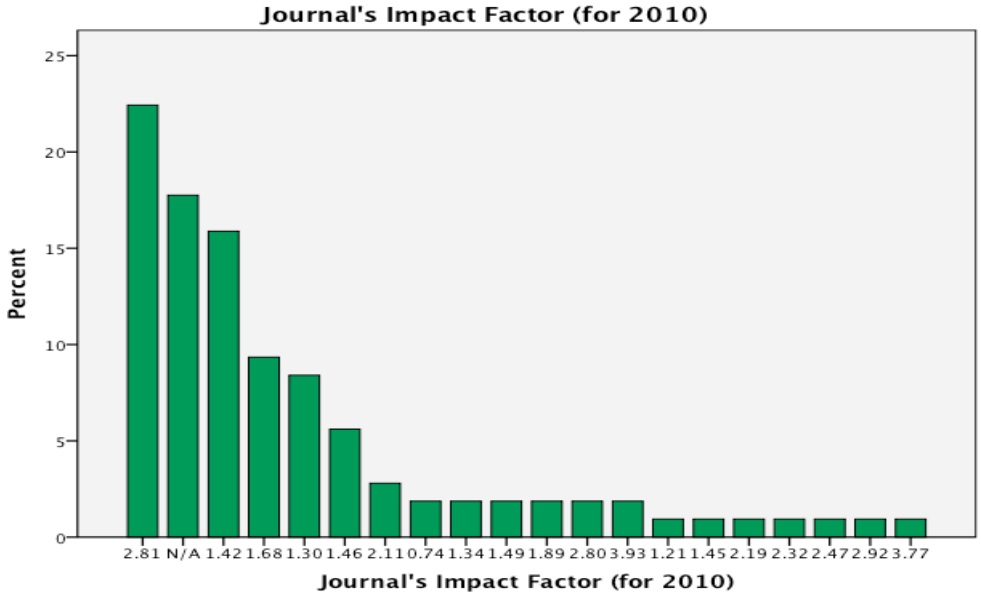

Figure 14. Year of Publication

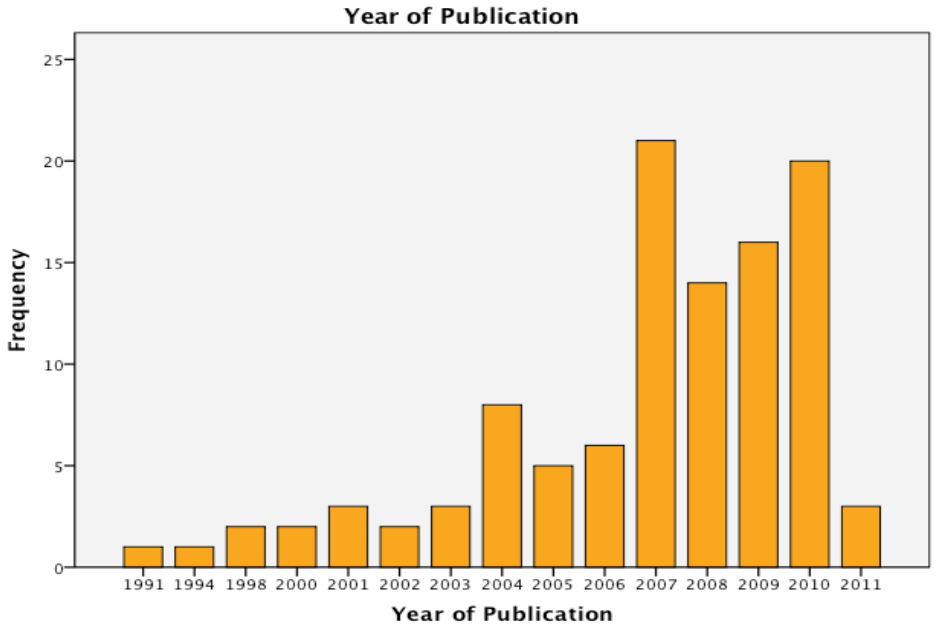

Figure 15. Systematic Review Results.

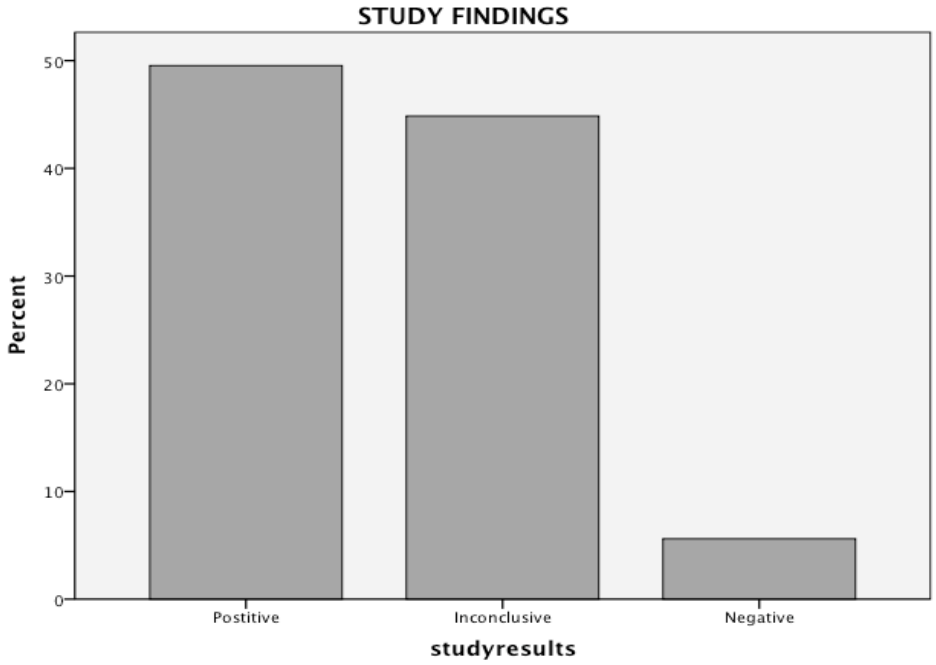

Figure 16. Meta analyses in Systematic Reviews

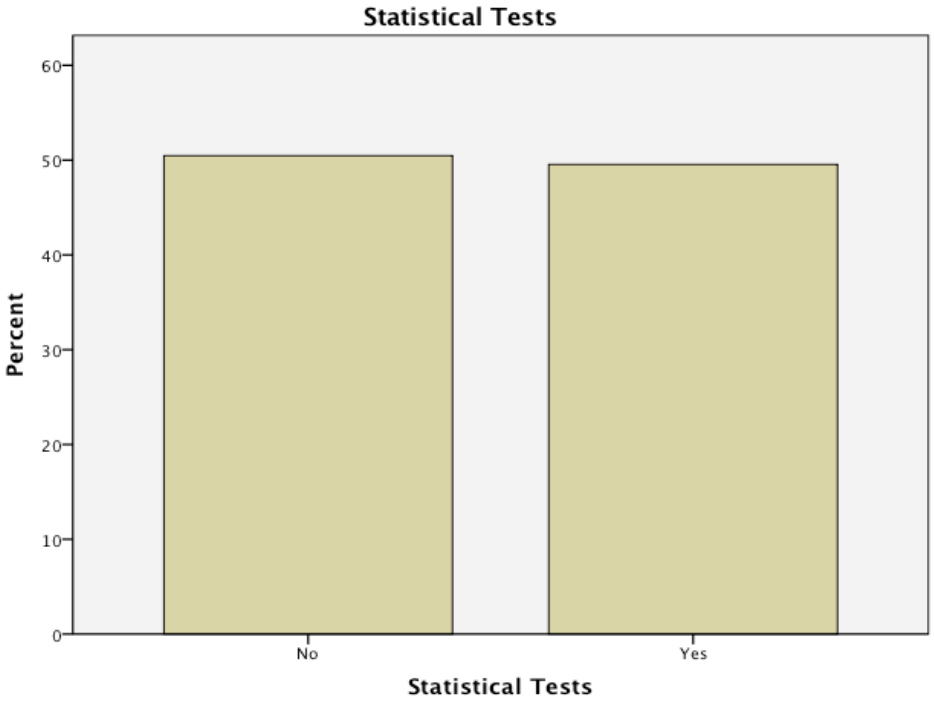

Figure 17. Flow Diagram in Systematic Review

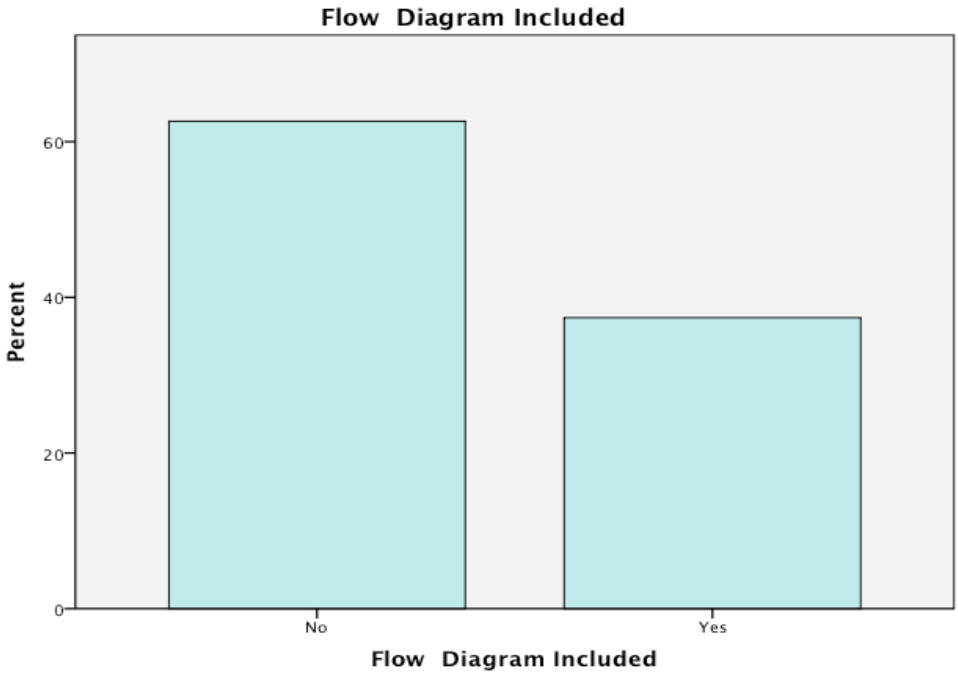

Table 5: Statistical Test Results

Query	Variables	Statistical Test	Results
1. If there is a difference in number of citations between journals in which the SR was published (Only categorized journals that have more than two SRs from our sample)	8 Predictor Variables; Journals 1. Int J Prosthodont {Impact Factor (IF)=1.42, citations=10} 2. Clin Oral Implants Res (IF= 2.81, citations =14) 3. J Prosth Dent (IF=1.30, citations = 27) 4. Cochrane Database Sys Rev (N/A, citations= 1.5) 5. Int J Oral Maxillofac Implants (IF=1.68, citations= 11) 6. Eur J Prosthodont Restor Dent (N/A, citations= 7) 7. J Oral Rehab (IF=1.42, citations=0) 8. Other Journals (citations= 3.5) 1 Response Variable: Citations	Kruskal Wallis	H (7)= 25.16, p = 0.001* [between journal 3 and 4 (Mann Whitney Z= -2.83, p=0.005), between 3 and 7 (Mann Whitney = -2.88, p=0.004), between 2 and 4 (Z=-2.73, p=0.006)]
2. If there is a difference in number of citations between SRs in specialty vs general dentistry journals.	2 Predictor variables 1. Specialty Journals (citations=10) 2. General Journals (citations=2) 1 Response Variable: Citations	Mann Whitney	Z= -2.68, p= 0.007*

3. If there is an association between number of citations and journal impact factor	Variables: Journal Impact Factor and citations	Spearman Correlation	Rho= 0.045, p=0.678**
4. If there is a difference in number of citations for authors of prior SR vs first time SR authors?	2 Predictor Variables 1. Prior systematic review by any of the author/s (citations=10) 2. No prior systematic review by any author (citations=7) 1 Response Variable: Citations	Mann Whitney	Z= -1.38, p= 0.167**
5. If there is a difference in number of citations between different study designs (RCT, Cohort, Case control etc) of included studies in SRs?	8 Predictor Variables 1. All included studies are Randomized Controlled Trials(RCT) (citations= 7) 2. All included studies are Prospective (P) (citations=5) 3. All included studies are Retrospective (R) (citations=23.5) 4. Included studies are RCT, P and R. (citations=11) 5. Included studies are P and R (no RCT) (citations=32) 6. Included studies are P and RCT (no R) (citations=1) 7. Included studies are R and RCT (no P) (citations=40) 8. Others (included lab studies, quasi experimental studies, cross sectional studies, systematic reviews, animal studies, in vitro studies) (citations=5)	Kruskal Wallis	H (7)= 16.37, P = 0.022* [Difference between group 1 and 5, Mann Whitney Z= -2.80, p value =0.005]

6. If there is a difference in number of citations between negative, positive and inconclusive results of SRs?	3 Predictor Variables 1. Positive Study Results (citations= 9.5) 2. Negative Study Results (citations=14.5) 3. Inconclusive findings (citations= 7) 1 Response Variable: Citations	Kruskal Wallis	H (2)= 3, p= 0.223**
7. If AMSTAR scores are associated with number of citations	Variables: Total AMSTAR scores and citations	Spearman Correlation	Rho= -0.112, p= 0.253**
8. If there is a difference in number of citations between Cochrane versus non-Cochrane studies?	2 Predictor Variables 1. Cochrane Studies (citations= 2) 2. Non Cochrane Studies (citations=9) 1 Response variable: Citations	Mann Whitney	Z= -2.21, p=0.027*
9. If there is difference in AMSTAR scores for authors of prior SRs versus novice SR authors?	2 Predictor Variables 1. Prior systematic review experience amongst authors (AMSTAR scores= 10) 2. No prior experience (AMSTAR scores= 7) 1 Response Variable: AMSTAR scores	Mann Whitney	Z= -4.17, p < 0.001*
10. Is there a difference in AMSTAR scores over three time periods?	3 Predictor Variables 1. 1990-2000 time period (AMTAR Scores= 9.5) 2. 2001- 2006(AMSTAR scores= 11) 3. 2007-2011(AMSTAR Scores= 12) 1 Response Variable: AMSTAR score	Kruskal Wallis	H (2)=3.90, p=0.142**

Key:

- *Significant at Alpha= 0.05 (two tailed)
- **Not Significant
- All total AMSTAR scores/numbers of citation are reported as median scores.

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Chapter Three

Survey to Assess the Impact of Published Prosthodontics Related Systematic Reviews on their Respective Authors' Career

3.1 Introduction

Online surveys are web-based questionnaires that allow a researcher to collect information over the Internet[1]. They came into existence in the 1980s and their use has escalated since the 1990's[2]. It was the accelerated growth of computer technology, (along with readily available Internet access), that facilitated surveyors to post web questionnaires on a server connected to the Internet[2,3].

The European Society for Opinion and Marketing Research (ESOMAR) reported that online survey research consisted of 20 % of all surveys conducted in 2002 in USA, and this number almost doubled to 35% by 2004[1,4]. In 2006, online collection of information from Internet surveys constituted 40% of all commercial research in USA[1,5]. With increased web use, it was estimated that 75% of Canadians used Internet at least once a day in 2009[6]. There are now about 350 active surveys performed by Statistics Canada on a regular basis and several of these are conducted online[7].

It was noted in the previous chapter that it is imperative to have a clear understanding of the methodological content and any biases that could arise during the SR process, before incorporation of its results into decision making at the chairside. In this chapter, we will utilize an online survey to investigate the overall impact of conducting and publishing SRs on its respective authors. The online survey will consist of two major areas of interest. Firstly, it will examine the authors' background and training in SR principles; secondly, it will explore the authors' perception of the importance of SRs, particularly the impact these SRs have had on their own teaching, research, and practice of prosthodontics.

3.1.1 Why use an online survey (advantages/disadvantages)?

Internet surveys have garnered popularity due to their low cost compared to other survey methods, ease of transmission, and "real time" data collection [1,2]. ESOMAR reported in 2007 that Internet research is the least expensive method for data collection in most developed countries such as Western Europe, United States, Japan, and Australia[4]. Internet surveys can be conveniently administered.

They are not limited by geographic separation and financial constraints like traditional survey methods[8] such as regular/snail mail, long distance phone calls, and/or in person interviews[8]. In addition, Internet surveys do require the simultaneous availability of the interviewer and interviewee like telephone surveys and face-to-face interviews[8].

There is negligible amount of time allotted for data entry with Internet surveys, since information is already tabulated in an electronic format. This reduces the element of human error and the amount of time allocated in collecting, inputting, sorting, and organizing the information.

Online surveys are unique in that they can incorporate visual and auditory media to dramatically boost response rates. Such media can keep the responder engaged, present survey questions in a more understandable format, and facilitate the process of answering the questions while providing feedback. Surveys supported with multimedia will also be able to better accommodate respondents with various physical impediments such as hearing loss or blindness. Internet surveys are especially beneficial to respondents who require more time to reflect on answers, as opposed to the pressured or forced response that can occur with an in-person interview format. Furthermore, certain design aspects of the online survey can minimize "respondent burden" (much like personal interviews, however without utilization of an interviewer) by employing algorithms that allow the respondent to skip to another question based on their answer to a prior question. This feature reduces respondent frustration from having to continue down a line of questions that will be mute or inapplicable because of their previous response; in essence, the survey becomes more user friendly. Finally in contrast to focus groups or in-person interviews, confidentially of responses, and anonymity of the responders is guarded because the element of direct human interaction is eliminated.[2]

There are some drawbacks to online surveys. Surveys may not reach the respondents because of a lack of Internet access, invalid e-mail addresses of

respondents, and inadvertent deletion of surveys that enters the respondent spam folder. In addition, Internet and mail out surveys can have poor response rates due to absence of the interviewer who is able to apply social pressure on the respondent to complete the survey. Furthermore, without a face-to-face interviewer present to keep the respondent on task, the respondents might succumb to other distractions due to lack of motivation or accountability while completing online/mail surveys.[2]

Despite of the purported disadvantages of Internet surveys, its ease of administration and efficient data collection made it the logical choice for this study.

3.2 Objective

The purpose of this chapter is to utilize an online survey tool to measure the impact of SRs (from chapter 2) on its correspondent authors. Main goals are as follows:

1. To investigate the background/evidence based dentistry (EBD) training of authors prior to the execution of the selected SR.
2. To investigate the limitations that the authors perceived during the process of SR conduction.
3. To assess the impact of SRs on it's respective authors in terms of teaching, research and clinical practice.
4. To assess the overall significance of SRs as perceived by it's authors.

3.3 Methods

The first step was the development of questions for the survey. Questions of interest included primary authors' background, author's previous SR publication, prior training in methodology, and the impact the authors' believed SRs had on their career. A similar study[9] focusing on SR authors in dentistry was used also used as a reference in formulating the survey questions.

The initial draft of survey questions was sent to the three thesis supervisors. This consisted of one prosthodontist and two clinicians with expertise in EBD and survey construction. After the thesis committee members revised the initial draft, it was sent to a group of clinicians and researchers with previous experience in EBD research and online surveys. Selection of these "evaluators" was based on suggestions from the members of the thesis committee. The evaluators were given information regarding the final purpose of the survey. The survey was modified after three rounds of discussion based on the feedback provided. Final survey questions were a combination of multiple choice (7 /17), 5-point Likert scale (7/17), and open ended questions (3/17).

Human Ethics Research Online (HERO) application was submitted to University of Alberta's Research Ethics Board 2. This board primarily reviews research concerned with survey methods. Once the ethical approval was obtained (Appendix C), the survey was uploaded on Survey Monkey (www.SurveyMonkey.com, Portland, OR, USA). The cover letter for initial contact (Appendix D) was sent through e-mail to the respective authors along with the survey (Appendix E).

E-mail addresses of all correspondent SR authors identified in chapter 2 were collected. This resulted in 106 contacts; same as the number of SRs from chapter 2. To avoid repetition, authors with multiple SRs were only sent one survey, which resulted in 84 contacts. However, four authors had two different e-mail addresses and the survey was sent to both in case one was invalid or old, resulting in 88 contacts, i.e. 84 new and four repeated. All the authors were contacted via e-mail and asked to follow a link through a web address (URL) to access the survey. Seven e-mails came back as invalid and two authors opted out of the survey resulting in a sample size of 79 contacts (88-7-2= 79). A reminder e-mail was sent to the survey recipients two weeks after the initial survey was sent.

3.4 Results

Survey results were collected and analyzed on the Survey Monkey platform. The response rate was low, with only 11 out of 79 authors responding (14 %). Eight authors responded to the survey initially, additional 3 authors responded with the reminder e-mail.

3.4.1 Author background and training in SR methodology.

Ten out of eleven authors that responded consider themselves primarily researchers along with being either educators or clinicians. Implant retained fixed prosthodontics was the area of expertise for (7/11) most authors, followed by expertise in removable and fixed (not implant retained) prosthodontics, and dental materials. Only one author responded as not being in the field of prosthodontics.

Less than half (5/11) of respondents had training in performing SRs. For participants that had training, few (2/5) reported one to two weeks or a full semester course of training; the rest (3/5) had either a full 1-2 days or only a few hours of training. Ten out of eleven authors reported as having published multiple SRs, ranging anywhere from two to eight SRs.

3.4.2 Author experience in methodology and topic of SR

One author (1/11) considered themselves to be an expert in the field of SR methodology. Most respondents (9/11) considered themselves as very to moderately knowledgeable and one author (1/11) considered themselves as having limited knowledge. For the question “Do you consider yourself knowledgeable regarding the topic of your systematic review before execution?” all authors (11/11) considered themselves moderately knowledgeable regarding the topic of their SR before execution. One author (1/11) reported as having expert level knowledge regarding the topic of their review after completion and the remaining authors reported as becoming moderately to very knowledgeable following the completion of their SR.

3.4.3 Impact of SRs on practice, teaching and research

One author completely revamped his/her practice of dentistry after conducting a SR, while the rest responded with moderate or significant changes in their practices. All authors except one stated that they significantly changed their research practices. Impact of SRs on teaching of dentistry was also assessed, and one author responded as completely changed and the rest as significantly or moderately changed. Two out of eleven authors responded that the institution they were affiliated with did not alter its teaching practices based on their published SRs, with 4/11 responding as somewhat, and 5/11 as moderate to significant change.

3.4.4 Possible limitations faced by authors/ journal choice

Two-thirds (7/11) authors reported as either publishing in a reputable/well read journal that would target readers of their choice, or a journal most likely to publish the SR based on their topic (for example, an implant related topic would be more likely to be accepted by Clinical Oral Implants Research). About one third (4/11) stated that their journal of submission was based on one having the highest impact factor or having previous experience of publishing in a particular journal. In retrospect, many respondents (7/11) wished they had changed inclusion/exclusion criteria, searched grey literature, or used studies (for inclusion in SR) in languages other than English. Three authors considered searching more databases, utilizing proper SR methodology, or employing critical appraisal of studies included in their SRs. One author reported as being completely satisfied with the content and quality of their SR.

3.4.5 General impact/ importance of SRs.

Eight out of eleven authors responded to the open-ended question " did the SR you authored impact the clinical practice of prosthodontics?" One author responded as their SR having "*very little*" impact on the practice of prosthodontics. Remaining authors responded as having a positive impact on clinical practice. One author responded that their SR "*opened the eyes of some (of*

my) colleagues that everything is not as they thought it to be and that other methods and materials should be tested". Another author responded that their *"systematic review(s) showed a higher risk associated with immediate (implant) placement and loading* ". This implies that emergence of new evidence from this author's SR rendered usual practice of immediate implant placement harmful. Therefore, this SR had a positive impact on clinical practice and patient care. Only 6 out of 11 authors responded when queried as to which SR has had the greatest impact in any aspect of the clinical practice of prosthodontics. Two (2/6) responded as not being able to select one, while the rest of the authors suggested SRs in implant survival. When questioned regarding the significance of publishing SRs, two thirds of authors (7/11) felt that SRs were the most important for clinical practice in improving patient outcomes. The remainder of authors suggested that SRs were important for research and education.

3.5 Discussion

The purpose of this chapter is to administer an online survey tool to the authors of prosthodontics related SRs. The results of the survey would provide insight into their background/ experience in SR methodology, limitations that they perceived in their own SR(s), and if the SR(s) influenced the respective authors' decision-making in teaching, research, and practice. In addition, the survey will provide insight into the authors' perception of the overall significance of SRs.

Due to the ease of data collection and sorting, economic feasibility, access to data in real time, and the exponential growth of Internet use, online surveys have far surpassed any other survey method [1,2]. This online survey was mainly concerned with the following: authors' knowledge and training in SR methodology, impact of SR on teaching, research and practice of prosthodontics (dentistry), and the overall significance of SRs as perceived by their authors. The supporting reasoning behind these question themes was twofold: first, it ascertained if the authors possessed sufficient training, background, and skills to conduct SRs; and secondly, if the SR had an impact on the application of the knowledge in context

of the learned evidence-based principles. Journal choice for publication was an additional question of interest, but not considered as the main goal of the survey.

Most authors that responded to the survey reported that SRs have had a significantly positive influence on their careers whether as a researcher, educator, and/or clinician. They also perceived that the overall significance of SRs was in the application of knowledge and decision-making with respect to patient centered outcomes. However, these results should be interpreted with caution due to the poor response rate, as only 11 out of 79 (14%) authors completed the survey. Therefore, one cannot generalize the results generated from this study to an entire population of authors publishing prosthodontic related SR(s), as the group of responders could be very inherently different from the non-responders [10].

About half (5/11) of the authors had prior training in performing SRs, but the majority (10/11) considered themselves as possessing moderate to expert level knowledge in SR methodology. This implies that either the authors do not consider SR training relevant, overestimated their knowledge regarding SR methodology, or settled on focusing on the subject of interest without paying much attention to proper protocol. Another explanation is that more than two-thirds (77%) of the SRs had at least one author with prior SR experience. These experienced authors may have provided the necessary guidance to first authors to ensure they adhered to appropriate SR protocol and methodology.

Most (two-thirds) authors reported as publishing their findings in a well read/ reputable journal that would target the audience of their choice. It could be due to the desire to have their work recognized by their peers. The remaining authors reported that their journal selection was based on impact factor. It is probable that authors considered journals with higher impact factors to be more prestigious than journals with no or low impact factors.

Searching of grey literature, using studies (for SR inclusion) in languages other than English, searching more databases, and changing inclusion/exclusion criteria

for an improved SR were reported as limitations faced by SR authors. A prior survey of SR authors in dentistry[9] reported that extensive literature search of several database(s) and of grey literature were lacking due to time constraints faced by their authors. Interestingly, 3/11 authors wished they paid more attention to the methodological content and carried out critical appraisal of studies they selected for their SR. However, due to anonymity reasons, it was impossible to correlate methodological quality of SR to its respective authors' response. In other words, we cannot ascertain whether authors who are content with the methodological quality of their SRs had superior SRs compared to ones that reported lack thereof.

Although Internet surveys have several advantages, they can have a wide disparity in response rates. A meta analysis of Internet surveys showed response rates can be as high as 40% with a standard deviation of about 20% [11]. One study[12] reported that their response rate was similar to mail or phone surveys, while another study[13] suggested that Internet surveys could have up to 6 to 15 percent lower response rates than other survey methods. This could be either due to errors in e-mail addresses, surveys being sent to junk mail folders due to filters[14], or users refraining from accepting survey invitations due to the possibility of Internet spam[1]. In addition, as with any survey method, users may find the survey tedious or have difficulty comprehending the questions. Potential respondents may also completely dismiss a survey if they fail to appreciate its relevance or any immediate benefit to them[14]. Unfortunately, it is very difficult to enforce completion of surveys under these circumstances. To circumvent this problem, our potential participants received a cover letter with the survey, highlighting the importance of this study. With the cover letter, it was aspired that these respondents will value participation in this study and hence reduce drop out rates.

There is also an inverse relationship between length of the survey and response rate [15,16]. Therefore, the survey was created as short and concise to reduce respondent fatigue. It was identified that it would be far more efficient to adapt a

previously published survey, since designing a novel survey tool can be a daunting task for the even the most experienced researcher[15]. As such, a prior survey[14] was utilized to guide the construction of the survey questions in this study. As this survey was adapted from a previously utilized survey, it adds considerable strength to the survey used in this study. An attempt to measure "content validity", defined as degree of accuracy with which the instrument measures what it is supposed to measure[15] was made. This involved a standardized peer review process by the sending survey to experts in EBD training. The experts reviewed the survey, provided feedback, and several iterations of the survey were made until we were satisfied with its content validity. However, this survey did not fulfill the criteria of "construct validity" which is refers to the internal structure/ construct of survey conforming to scientific survey principles[15]. Fulfillment of construct validity requires a complex protocol, and is usually utilized by researchers considered experts in survey design[15].

As stated previously, this survey suffered from a poor response rate. In retrospect, the response rate could have been optimized by conducting introductory phone calls or sending personally signed letters to the authors explaining the survey, the objective of the study, and highlighting its importance. Although a cover letter was sent with the survey through e-mail, it may have failed to connect with the authors on a personal and emotional level, resulting in a futile attempt to spark motivation in these authors to complete the survey. Sending more reminders during the survey could have also enhanced response rates. Targeting non-respondents with phone calls and requesting they complete the survey could have been another alternative. However, this was not an option, as the anonymity of survey users had to be maintained. It has been suggested that monetary enticement in exchange for completing the survey can increase response rates by as much as 57%, while gift cards can inflate them by as much as 40% [17]. In this case, reasons of anonymity prohibited us from utilizing these incentive driven strategies. However, in reality, it may be time constraints/ lack

of motivation and not a lack of incentives that prevented this cohort of authors from completing the survey.

3.6 Conclusions

Due to a poor response rate (14%), the true impact of SRs on its corresponding authors could not be ascertained. Any conclusions drawn from the survey should be interpreted with caution. Findings were as follows:

- It is be important to note that about half of authors that responded had no prior training in performing SRs, but a majority of them considered themselves as possessing moderate to expert level knowledge in SR methodology.
- It was gathered from the survey that most authors would have liked to search grey literature, use primary studies in languages other than English, and/ or change inclusion/exclusion criteria. Few authors wished they searched more database(s) and addressed methodological protocol issues.
- Most authors chose to publish their studies in visible or well-read journals that were recognized by their peers, or in journals that would have the highest likelihood of publishing their paper.
- A vast majority of respondents felt their knowledge regarding the topic of the SR increased and had a positive impact on teaching, research, and clinical practice. They also perceived that the greatest utility of SRs was in facilitating clinical decision making to improve patient outcomes.

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Chapter Four

Discussion and Conclusion

4.1 General Discussion

Systematic review (SR) is a form of publication that synthesizes information from various studies in a methodical and reproducible manner to answer a specific research question[1]. Results from individual studies can be varied due to differences in research design, making the conclusions that can be drawn from them ambigous[2]. The amalgamation of information if conducted properly, can have a powerful effect in decision-making, especially as it applies to formulating practice guidelines and policymaking regarding patient care [3]. Considering the importance of SRs, the goal of this study was to examine the overall quality of SRs published in prosthodontics, analyze their key descriptive characteristics, methodological quality, and the perceived impact these SRs have had on their respective authors.

All SRs (total of 106) related to prosthodontics were collected from the ADA EBD website, MEDLINE, EMBASE, and Web of Science. More than two thirds of the studies were found on the ADA EBD website and less than half were on found on MEDLINE.

When examining the origins of these prosthodontic SRs, the United States and United Kingdom had a similar amount of publications, whereas Europe was the most publication intensive continent followed by North America. A reason for this could be due to significant vested interests from the National Health Services (UK) and other European government agencies in promoting research that optimizes efficiency and improves patient outcomes in a socialist health/dental care system. It is the utilization of SRs that amalgamates this body of research into a working knowledge, which allows these government healthcare agencies to form evidence based policies that improve healthcare indices.

Two to four authors conducted a major portion of the included SRs in this study, however 10% of the SRs in this study were reported as being conducted by a single author. Single authors in this cohort did not report utilization of another

reviewer for data extraction and inclusion/exclusion of studies. This is concerning as the use of only one reviewer certainly introduces bias and subjectivity in selection of studies to be included in the SR.

Over 90% of publications came from academic institutions and the rest from private practice. For academic clinicians, the currency for promotion and tenure is academic output and this begets accountability to perform research. Academic clinicians may also receive resources and financial support for these academic activities. On the contrary, private practice clinicians are not dependent on academic institutions for gainful employment, and therefore are not expected to be accountable to the same standards for research output as their academic counterparts. With minimal support, the private practice clinician dedicates the majority of his or her time in ensuring the financial viability of the private practice rather than performing research.

Approximately 80% of SRs came from specialty dental journals, indicating that authors chose to publish in journals that would target their peers' i.e. prosthodontic specialists, and garner some academic prestige among their own colleagues. Clinical Oral Implants Research was the most popular journal; in fact, implant or related topics comprised two- thirds of the topics of interest in the cohort of SRs.

Most impact factors were between one and three; 20% of the journals had no impact factor. It is possible that researchers might not even choose to publish their studies in journals in which their findings are not likely to be cited, or they would want to publish in high impact journals due to their presumably impressive status. It is important to note that impact factors mostly attract interest in the research community, but do not hold much value from clinicians.

Anywhere from two to six resources were searched for the majority of SRs (80%), including electronic database(s), hand searches of journals, or bibliographies of similar publications. One tenth utilized only one resource, which is problematic, as a given database will have a limited geographic and

journal coverage range. Thus, if comprehensive literature search of multiple databases and other resources is not performed, potentially useful studies indexed in another resource will be excluded.

Half of the SRs had a meta analysis included, while the other half did not. It is probable that the other half consisted of SRs that were constructed from a heterogeneous group of studies. Meta analysis cannot be performed if there is a marked heterogeneity amongst studies included in SR, and therefore, this is necessarily not a deficiency on the author's part by not performing a meta analysis. However, poor adherence to methodological quality was noted when verification of publication bias by Egger or funnel plot was performed in only six percent of the SRs that included meta-analyses.

A flow diagram depicting the inclusion/ exclusion process of studies was present in almost one third (37%) of SRs. The authors of other two thirds perhaps failed to acknowledge the significance of incorporating an inclusion/exclusion flow chart into their publication or were simply restricted by space limitations imposed by the journal.

Half (50 %) of the SRs reported positive findings while five percent stated negative findings. Publication bias, a phenomenon where authors and editors are less likely to publish negative or inconclusive results, can be a possible explanation for lack of negative results. However, this is unlikely as just under half (45%) of the prosthodontic SRs had inconclusive results published.

AMSTAR tool was applied to assess the quality of SRs in this sample. "A priori design" and "characteristics of included studies" criteria on the AMSTAR measurement tool had the highest scores of all 11 components based on descriptive statistics. The criterion for "comprehensive literature searches" and "duplicate study selection" from the AMSTAR tool was only fulfilled by half of the authors. Whereas the criterion for "conflict of interest" along with "scientific quality of the included studies assessed/ utilized in forming conclusions" was only adequately completed by one third of the authors. The items that were rated

the lowest on the AMSTAR tool were “grey literature searches” and “assessment of publication bias”. Despite the fact that half of the SRs in our study employed a meta-analysis, only a limited number of these studies actually addressed publication bias. This introduction of bias is of major concern since it seriously compromises the integrity of the conclusions of the SR. If one ascertains that a SR that included meta analysis has ignored publication bias, application of its results in practice should be approached with caution.

Some strategies to circumvent the aforementioned issues of SR quality would be to always employ at least two reviewers in the study selection process, and to conduct comprehensive literature searches using multiple databases that have complementary geographic coverage. Authors and journal editors need to be more alert to issues of publication bias in meta-analyses. Use of translators to allow inclusion of studies for SRs in languages other than English, and enlisting the assistance of an experienced librarian for grey literature searches, will leave consumers of SRs convinced that an exhaustive literature search was carried out. “Conflict of interest” should always be stated, as final conclusions of the publication could favor the source of the funding.

The methodological quality of the SRs examined was limited. Although, the scoring method used in this study for tabulating total AMSTAR scores has not been validating, it was based somewhat on a prior study. This study[4] noted that any SR with average/near average total AMSTAR scores would have methodological limitations and findings from such SRs should be approached with caution. This was in fact the case for most SRs in our sample.

Inferential statistical testing was performed to investigate the association between citations and other key characteristics extracted from the SRs. Statistical significance was found for the number of citations between different journals, with Journal of Prosthetic Dentistry (27) having the highest and Journal Oral Rehabilitation (0) having the least number of median citations. A likely explanation for difference in citation numbers between different journals could be

that authors of similar studies are more likely to cite from sources they believe to be prestigious, such as journals with higher impact factor. A significant difference was detected in numbers of citations between general and specialty dental journals in this study, with specialty journals having five times as many citations as a general dentistry journal.

Various study designs such as RCT, prospective, retrospective, or different combinations of them included in each SR had a statistically significant difference in the numbers of citations. Further statistical testing demonstrated the greatest difference in the numbers of citation was between SRs that included RCT's versus those that did not. Interestingly, median citations of SRs that included only RCTs (as primary study design) were lower than that of SRs that did not include any RCTs. RCTs are considered a higher level to evidence compared to prospective or randomized study design[5]. Therefore, it can be presumed that authors and researchers were more interested in the subject content of the SR, rather than the study design or the level of evidence that was yielded. Outcomes of the SRs were not associated with citation numbers, which suggest that inconclusive and negative SR results are just as likely to be cited as positive results.

Methodological quality of SRs did improve slightly over the years as total AMSTAR scores progressively increased from 9.5 (1990-2000 time period) to 11 (for 2001-2006) and then to 12 (for 2007-2011). However, this change was not statistically significant. In addition, there was a statistically significant difference between AMSTAR scores for publications by authors who had prior SR experience, versus novice authors, with higher AMSTAR scores noted in experienced authors.

Due to a poor response rate (14%), no well-supported conclusions can be drawn about the perceived impact of SRs from its authors. Nevertheless, some important observations can be gleaned from the survey results. Half of authors that responded had no prior training in performing SRs. Despite this lack of training,

the majority of these authors (10/11) still self-assessed their knowledge in SR methodology at a moderate to expert level. There are numerous explanations that can be extrapolated from this finding: perhaps the authors may have not considered SR training relevant or important; they may have overestimated their knowledge regarding the conduction of their SR; they may also have placed excessive emphasis on the subject content that they failed to give due diligence to the SR protocol. Another explanation could be that more than two-thirds (7/11) of the SRs had at least one author with prior SR experience. Veteran authors could have guided the first author in following key steps during the planning and execution of the SR and not to mention, even the writing of the manuscript to ensure that key content elements were included. Other findings from the survey were also relevant. For instance, in retrospect, the authors would have liked to search grey literature, use primary studies (for inclusion in SR) in languages other than English, and/or change inclusion/exclusion criteria. Searching more database(s) and change in methodology followed this. From the results of the survey, it was noted that most authors published their SRs in journals that were either well read by their peers, or in ones that were most likely to accept their manuscript based on prior publishing experience with the journal. Most of the respondents felt that their knowledge regarding the topic of the SR increased tremendously. Most authors also reported a significantly positive impact on teaching, research, and practice of dentistry, and believed that the most crucial use of SRs was in clinical decision making to enhance patient outcomes. Any conclusions drawn from the survey should be interpreted with caution, as one cannot make assumptions regarding responses of authors that did not complete the survey. The non-responder group may be very inherently different than the one that did respond[6], and therefore the results cannot be extrapolated to the larger population of authors of prosthodontic related SRs.

4.2 Final Conclusions

SRs are foundational to evidence-based practice and need to be conducted in a transparent fashion[7]. Quality of most SRs in our sample was limited, which implies that SRs would have to be critically appraised for their scientific merit before integrating their findings in clinical practice. Several future research questions emerge from this study: does formal education in conducting SRs improve the quality of SRs? Does stricter adherence to SR protocols and checklists improve the quality of SRs being published? What is the impact of these interventions to improve SR on clinical practice outcomes, driving new research, and/or improving education?

Unfortunately, due to poor response rate on the survey it was not possible to form definitive conclusions from author responses, but from the available answers it can be argued that the authors perceived a positive impact of SRs on teaching, research, and the practice of dentistry.

4.3 Future recommendations

- Authors should have exposure to the assessment tools and checklists such as AMSTAR and PRISMA to improve their SRs. AMSTAR is a tool that assesses the conduction of a SR, while PRISMA assesses the reporting methods of SRs. Although, both methodological and reporting qualities are interrelated[7], this study did not address reporting quality of SRs per se. It would be beneficial to compare and contrast the methodological quality of SRs with it's reporting quality in the future. As mentioned, seeking guidance from more experienced SR authors is yet another way to improve one's SRs.
- Undergraduate and graduate dental programs should have mandatory courses in critique of clinical research, including SRs, to give future clinicians' exposure not only to publishing papers, but also to critically appraise research before application of its findings into practice. This should be an essential competency for any graduating clinician, especially

as it applies to clinical practice and patient care. In addition, educators, clinicians, and researchers should have similar training in application of evidence-based principles from SRs and related studies.

- Qualities of both meta-analyses and randomized controlled trials (RCTs) have been enhanced from the application of checklists such as QUOROM and CONSORT. It is probable that AMSTAR will have the same effect on SRs. Further refinement of the AMSTAR measurement tool might be necessary to distinguish between poor and good quality SRs, since AMSTAR is currently not sensitive enough to accomplish this, according to it's developers.
- To enable transparency in SR conduction, journals should utilize an universal checklist such as AMSTAR and/or PRISMA for all incoming SR manuscripts. This identifies and assesses all the key characteristics of an unbiased SR protocol. All journals and authors should ubiquitously adopt this standardized protocol. Authors should use the checklist(s) as a template for their SR prior to its conception. Authors should also make note in their SR manuscript the assessment results of their checklist to help readers decipher the quality of the SR. To even a greater extent, journal editors should request authors to include their SR checklist results with the manuscript submission. When journal editors and authors are utilizing the same metrics for SR assessment, the process from peer review to journal publication becomes greatly expedited and standardized. Timely publication of a submitted SR is critical, as it can quickly be rendered dated with the passage of time and further exponential growth of the literature. Furthermore, with a high quality standardized checklist that is ubiquitous, the assessment for the same SRs between different journal editors becomes more consistent. That is, there is greater inter-rater reliability, resulting in editors publishing good SRs regardless of their findings, and requesting authors to revise poor quality SRs. The overall impact is that the quality of SR in the literature increases, resulting in

clinicians making better healthcare decisions and more informed policy-making**.**

- To understand the true impact of SRs on practice, a larger cohort of dentists, such as all prosthodontists in Canada, should be recruited to conduct a larger scale survey. Evidence-based practice is at the forefront of all health care disciplines. As a result, the Canadian Association of Prosthodontists may be very receptive to the study and endorse it to its members. This may require a presentation at the annual national meeting of prosthodontists to gain their "buy in". Of course, utilizing personalized courtesy phone calls and mail out reminders will also boost responses rates. In the end, the onus eventually is on researchers and clinicians to respond to surveys or queries that can broaden our understanding of the integration of evidence-based knowledge from SRs into clinical practice.

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Appendices

Appendix A: AMSTAR Assessment Tool

Questions	Explanation
1. Was an "a priori" design provided?	The research question and inclusion criteria should be established before the systematic review is conducted.
2. Was there duplicate study selection and data extraction?	There should be at least two independent evaluators to extract data from the studies and consensus procedures for any disagreements should be in place.
3. Was a comprehensive literature search performed?	At least two electronic sources should be searched. The systematic review should include both the years of search strategy and databases used (e.g. MEDLINE, EMBASE, Central). Keywords and/or MESH terms should be mentioned, and where feasible, the search strategy should be provided. All searches should be supplemented by consulting current contents, reviews, textbooks, specialized registers, or experts in the field of study, and by reviewing the references of the studies found.
4. Was the status of publication (i.e. grey literature search performed)?	The authors of the systematic review should state whether they searched for studies regardless of their publication type. They should also mention whether or not they excluded any reports from the systematic review based on their language, publication status etc.
5. Was the list of studies (included and excluded) provided?	A list of included and excluded studies should be provided.

6. Were the characteristics of the included studies provided?	It should be provided in an aggregated form such as a table, data from the original studies should be provided on the participants, interventions and outcomes. The ranges of characteristics in all studies analyzed for example, age, race, sex, relevant socioeconomic data, disease status, duration, severity, or other diseases should be reported.
7. Was the scientific quality of the included studies assessed and documented?	"A priori" methods of assessment should be provided (for example if the author(s) chose to include only randomized, double blind, placebo controlled studies, or allocation concealment as inclusion criteria for effectiveness of studies); alternative items will be relevant for other types of studies.
8. Was the scientific quality of the included studies used appropriately in formulating conclusions?	The results of the methodological rigor and scientific quality should be considered in the analysis and conclusions of the review and should be explicitly stated in formulating recommendations.
9. Were the methods used to combine the findings of studies appropriate?	A test of homogeneity (i.e. Chi squared test of homogeneity, I^2) should be performed for pooled results to make sure that the studies are combinable. If heterogeneity exists, then a random effects model should be used and/or clinical appropriateness of combining should be taken into consideration (i.e. does it make sense to combine the results?)

10. Was the likelihood of publication bias assessed?	Publication bias should be assessed by means of a combination of graphical plots (e.g., funnel plots, other available tests) and/ or statistical tests (e.g., Egger regression test)
11. Was the conflict of interest stated?	All potential sources of support should be mentioned for both the systematic review and the included studies.

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*Key:

Numbers at the end of the reference in bold are actual reference numbers from Chapter 2.

Appendix C: HERO Approval

UNIVERSITY OF ALBERTA

RESEARCH ETHICS BOARD

308 Campus Tower
Edmonton, AB, Canada T6G 2K8
Tel: 780.492.0459
Fax: 780.492.9429
www.reo.ualberta.ca

Notification of Approval

Date:	January 24, 2012
Study ID:	Pro00027972
Principal Investigator:	Tehnia Aziz
Study Supervisor:	Carlos Flores Mir
Study Title:	A qualitative and quantitative analysis of the perceived impact of published prosthodontic systematic review have had on clinical practice and teaching according to the correspondent authors.
Approval Expiry Date:	January 22, 2013

Thank you for submitting the above study to the Research Ethics Board 2. Your application has been reviewed and approved on behalf of the committee.

A renewal report must be submitted next year prior to the expiry of this approval if your study still requires ethics approval. If you do not renew on or before the renewal expiry date, you will have to re-submit an ethics application.

Approval by the Research Ethics Board does not encompass authorization to access the staff, students, facilities or resources of local institutions for the purposes of the research.

Sincerely,

Dr. Stanley Varnhagen

Chair, Research Ethics Board 2

Note: This correspondence includes an electronic signature (validation and approval via an online system).

Appendix D: Letter of Initial Contact

A qualitative and quantitative analysis of the perceived impact on clinical practice and teaching from prosthodontic systematic reviews according to their correspondent authors

Supervisor – Dr Carlos Flores-Mir

Masters Student – Dr Tehnia Aziz

Study Information and Consent Form

Dear Potential Survey Participant,

The following is a description of a web-based survey, which investigates the perceived impact from published systematic reviews related to prosthodontics on clinical practice and teaching. This is an anonymous web-based survey (SurveyMonkey) and as such your personal information will not be linked at all with your responses.

For your information, the intention of the primary survey for this investigation is as follows:

The **purpose** of this study is to explore if published systematic reviews have changed the way the surveyed authors perceive they practice/teach prosthodontics. An assessment will be made to determine if there is an association between the author's experience and knowledge of EBD with respect to the quality and/or citation of the publication. Other factors that are believed to have an influence will also be considered.

The **final outcome** of my investigation will be useful to increase our body of knowledge regarding knowledge translation. In other words identify and analyze potential barriers that limit the impact of published research on clinical practice.

Before proceeding with the survey, please take a moment to read the following information. Should you decide to contribute to this research, **your submission of the survey will be considered implied consent to participate.**

1) Your participation is **voluntary** and expected to take approximately 10 minutes of your time.
2) Your responses are **confidential** and the questionnaires do not have names or other identifiers on them.
3) No individual or regional information will be reported. All responses will be aggregated for analysis.

4) This study has received ethics approval from the Research Ethics Board 2 at the University of Alberta, Edmonton, Alberta, Canada.
5) Once you have submitted the questionnaire it will become property of the University of Alberta and cannot be returned to you due to lack of personal identifiers on it.

Should you decide to participate, please click xxx.xxxx.xxx, and answer the questions on the pages that follow. If you choose not to participate, simply exit this page on your Internet browser. For anonymity purposes you cannot come back to the survey at a later time.

It should be noted that the data collected is stored momentarily on SurveyMonkey's servers that are located in the United States. Under the U.S. Patriot Act, the U.S. government can request access to data. The information we are collecting is not likely of sensitive nature and no personal identifiers are collected as part of our survey.

You can contact me or my primary supervisor by the following means should you have any questions or concerns.

If you have any questions or concerns about your rights as a participant, or how this study is being conducted, you may contact the University of Alberta's Research ethics office at (780) 492-2614. This office has no affiliation with the study investigators.
Email: tehnia@ualberta.ca or carlosflores@ualberta.ca

Sincerely,

Tehnia Aziz

BSc, DDS, MSc Candidate (University of Alberta)

Appendix E: Survey

Survey of Systematic Review Authors to Assess Impact on their Careers

1. 1. Do you consider yourself: (check mark all that apply)

- [ ] a. A Clinician
- [ ] b. A Researcher
- [ ] c. An Educator

2. 2.What is your area of expertise within Prosthodontics? (check mark all that apply)

- [ ] a. Removable Prosthodontics (not implant retained)
- [ ] b. Fixed Prosthodontics (not implant retained)
- [ ] c. Implant retained fixed prosthesis.
- [ ] d. Overdentures
- [ ] e. Implantology dealing with implant site preparation, osseointegration, surface of implant etc.
- [ ] f. Dental Materials.
- [ ] g. CAD/CAM/Computer generated prosthesis
- [ ] h. Other. (Space to explain below)
- [ ] i. None, my expertise lays outside Prosthodontics.

Other (please specify)

3. 3. Did you have any formal training in conducting systematic reviews?

- ◯ a. Yes. (Answer question 4)
- ◯ b. No. (Skip to question 5)

4. 4. What type of training did you have?

- ◯ a. A few hours of cumulated training.
- ◯ b. 1-2 full-days of cumulated training.
- ◯ c. Between 3 and 7 full-days of cumulated training.
- ◯ d. Between one and two weeks of cumulated training.
- ◯ e. A full university course (equivalent to one semester) or more (Master degree).

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Survey of Systematic Review Authors to Assess Impact on their Careers

5. 5. How many systematic reviews have you published?

6. 6. Do you consider yourself knowledgeable in systematic review methodology?

	Very limited Knowledge	Limited knowledge	Moderate knowledge	Very knowledgeable	Expert level knowledge
Enter Choice	◯	◯	◯	◯	◯

7. 7. Did you considered yourself knowledgeable regarding the topic(s) of your systematic review(s) before executing the review(s)?

	Very limited Knowledge	Limited knowledge	Moderate knowledge	Very knowledgeable	Expert level knowledge
Enter Choice	◯	◯	◯	◯	◯

8. 8. Do you think your knowledge regarding the topic(s) of your systematic review(s) has increased after completion of the systematic review(s)?

	Very limited Knowledge	Limited knowledge	Moderate knowledge	Very knowledgeable	Expert level knowledge
Enter Choice	◯	◯	◯	◯	◯

9. 9. Do you believe that the systematic review(s) you authored changed the way you practice dentistry now?

	Not at all changed	Somewhat changed	Moderately changed	Significantly changed	Completely changed
Enter Choice	◯	◯	◯	◯	◯

10. 10. Do you believe that the systematic review(s) you authored changed the way you research in dentistry now? (Leave blank if you do not do research)

	Not at all changed	Somewhat changed	Moderately changed	Significantly changed	Completely changed
Enter choice if applicable	◯	◯	◯	◯	◯

11. 11. Do you believe that the systematic review(s) you authored changed the way you teach dentistry now? (Leave blank if you do not do teaching)

	Not at all changed	Somewhat changed	Moderately changed	Significantly changed	Completely changed
Enter choice if applicable	◯	◯	◯	◯	◯

Survey of Systematic Review Authors to Assess Impact on their Careers

12. 12. Do you believe that the institution you are affiliated with has changed the way they teach a topic based on a published systematic reviews? (Leave blank if you do not do teaching)

	Not at all changed	Somewhat changed	Moderately changed	Significantly changed	Completely changed
Enter choice if applicable	◯	◯	◯	◯	◯

13. 13. What made you decide to select the Journal for your publication(s)? (check mark all that apply)

- ☐ a. It is a reputable/well-read Journal.
- ☐ b. Past experience of being published in the Journal.
- ☐ c. It targets the readers I wanted.
- ☐ d. It has the highest impact factor.
- ☐ e. It has the largest audience.
- ☐ f. It is most likely to publish my systematic review based on my topic.
- ☐ g. It was my second choice since my paper was not accepted in the journal of my choice.
- ☐ h. Other (Space to explain)

Other (please specify)

***14. 14. In retrospect, is there anything you would change in your systematic review(s)? (Check mark all that apply)**

- ☐ a. There is no need to change anything.
- ☐ b. Search more databases.
- ☐ c. Change inclusion/exclusion criteria.
- ☐ d. Change methodology, search methods, or ratings methods
- ☐ e. Search grey literature.
- ☐ f. Use languages other than English.
- ☐ g. Use more co-authors.
- ☐ h. Use fewer co-authors.
- ☐ i. Other (please specify)

Other (please specify)

Survey of Systematic Review Authors to Assess Impact on their Careers

15. 15. In your opinion, how has your systematic review(s) impacted clinical practice in prosthodontics?
(Space to explain)

16. 16. In your opinion, which systematic review has had the greatest impact in any aspect of clinical practice of prosthodontics?
(Space to explain)

***17. 17. Where do you think lays the most importance of a systematic review? (Add a relative percentage in the space provided)**

- [ ] a. Clinical practice.
- [ ] b. Research.
- [ ] c. Education.
- [ ] d. Patient-oriented outcomes

PERCENTAGE