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Original article

Time relevance, citation of reporting guidelines, and breadth of literature search in systematic reviews in orthodontics

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Summary

Introduction: As the importance of systematic review (SR) conclusions relies upon the scientific rigor of methods and the currency of evidence, we aimed to investigate the currency of orthodontic SRs using as proxy the time from the initial search to publication. Additionally, SR information regarding reporting guidelines, registration, and literature searches were recorded when available.
Materials and methods: A systematic PubMed search was carried out using the Clinical Queries page to identify orthodontic SRs cited between 1 January 2008 and 7 November 2013. Data related to reporting guidelines, review registration, dates of review processing, literature search, and abstract reporting were retrieved and classified by journal type. Survival analysis was used to assess the time to reach predefined manuscript stages for orthodontic and non-orthodontic journals.
Results: One hundred twenty seven of the originally identified 585 SRs were considered eligible. The median interval from search until publication was 13.2 months (interquartile range: IQR = 9.7 months) irrespective of the journal type. There was evidence (P = 0.05) that SRs published by non-orthodontic journals appeared in PubMed faster than in orthodontic journals (non-orthodontic: median = 6.5 months; IQR = 5.7 months; orthodontic: median = 10.2 months; IQR = 5.6 months) from submission to publication and from acceptance to publication (non-orthodontic: median = 1.5 months; IQR = 2.4 months; orthodontic: median = 6.0 months; IQR = 6.2 months; $P < 0.001$). More than half of these SRs did not cite adherence to any reporting guidelines, whereas all but five studies were not prospectively registered. Search of unpublished research was undertaken in approximately 21 per cent and 29 per cent of the SRs published in non-orthodontic and orthodontic periodicals, respectively.
Conclusions: This study indicates that SR users should be aware that median time for orthodontic SRs from search to publication is 13.2 months. SRs published in non-orthodontic journals are likely to be more current in terms of submission until time to publication and acceptance until time to publication compared with those published in orthodontic journals.

Introduction

A systematic review (SR) has been defined as 'a review of a clearly formulated question that attempts to minimize bias using systematic and explicit methods to identify, select, critically appraise, and summarize relevant research' (1). In evidence-based dentistry, SRs have gained prominence in underpinning clinical decision making and health care policies. Nevertheless, the exponential increase of SRs

in the dental literature has not been accompanied by parallel quality improvement in terms of methodology and reporting (2–9).

To address the suboptimal reporting of SR and meta-analyses in health care research, reporting guidelines have been developed such as the QUOROM Statement (QUality Of Reporting Of Meta-analyses) (10), later superseded by the PRISMA statement (Preferred Reporting Items for Systematic reviews and Meta-Analyses) (11), the MOOSE Standards (Meta-analysis Of Observational Studies in Epidemiology) (12), and the Guidelines of the National Health Service (NHS) Centre for Research and Dissemination (13). Registration in an international registry of SRs (PROSPERO; http://www.crd.york.ac.uk/prospero/) has been also advocated to promote transparency and counteract unintended review duplication, selective reporting and waste of resources (14).

Whereas reporting of search methodology strengthens the quality of the review (15), the inclusion of the latest published studies at the time of publication of the SR may reflect how up-to-date and relevant the review is to clinical practice (16). The time of the initial search to publication can possibly serve as a proxy of how up-to-date the SR can be. During the interval between the last date of search and publication, the review conclusions run great risk to become outdated (15). In a cohort of high-quality SRs (17), new evidence mandating updates was published within 12–24 months after publication. Thus, SR users are encouraged to do additional literature searches when the interval between search and publication dates exceeds 1 year (17). To our knowledge, reporting on the duration of the stages from the initial search to publication of SRs in orthodontics has not been so far investigated. Therefore, the main objective of this study was to evaluate the time elapsed between initial search and publication of an SR. Additional objectives were to record reported guidelines and the sources of the literature searches conducted in orthodontic SRs published between the years 2008–13.

Methods

Search strategy

A comprehensive literature search was undertaken to identify SRs of orthodontic relevance indexed in PubMed from 1 January 2008 to 7 November 2013 using the Clinical Queries feature (http://www.ncbi.nlm.nih.gov/pubmed/clinical). PubMed Clinical Queries operate specialized searches that filter citation retrieval by clinical study category, the SR subset, and medical genetics topics. By entering the term 'Orthodontics' in the search box of the Clinical Queries page, and consequently selecting the SRs column, our search was confined to citation results of SRs, meta-analyses, reviews of clinical trials, evidence-based medicine, consensus development conferences, and guidelines. Initially, one of the authors (CL) screened titles and abstracts, and, if necessary, full texts to decide whether the article fell into the category of SR on the basis of two criteria: search strategy description and analysis of all included studies (16). Supplementary assessment was carried out by a second reviewer (NP) independently in case of uncertain classification.

Data collection

Data collection from abstracts and full text manuscripts aimed to retrieve information on the following items: name of the journal, first author, and publication year. Additionally, SR reporting guidelines, registration, dates of last search, submission, acceptance (where applicable) and first PubMed available publication date, databases, identification attempt of unpublished studies, and hand-searching were recorded. In the occasions that authors failed to provide precise dates, the last day of the month (either the 30th or the 31st) was used (16). If more than one Cochrane Database Systematic Reviews on the same topic appeared in the 5 year period, only the latest update was included. Data regarding abstract reporting such as search date and period, number and types of databases were also documented. In SRs with multiple databases and search end dates, the latest was considered. SRs of less traditional orthodontics-related topics, like for example temporomandibular disorders, sleep apnoea, and craniofacial growth, were included in data analysis only in the case where either the first or last author was an orthodontist.

Statistical analysis

Descriptive statistics were calculated. Kaplan–Meier survival estimates were used to measure the proportion of SRs reaching the next defined stage in publication process from search, submission, and acceptance dates. Log-rank tests were performed to compare survival distributions between orthodontic and non-orthodontic journals at different time points of the publication course. Statistical significance was set at 5 per cent (two-sided). Data analysis was implemented with the STATA® version 13.1 software (Stata Corporation, College Station, Texas, USA).

Results

The 585 studies originally retrieved by the PubMed search were reduced to 133 after customizing the publication date and applying the aforementioned SR definition criteria. Finally, after excluding the 6 Cochrane Database Systematic Reviews, 127 meta-analyses were analysed for the purposes of this study. Cochrane reviews besides following more rigid steps and updating criteria, they were insufficient to be considered as a single category. Ninety three of the included SRs were published in orthodontic journals and the remaining 34 in non-orthodontic journals.

Time between publication process steps

Summary statistics for lags between different publication processing stages are displayed in Table 1.

The Kaplan–Meier plots for search to publication, submission to publication, and acceptance to publication between orthodontic and non-orthodontic journals are shown in Figure 1A–C. The number of SRs with complete information on time lags are shown in Table 2 and in Figure 1 (numbers at risk). Overall, the median times from search to publication were 13.2 and 13.5 months for specialty and non-specialty journals, respectively. Log-rank test for

Table 1. Summary statistics of publication time processing by journal type (in months).

	Lags		
Journals	Search-publication	Submission-publication	Acceptance-publication
Orthodontic			
Median (IQR)	13.2 (11.0)	10.2 (5.6)	6.0 (6.2)
Min-max	2.2–64.0	2.0–46.0	0.7–22.3
Non-orthodontic			
Median (IQR)	13.5 (8.6)	6.5 (5.7)	1.5 (2.4)
Min-max	1.7–35.1	1.0–21.9	0.3–14.2
Overall			
Median (IQR)	13.2 (9.7)	9.2 (7.1)	5.0 (7.1)
Min-max	1.7–64.0	1.0–46.0	0.3–22.3

IQR, interquartile range.

Table 2. Distribution of the 127 SRs according to abstract and full text reporting of literature search protocols.

	Journals			
	Orthodontic (*N* = 93)		Non-orthodontic (*N* = 34)	
	Yes	No	Yes	No
SR literature search data	*N* (%)	*N* (%)	*N* (%)	*N* (%)
Search date	12 (12.9)	81 (87.1)	4 (11.8)	30 (88.2)
Search period	42 (45.2)	51 (54.8)	16 (47.1)	18 (52.9)
Title of databases	54 (58.1)	39 (41.9)	23 (67.6)	11 (32.4)
Number of databases	63 (67.7)	30 (32.3)	27 (79.4)	7 (20.6)
Hand-searching	68 (73.1)	25 (26.9)	19 (55.8)	15 (44.2)
Unpublished literature search	27 (29.0)	66 (70.0)	7 (20.6)	27 (79.4)

SR, systematic review.

equality of survivor functions showed no significant differences for this interval between the two types of journals ($P = 0.75$). There was some evidence ($P = 0.05$) that SRs published by non-orthodontic journals appeared in PubMed marginally faster than in orthodontic journals (non-orthodontic: median = 6.5 months; interquartile range: IQR = 5.7 months, orthodontic: median = 10.2 months; IQR = 5.6 months) from submission to publication and significantly faster ($P < 0.001$) from acceptance to publication (non-orthodontic: median= 1.5 months; IQR = 2.4 months; orthodontic: median = 6.0 months; IQR = 6.2 months; $P < 0.001$). There was no evidence that search for unpublished literature ($P = 0.49$) or hand-searching ($P = 0.81$) added significantly to the necessary time, calculated from the search date, for a SR to get indexed by PubMed.

Literature search

Overall, 43 unique databases were described in the Materials and Methods section in all 127 SRs with the largest number of data management systems being 14 in two studies. Two to five bibliographic databases were used in the search strategy in 70 per cent of the SRs, whereas literature search was limited to one database in 9 per cent of the articles. In all, but three SRs Medline/PubMed databases were searched solely or combined with others. Cochrane Library, EMBASE, Web of Science, and Scopus followed in frequency use, adopted by 96, 70, 43, and 36 SRs, respectively. Reviewers screened references and journals to maximize output of articles in 87 studies. Finally, identification of grey literature by cross-checking of conference proceedings and registration databases was performed in 20.59 per cent and 29.03 per cent of the SRs published in non-orthodontic and orthodontic journals (Table 2).

Abstract reporting

With reference to abstract reporting, authors failed to present the exact search date or searches for unpublished literature in the majority of SRs irrespective of journal type. Most of the orthodontic non-orthodontic SR abstracts provided information about the number and the titles of databases (Table 2).

SR reporting

More than half of SRs did not mention any reporting guidelines. PRISMA, PICO (e.g. component of the PRISMA statement, acronym denoting Participants, Intervention, Comparison, Outcomes, which enables specification of objectives and eligibility criteria), and the Guidelines of the NHS Centre for Research and Dissemination were the most cited acronyms. The authors of five studies claimed adherence to multiple reporting standards (Table 3). Prospective registration was carried out in only five SRs.

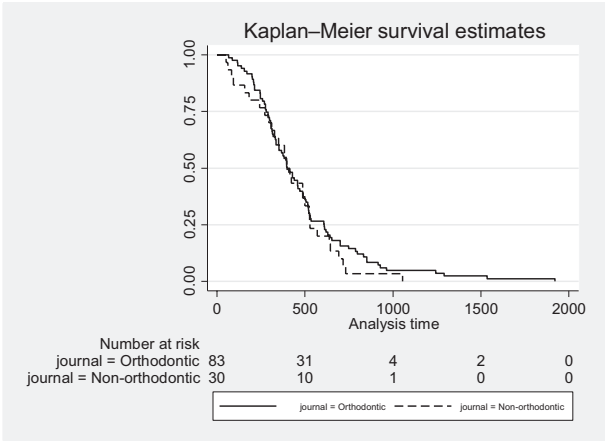
Discussion

This study aimed to assess the time to reach the main stages (submission and publication) from the initial search during the publication process of orthodontic SRs identified in PubMed. Additional information was collected on cited reporting guidelines, and sources utilized by the SR authors for retrieval of individual studies.

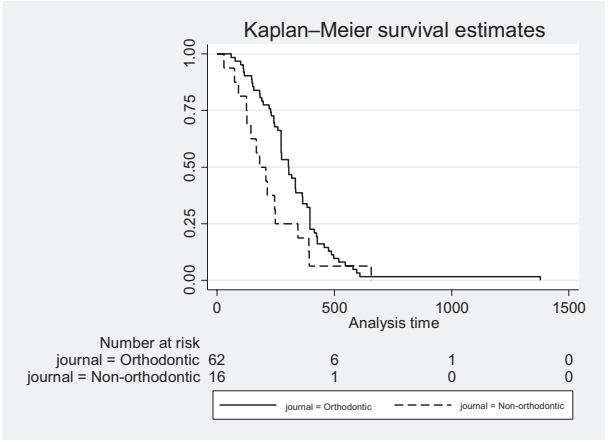
Due to the continuous growth of evidence, SR results are prone to changes over time, which can undermine their clinical relevance. To expand the potential evidence retrieval from SRs, it is important to constantly consider information currency and the need for updates (18). According to the Cochrane Collaboration's protocols, Cochrane reviews should be evaluated for updating within 2 years after publication, and authors have to consent to keep reviews up-to-date at the time of registration. Nonetheless, a priority-setting approach instead of a time-based approach to the updating of SRs may be more appropriate (19). The length of time from last search to publication has been proposed as a simple measure of the recency of a review (16). A median period of 13.2 months elapsed between the dates of search and PubMed citation of the orthodontic SRs analysed by this study. Approximately 70 per cent of the lifespan of a review, estimated from the search date, was devoted in production and publication. Similarly, time lags of 8.0 and 14.0 months have been estimated for Medline (16) and ACP Journal Club SRs (15). We attempted to determine differences in publication process times of orthodontic SRs published in specialty and non-specialty journals. SRs published in non-orthodontic journals were published faster compared with SRs published in orthodontic journals, and such an observation may deserve the attention of granting agencies, journal editors, and systematic reviewer groups. However, prioritization for publication by the journal editor may potentially shorten the time lag between acceptance and publication.

Our study found that most orthodontic SRs appeared in PubMed within the last 5 years did not include a statement of adherence to any reporting guidelines. The PRISMA Statement or its predecessor QUOROM was the most commonly used reporting instruments. Interestingly, PICO, not a guideline, was also frequently cited. *A priori* protocol definition by means of registration in electronic databases may prevent manipulation of study results (7). The first year of the PROSPERO initiative was deemed satisfactory in numbers of registered protocols of SRs (20). Registration of SR protocols in orthodontics is low (4) as PROSPERO is expanding and gaining

A.



B.



C.

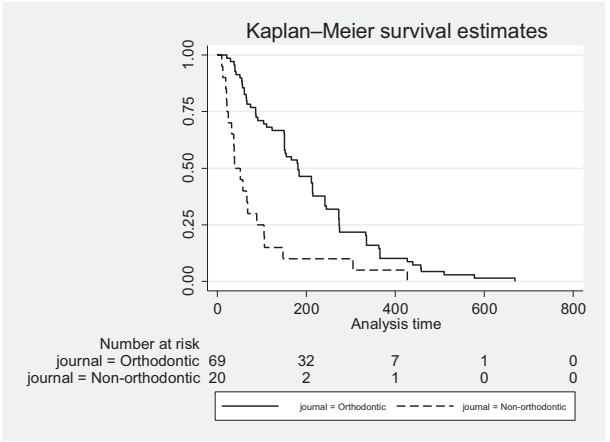


Figure 1. Kaplan–Meier survival estimates for the lags between search-publication (A), submission-publication (B), and acceptance-publication. The Kaplan–Meier plot on the x-axis indicates the number of days and the y-axis the proportion of systematic reviews (SRs) reaching the event (such as submission, acceptance, and publication) by the corresponding day. The numbers at risk indicate the number of SRs contributing data to the analysis at the search (A), submission (B), and acceptance (C) stages.

Table 3. Reported compliance of systematic review to reporting guidelines by journal type. MOOSE, Meta-analysis Of Observational Studies in Epidemiology; NHS, National Health Service; PICO, Participants, Intervention, Comparison, Outcomes; PRISMA, Preferred Reporting Items for Systematic reviews and Meta-Analyses; QUOROM, QUality Of Reporting Of Meta-analyses.

	Journals	
	Orthodontic	Non-orthodontic
Guidelines	*N* (%)	*N* (%)
No guidelines	47 (68.1)	22 (31.9)
PRISMA	16 (72.7)	6 (27.3)
QUOROM	2 (100.0)	0 (0)
MOOSE	3 (75.0)	1 (25.0)
Cochrane Handbook for Systematic Reviews	4 (100.0)	0 (0)
NHS	6 (85.7)	1 (14.3)
PICO	11 (84.6)	2 (15.4)
Article	1 (100.0)	0 (0)
Multiple	3 (60.0)	2 (40.0)

awareness. Given the relatively recent launch of SR registration databases, prospective registration may be expected to be embraced by increasingly more reviewer groups in the future.

On average, four bibliographic databases were searched per SR. This finding approximates the median of three electronic databases and two other sources that have been reported elsewhere (21). Moreover, a cross-sectional observational study of oral health SRs published in the period 1991–2012 concluded that up to two databases were searched by nearly half of the non-Cochrane reviews (22). In our study, we observed that one to two databases were reviewed by nearly 22 per cent of the SRs. In the interest of SR users, limited database search may prevent identification of relevant articles, which in turn may introduce bias and mislead decision making in clinical practice.

In addition, to increase the chances of obtaining important information (23) and to reduce the risk of publication bias (24), checking of reference lists is recommended. A previous study has reported that hand-searching of article references can result in identification of additional relevant studies by 2.5–42.7 per cent (23). In this study, the overwhelming majority of the SRs carried out hand-searching, however, efforts to locate unpublished research were reported in only a quarter of SRs.

Literature reviewers scrutinize initially the abstract to decide whether the study falls within the range of interest, and subsequently obtain the full text of the article. Databases and time points allied to literature search should be enclosed in abstracts to clearly indicate the completeness and recency of the review (16). Notwithstanding the assumption that structured abstract formats present detailed and high-quality information (25), the presence of structure *per se* does not ensure comprehensiveness in providing information (5). On the other hand, constraints placed on length and word count by abstract standard formats may result in inadequate reporting. Although search dates were generally provided, databases were not specified in most SR abstracts regardless of journal type. Omission of names and search dates of databases has been also identified by previous analysis of orthodontic SRs (6). On a similar note, Beller *et al.* (16) recently reported that only 47.0 per cent of Medline SRs provided the search dates, and 60.3 per cent of the SRs provided the databases in the abstract.

There are several limitations associated with this study. To determine whether a SR has been up-to-date or not, we focused on the

time lag between last search and publication dates. Alternatively, surveillance systems and methods to identify signals for the need to update SRs (26, 27) are also available. Missing dates and inaccuracies in calculating the time intervals may be foreseen wherever exact dates were not presented, and the last day of the month was considered instead. We did not assess whether the implementation of cited checklists was carried out properly. Furthermore, the search was limited to PubMed, and therefore, it is likely that inclusion of additional databases would have yielded more SRs. Prerequisites imposed by granting agencies and journal editors such as documentation of SR training and inclusion of protocols along with completed review submissions have been proposed to endorse improvement of reporting standards (21). Given the lack of consensus on optimum reporting, other authors have urged for refinement and unification of available instruments to ensure inclusive reporting and guidance of novice researchers and SR users (15, 24, 28). As new research evidence may accumulate rapidly, shortening of review and revision processes (16), and mandatory updating for searches performed over 12 months prior to the submission (17) should be the goal. At the same time, SR readers are cautioned to look for more recent studies and examine the consistency of the results with those of the latest review (17).

Conclusions

The results of this study indicate a median time of 13.2 months was required for orthodontic SRs to reach publication. SRs appeared to get published faster after acceptance in non-orthodontic compared with orthodontic journals. Most of the SRs cited some sort of reporting guidelines, but failed to report SR protocol registration.

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