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Original article

Authorship characteristics of orthodontic randomized controlled trials, systematic reviews, and meta-analyses in non-orthodontic journals with impact factor

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Summary

Background/Objective: This study was conducted to explore authorship characteristics and publication trends of all orthodontic randomized controlled trials (RCTs), systematic reviews (SRs), and meta-analyses (MAs) published in non-orthodontic journals with impact factor (IF).

Materials and methods: Appropriate research strategies were developed to search for all articles published until December 2015, without restrictions regarding language or publication status. The initial search generated 4524 results, but after application of the inclusion criteria, the final number of articles was reduced to 274 (SRs: 152; MAs: 36; and RCTs: 86). Various authorship characteristics were recorded for each article. Frequency distributions for all parameters were explored with Pearson chi-square for independence at the 0.05 level of significance.

Results: More than half of the included publications were SRs (55.5 per cent), followed by RCTs (31.4 per cent) and MAs (13.1 per cent); one hundred seventy-eight (65 per cent) appeared in dental journals and 96 (35 per cent) were published in non-dental journals. The last decade was significantly more productive than the period before 2006, with 236 (86.1 per cent) articles published between 2006 and 2015. European countries produced 51.5 per cent of the total number of publications, followed by Asia (18.6 per cent) and North America (USA and Canada; 16.8 per cent).

Limitations: Studies published in journals without IF were not included.

Conclusions/Implications: Level-1 evidence orthodontic literature published in non-orthodontic journals has significantly increased during 2006–15. This indicates a larger interest of other specialty journals in orthodontic related studies and a trend for orthodontic authors to publish their work in journals with impact in broader fields of dentistry and medicine.

Introduction

Evidence-based clinical decision making is achieved by combining the most current scientific evidence with clinical experience, and individual patient's needs and expectations (1, 2). The purpose of scientific periodicals is to introduce, publish, and disseminate new knowledge produced by imaginative thinking, and vigorous and systematic research (3). Journals are commonly ranked based on their impact factor (IF), which measures a journal's impact by assessing the citation frequency of its published articles within a certain time frame (4). However, IF is not an ideal measure for quality (5). The quality of a published article is evaluated according to the level of evidence it conveys with systematic reviews (SRs), including or not a meta-analyses (MAs), and randomized controlled trials (RCTs) providing the highest possible level of scientific evidence (6).

An indirect method to assess the quality of literature within a scientific field would thus be to gather information regarding high-quality published articles. Bibliometric data from various dental specialities exhibit clear trends towards international collaborations and higher quality publications (7–11). Evidently, electronic databases and open-access (OA) publications have enhanced access to information and cross-specialty communication. In recent years, there has been a significant increase of OA publications in dentistry with 45.8 per cent of all articles in a given year being available as 'open-access' (12). In orthodontics, there has also been a dramatic increase in original published literature during the last three decades (13–15), which is also accompanied by an increase in the number of orthodontic journals with IFs from three to seven since 2008. Following this trend, the number of high-quality orthodontic articles (i.e. SRs, MAs, and RCTs) has significantly increased as well. A recent comprehensive review of the entire orthodontic literature from 1900 to 2013 revealed that 77.2 per cent of all SRs, MAs, and RCTs were published during 2004–13) (16).

Although the quality of orthodontic journals has evidently improved, their IFs remain relatively weak due to their low circulation among other groups of scientific readerships. Furthermore, high quality research tends to receive larger exposure (as measured from the citation count of a certain article) when published in a journal with high IF, even if the journal is not directly related to the same scientific field (17). Although this phenomenon has previously been reported in the orthodontic literature (13), the data presented included all types of publications (reviews, case reports, etc.), thus masking information regarding high quality orthodontic research. Therefore, the aim of this investigation was to explore demographic characteristics of SRs, MAs, and RCTs published in SCIE-indexed (Science Citation Index Expanded) non-orthodontic journals. The outcomes will supplement previously published data (16) in providing a comprehensive outlook on level-1 evidence orthodontic literature.

Materials and methods

Search strategy

Precise search strategies were developed and executed in order to identify all SRs, MAs, and RCTs published in non-orthodontic journals with IF since 1900. In order to identify SCIE-indexed non-orthodontic journals, all journals included in the search results were crosschecked with the latest listing of scientific journals with IF (18), by two authors (ARA and GK) separately. A detailed list of all included journals is displayed in Supplementary Table 1. The search was based on the strategy developed for MEDLINE, but was revised for each database in order to account for differences in controlled vocabulary and syntax rules. The following electronic databases were searched (Table 1, and Supplementary Tables 1 and 2): MEDLINE via PubMed (http://www.ncbi.nlm.nih.gov/pubmed), Scopus (http://www.scopus.com), Web of Science™ Core Collection (http://apps.webofknowledge.com/), Google Scholar (https://scholar.google.com), and Ovid database (*http://ovidsp.tx.ovid.com*). Each database was searched individually and included all articles published until December 2015. The results were exported into Endnote (X7.2.1 version: Thomson Reuters™, USA) in order to eliminate all duplicates. No restrictions were applied during the

Table 1. Individual database search.

Database	Search strategy	Hits
General Sources		
MEDLINE via PubMed http://www.ncbi.nlm.nih.gov/pubmed	("orthodont*" AND "meta-analysis") and ("orthodont*" AND "systematic review") and ("orthodont*" AND "randomised control trial") and ("orthodont*" AND "randomized control trail") Timespan: All years until December 2015. All field.	1556
Scopus https://www.scopus.com/	("orthodont*" AND "meta-analysis") and ((orthodont*) AND systematic review) and ("orthodont*" AND "randomised control trial") and ("orthodont*" AND "randomized control trail") Timespan: All years until December 2015.	415
Web of Science™ Core Collection	TOPIC: ("orthodont*" AND "meta-analysis") and ("orthodont*" AND "systematic review") and ("orthodont*" AND "randomised control trial") and ("orthodont*" AND "randomized control trail") Timespan: All years until December 2015. Search language=Auto	545
Ovid database	Keyword: ("orthodont*" AND "meta-analysis") and ("orthodont*" AND "systematic review") and ("orthodont*" AND "randomised control trial") and ("orthodont*" AND "randomized control trail") Timespan: All years until December 2015.	1258
Grey literature sources		
Google Scholar	("orthodont*" AND "meta-analysis") and ("orthodont*" AND "systematic review") and ("orthodont*" AND "randomised control trial") and ("orthodont*" AND "randomized control trail") Timespan: All years until December 2015.	774

electronic search regarding language or publication status. However, articles without an abstract in English were excluded. Portable Document Format (PDF) files of all articles were downloaded, saved, and arranged according to journal and type of article in an external hard drive. Articles that were not available in electronic format were hand searched, scanned, and added to the electronic database.

After completion of the electronic database and removal of all duplicates, all articles' abstracts were reviewed by authors ARA and SN individually to exclude articles that did not meet criteria for SRs, MAs, and RCTs. Articles clearly stating, in the title or the abstract, that they included a 'Systematic Review', 'Meta-analysis', or 'Randomized Controlled Trial' directly. In systematic reviews with no mention of data synthesis in the abstract, the full text was scanned to determine whether a meta-analysis was performed. Disagreements were resolved by discussion between the two authors and through consultation with authors GK and AEA. If the abstract was not clear regarding the nature of the study, the full text of the article was also reviewed by all authors. The comprehensive review generated 274 articles that met all inclusion criteria (Figure 1).

Data extraction

The first author recorded the following parameters and extracted them in an Excel worksheet (Microsoft Excel, Microsoft©, Redmond, WA, USA): 1. journal name, 2. type of journal (dental/non-dental), 3. year of publication, 4. publication period (before 2006/2006–15), 5. type of article (SR/MA/RCT), 6. number of authors, 7. country name, and 8. region of origin (North America/Europe (EU)/Europe (non-EU)/Central and South America/Asia/Oceania/Africa) as shown in Supplementary Table 3.

Although, by definition meta-analyses are systematic reviews using statistical methods to summarize results, it was decided to explore them as two different groups for the purpose of this investigation.

Statistical analysis

Data were explored with descriptive statistics and frequency distributions. Pearson's chi-square test or Fisher's exact test was used to evaluate associations between various parameters at the 0.05 level of statistical significance. In order to account for multiple comparisons, a Bonferroni adjustment was performed. All statistical analyses were performed with SPSS version 24 (SPSS, IBM©, Armonk, NY, USA).

Results

Frequency distributions between various regions of origin

The numerical and percentage distribution of articles from various geographical regions in relationship to the studied parameters is displayed in Table 2. More than half of all included articles in non-orthodontic journals were SRs (55.5 per cent), and 65 per cent were published in dental periodicals. European countries (EU and non-EU) published more than half (51.5 per cent), followed by Asia (18.6 per cent), North America (US and Canada; 16.8 per cent), Central and South America (10.2 per cent), Africa (1.8 per cent), and Oceania (1.1

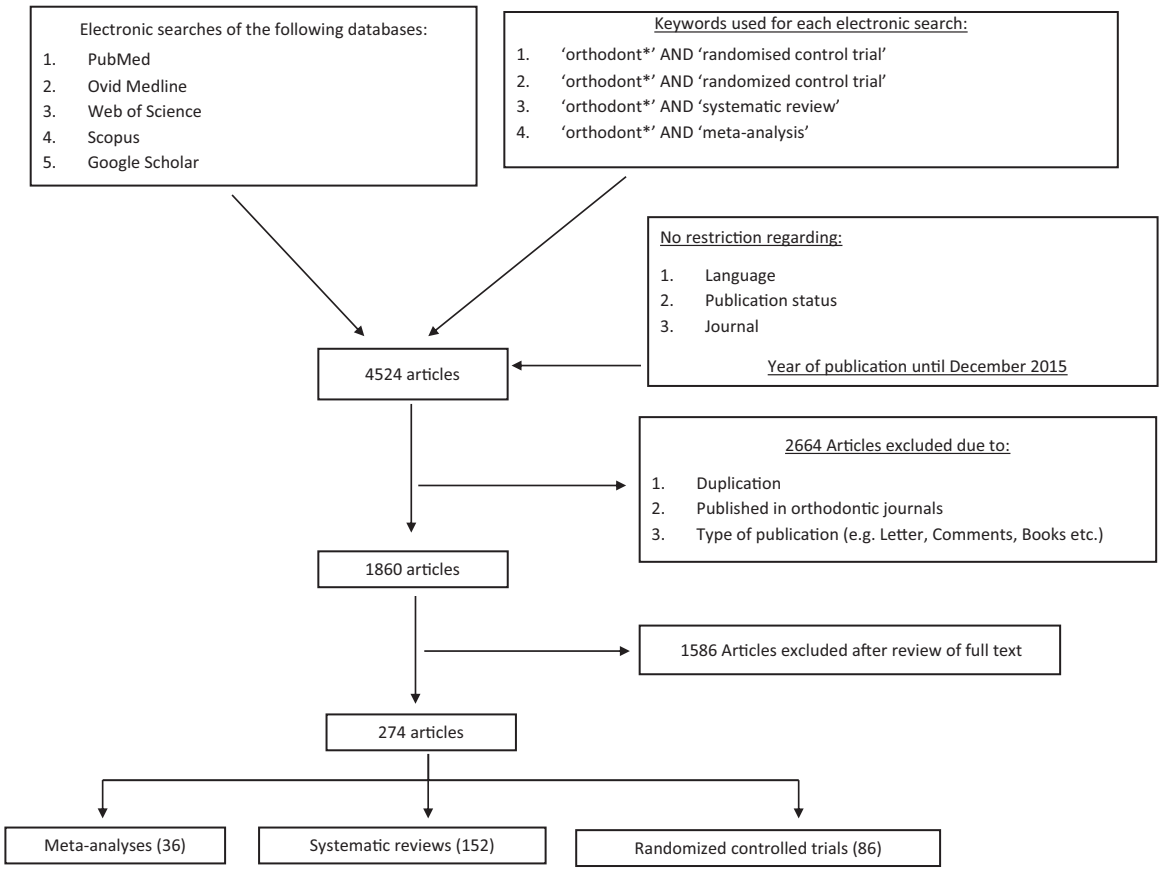

Figure 1. Detailed search strategy.

Table 2. Frequency distributions of all orthodontic articles over the entire observation period in relation to their geographic region of origin, article type, journal type, and number of authors.

		Number (N)/per cent (%) of articles between regions of origin							
		Total number (% within article type, journal type, number of authors) (% within region of origin)							
	Total N (% of total)	North America	Europe-EU	Europe–non-EU	Central and South America	Asia	Oceania	Africa	*P*-value
Article type									
RCTs	86 (31.4)	15 (17.4) (32.6)	44 (51.2) (34.6)	3 (3.5) (21.4)	9 (10.5) (32.1)	11 (12.8) (21.6)	3 (3.5) (100.0)	1 (1.2) (20.0)	0.278*
SRs	152 (55.5)	24 (15.8) (52.2)	72 (47.4) (56.7)	9 (5.9) (64.3)	15 (9.9) (53.6)	29 (19.1) (56.9)	0 (0.0) (0.0)	3 (2.0) (60.0)	
MAs	36 (13.1)	7 (19.4) (15.2)	11 (30.6) (8.7)	2 (5.6) (14.3)	4 (11.1) (14.3)	11 (30.6) (21.6)	0 (0.0) (0.0)	1 (2.8) (20.0)	
Journal type									
Dental	178 (65.0)	40 (22.5) (87.0)	73 (41.0) (57.5)	13 (7.3) (92.9)	15 (8.4) (53.6)	32 (18.0) (62.7)	2 (1.1) (66.7)	3 (1.7) (60.0)	0.001*
Non-dental	96 (35.0)	6 (6.3) (13.0)	54 (56.3) (42.5)	1 (1.0) (7.1)	13 (13.5) (46.4)	19 (19.8) (37.3)	1 (1.0) (33.3)	2 (2.1) (40.0)	
Number of authors									
One	18 (6.6)	5 (27.8) (10.9)	9 (50.0) (7.1)	0 (0.0) (0.0)	0 (0.0) (0.0)	4 (22.2) (7.8)	0 (0.0) (0.0)	0 (0.0) (0.0)	0.111*
Two	33 (12.0)	8 (24.2) (17.4)	13 (39.4) (10.2)	4 (12.1) (28.6)	1 (3.0) (3.6)	5 (15.2) (9.8)	0 (0.0) (0.0)	2 (6.1) (40.0)	
Three	43 (15.7)	8 (18.6) (17.4)	20 (46.5) (15.7)	1 (2.3) (7.1)	2 (4.7) (7.1)	9 (20.9) (17.6)	1 (2.3) (33.3)	2 (4.7) (40.0)	
Four	57 (20.8)	5 (8.8) (10.9)	31 (54.4) (24.4)	6 (10.5) (42.9)	6 (10.5) (21.4)	8 (14.0) (15.7)	1 (1.8) (33.3)	0 (0.0) (0.0)	
Five	51 (18.6)	8 (15.7) (17.4)	26 (51.0) (20.5)	3 (5.9) (21.4)	7 (13.7) (25.0)	6 (11.8) (11.8)	0 (0.0) (0.0)	1 (2.0) (20.0)	
Six	38 (13.9)	7 (18.4) (15.2)	17 (44.7) (13.4)	0 (0.0) (0.0)	6 (15.8) (21.4)	8 (21.1) (15.7)	0 (0.0) (0.0)	0 (0.0) (0.0)	
More than six	34 (12.4)	5 (14.7) (10.9)	11 (32.4) (8.7)	0 (0.0) (0.0)	6 (17.6) (21.4)	11 (32.4) (21.6)	1 (2.9) (33.3)	0 (0.0) (0.0)	

The level of statistical significance was adjusted to $P = 0.0167$ after a Bonferroni correction.

*P-values calculated with the Fisher exact test.

per cent). However, the distribution of the three types of publications was not significantly different between regions ($P = 0.278$).

Articles originating from EU countries and South and Central America presented a more balanced distribution between dental and non-dental journals (Table 2), whereas other regions were represented primarily in dental journals ($P = 0.001$). The frequency distribution for number of authors was similar between regions ($P = 0.111$), and the majority of publications (65.7 per cent) were a collaborative result of four or more authors.

Comparisons between the last decade (2006–15) and the time period 1900–2005 (Table 3)

The last observed decade between 2006 and 2015 included 236 (86.1 per cent) articles published in non-orthodontic journals. Frequency distributions revealed that before 2006, RCTs represented a larger percentage of all level-1 evidence articles (65.8 per cent) compared with SRs (26.3 per cent) and MAs (7.9 per cent), which appeared less often. On the contrary, after 2006, the percentage of SRs and MAs increased dramatically, whereas RCTs were no longer so highly represented (25.8 per cent; $P < 0.001$). Also, most articles were published in dental journals, a trend which was equally observed in both observation periods ($P = 0.908$).

Significant differences in the frequency distribution between various regions of origin were revealed between the last decade and the time period before 2006. The percentage of articles coming from North America and the EU decreased significantly during the last decade, compared with articles from non-EU European countries, Asia, and Central and South America ($P < 0.001$). The latter three regions produced only one article (2.6 per cent) during the period before 2006, whereas in the last decade this number increased to 92 (33.6 per cent).

Regarding the number of authors of each publication, there were no significant differences in the distribution of articles between the two observation periods ($P = 0.995$), with more than 60 per cent of articles published by four or more co-authors.

Comparisons between types of articles

Frequency distributions between different types of articles are displayed in Table 4 and Figure 2. There was no difference between dental and non-dental journals in the frequency in which they published each type of article ($P = 0.60$). SRs were represented more than the other two categories of articles in both types of journals (Figure 2). In regards to the degree of collaboration for each article, it appeared that RCTs were mostly published by four or more authors (76.7 per cent). Although more than half of SRs and MAs were also a collaborative effort of four or more authors, some were published by one or two authors alone ($P = 0.037$; Table 4).

Discussion

This investigation explored the demographic characteristics of all level-1 evidence articles in orthodontics that have been published in SCIE-indexed non-orthodontic periodicals. It provides important bibliometric data that can be used to indirectly assess the quality of the orthodontic literature since 1900. The results revealed certain publication trends in regards to geographic origin of published articles and type of article. They also demonstrated significant differences between the last observed decade (2006–15) and the previous period (1900–2005).

The volume of orthodontic RCTs, SRs, and MAs in non-orthodontic journals has increased remarkably during the last decade, with 86.1 per cent of all included studies having been published during that period. This may be an indication of higher acceptance rates of high quality orthodontic publications in other scientific (dental and non-dental) journals. Considering the larger readership that most non-orthodontic journals have, one can assume that orthodontics has improved its overall status among other scientific fields over the last years, which is in accordance with the great emphasis given to evidence-based orthodontic practice (19, 20). From a different scope, however, this observation could also be attributed to an expansion of journals into more scientific fields, including orthodontics, or to a noticeable increase of orthodontic articles published in recently emerging open-access journals (12). In addition, higher acceptance rates of level-1 evidence orthodontic articles in non-orthodontic journals could be related to higher submission rates of these types of articles in journals with higher IFs in order to increase their impact (17) and improve the academic standing of their authors.

Prior to 2003, 45 per cent of all orthodontic articles were published in non-orthodontic journals; however, this percentage refers to original articles, but also to case reports and literature reviews (13). Previously published data exhibited that the literature consisting of SCIE-indexed orthodontic journals included 557 RCTs, SRs, and MAs between 1900 and 2013 (16). In the present data, we found 194 RCTs, SRs, and MAs published between 1900 and 2013. These results in combination show that there are 751 level-1 evidence orthodontic articles in the entire scientific literature until 2013, out of which 25.8 per cent (194/751) were published in non-orthodontic journals, a much lower percentage than the one reported in 2003 (13). It can thus be concluded that although the amount of level-1 evidence orthodontic articles has increased remarkably in the last decade, still the vast majority is being published in orthodontic journals. In addition, a breakdown of the last observed decade (2006–15) revealed that 80 (30 per cent) RCTs, SRs, and MAs in non-orthodontic journals were published in 2014 and 2015. Although there are no comparative data to further comment upon this finding, it certainly indicates that, in the future, the orthodontic literature is expected to increase its overall scientific impact even further.

Another interesting observation relates to the discrepancy between orthodontic journals and non-orthodontic journals regarding the publication of SRs. The previous study by Kanavakis *et al.* (16) reported that 112 out of 557 (20.1 per cent) of level-1 evidence articles in orthodontic journals were SRs. In the present study, the equivalent percentage was almost 49.5 per cent (96/194), for the same observation period (until 2013). Due to the high scientific value of systematic reviews and the well-summarized information that they provide, non-orthodontic journals might be more likely to accept them compared with RCTs, which are more speciality-specific. Furthermore, authors often prefer to submit systematic reviews to journals with higher IFs in order to increase their impact in other fields and meet specific promotion requirements.

Our results also revealed publication trends related to the geographic origin of articles. There was a significantly larger representation of RCTs, SRs, and MAs originating from Europe (EU), Asia, and Central and South America that were published in non-dental journals (Table 2). Due to the publicity and citation counts of an article being related to the IF of a journal (21, 22), authors prefer to publish their work in high impact journals even if they are not immediately related to the scientific scope of the article itself. This is more evident in the above-mentioned geographic regions, where, possibly, there is larger incentive for authors and institutions to accumulate

Table 3. Frequency distributions of all orthodontic articles for the two periods in association with article type, journal type, region of origin, and number of authors.

		Number (N)/per cent (%) per time interval		
		Total number (% within article type, journal type, region of origin, and number of authors) (% within interval)		
	Total N (% of total)	<2006	2006–15	*P*-value
Article type				
RCTs	86 (31.4)	25 (29.1) (65.8)	61 (70.9) (25.8)	<0.001
SRs	152 (55.5)	10 (6.6) (26.3)	142 (93.4) (60.2)	
MAs	36 (13.1)	3 (8.3) (7.9)	33 (91.7) (14.0)	
Journal type				
Dental	178 (65.0)	25 (14.0) (65.8)	153 (86.0) (64.8)	0.908
Non-dental	96 (35.0)	13 (13.5) (34.2)	83 (86.5) (35.2)	
Region of origin				
North America	46 (16.8)	8 (17.4) (21.1)	38 (82.6) (16.1)	<0.001
Europe-EU	127 (46.4)	26 (20.5) (68.4)	101 (79.5) (42.8)	
Europe–Non-EU	14 (5.1)	0 (0.0) (0.0)	14 (100.0) (5.9)	
Central and South America	28 (10.2)	0 (0.0) (0.0)	28 (100.0) (11.9)	
Asia	51 (18.6)	1 (2.0) (2.6)	50 (98.0) (21.2)	
Oceania	3 (1.1)	2 (66.7) (5.3)	1 (33.3) (0.4)	
Africa	5 (1.8)	1 (20.0) (2.6)	4 (80.0) (1.7)	
Number of authors				
One	18 (6.6)	2 (11.1) (5.3)	16 (88.9) (6.8)	0.995*
Two	33 (12.0)	6 (18.2) (15.8)	27 (81.8) (11.4)	
Three	43 (15.7)	6 (14.0) (15.8)	37 (86.0) (15.7)	
Four	57 (20.8)	8 (14.0) (21.1)	49 (86.0) (20.8)	
Five	51 (18.6)	7 (13.7) (18.4)	44 (86.3) (18.6)	
Six	38 (13.9)	5 (13.2) (13.2)	33 (86.8) (14.0)	
More than six	34 (12.4)	4 (11.8) (10.5)	30 (88.2) (12.7)	

The level of statistical significance was adjusted to $P = 0.0125$ after a Bonferroni correction.*P-value calculated with Fisher's exact test.

higher impact scores. Furthermore, a significantly higher representation of the same regions was observed during the last decade (Table 3), a phenomenon that was also trending in high-quality articles published in SCIE-indexed orthodontic journals (16). Beyond doubt, the productivity of Asian and Central and South American countries has increased tremendously in the last years indicating emerging differences between universities and countries in their academic performance. Similar observations have also been made in other scientific fields (23, 24), creating an overall impression that the scientific community is expanding, and knowledge is being produced worldwide. In the past, there was a 'brain drain' towards developed countries where research opportunities and funding were largely available (24). This appears to be changing as other geographic regions develop, and new economic and academic ecosystems are formed.

Although the numerical increase of orthodontic RCTs, SRs, and MAs is an indication that the orthodontic literature has improved, important questions remain regarding the quality of these articles.

Table 4. Associations between type of article and number of authors.

		Number of authors							
		Total number (% within article type)							
Article type	Total	1	2	3	4	5	6	>6	*P*-value
RCTs	86	3 (3.5)	6 (7.0)	11 (12.8)	20 (23.3)	17 (19.8)	12 (14.0)	17 (19.8)	0.037*
SRs	152	13 (8.6)	24 (15.8)	21 (13.8)	28 (18.4)	32 (21.1)	21 (13.8)	13 (8.6)	
MAs	36	2 (5.6)	3 (8.3)	11 (30.6)	9 (25.0)	2 (5.6)	5 (13.9)	4 (11.1)	

**P*-value calculated with Fisher's exact test.

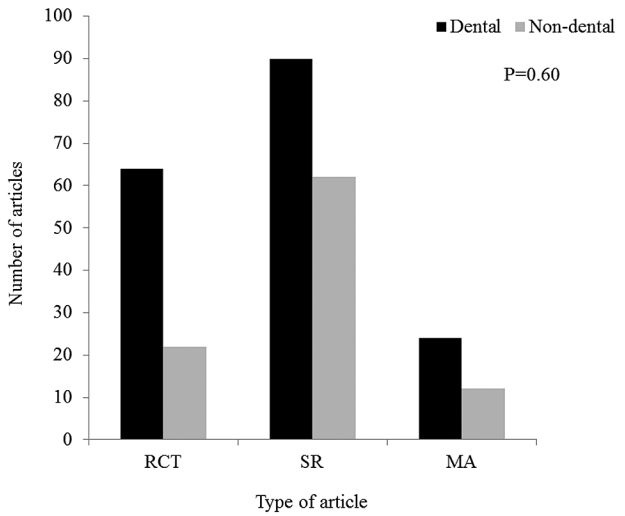

Figure 2. Distribution of different types of articles between dental and non-dental journals with impact factor.

When the inclusion criteria for this investigation were applied, there were clear differences between articles of the same type. Previous assessments of level-1 evidence orthodontic articles have almost unanimously reported that the quality of orthodontic RCTs, SRs, and MAs is suboptimal in most cases (25–29). The publication of poor medical research has raised concerns in the past as well (30), hinting towards a need to improve the peer-review process and enforce stricter criteria for conducting good research. For the same purpose, the CONSORT group has developed a list of guidelines for reporting medical research (31). Adherence to these guidelines has been shown to significantly improve research quality (32, 33), and thus, their implementation is highly recommended for future research.

Another concern that might potential arise from this investigation is the 'leakage' of orthodontic knowledge through publications in non-orthodontic journals. If the most important developments in our field are published in journals that are not easily accessible by the average orthodontist, this could potentially have an adverse impact on the application of modern knowledge in everyday orthodontic practice. It could be beneficial if orthodontic journals presented summaries of interesting orthodontic articles appearing in non-orthodontic journals in order to better educate their readership.

This investigation adds to previously published results regarding the demographic characteristics of RCTs, SRs, and MAs published in SCIE-indexed orthodontic journals (16). In summary, these two studies provide complete information regarding publication trends in the level-1 evidence orthodontic literature. Future research could potentially focus on further exploring the orthodontic literature by identifying chronological trends in research interests, and further background information about authors, research, and academic institutions.

Limitations

This investigation did not include level-1 evidence studies published in non-orthodontic journals that are not SCIE indexed, or studies that did not include the term 'orthodont*' in their title, abstract, or keywords. In addition, the implemented search strategy was limited to very specific terms and could have been more extensive in order to increase the spectrum of retrieved articles (34). However, due to the very long observation period and the large number of included journals, it was preferred to increase the precision of the search and reduce its sensitivity (35). In addition, it is unlikely that a more extensive search would have altered the results of this investigation noticeably (36).

Conclusions

1. In SCIE-indexed non-orthodontic journals, 86.1 per cent of orthodontic RCTs, SRs, and MAs publications took place between 2006 and 2015.
2. In SCIE-indexed dental journals, 65 per cent of articles were published.
3. Articles from Central and South America, Asia, and non-EU countries significantly increased their contributions during the decade 2006–15.

Supplementary material

Supplementary material is available at *European Journal of Orthodontics* online.

Conflict of interest

The authors declare that they do not have any financial or non-financial conflict of interest regarding this study.

References

1. Sackett, D.L., Rosenberg, W.M., Gray, J.A., Haynes, R.B. and Richardson, W.S. (1996) Evidence based medicine: what it is and what it isn't. *British Medical Journal (Clinical Research Ed.)*, 312, 71–72.

2. Gray, J.A. (1997) Evidence-based public health—what level of competence is required? *Journal of Public Health Medicine*, 19, 65–68.
3. Eliades, T. and Athanasiou, A.E. (2001) Impact factor. A review with specific relevance to orthodontic journals. *Journal of Orofacial Orthopedics*, 62, 74–83.
4. Garfield, E. (1996) How can impact factors be improved? *British Medical Journal (Clinical Research Ed.)*, 313, 411–413.
5. Garfield, E. (2006) The history and meaning of the journal impact factor. *JAMA*, 295, 90–93.
6. Higgins, J. and Green, S. Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [updated March 2011], The Cochrane Collaboration. http://handbook.cochrane.org (January 2016, date last accessed).
7. Geminiani, A., Ercoli, C., Feng, C. and Caton, J.G. (2014) Bibliometrics study on authorship trends in periodontal literature from 1995 to 2010. *Journal of Periodontology*, 85, e136–e143.
8. Nishimura, K., Rasool, F., Ferguson, M.B., Sobel, M. and Niederman, R. (2002) Benchmarking the clinical prosthetic dental literature on MEDLINE. *The Journal of Prosthetic Dentistry*, 88, 533–541.
9. Barão, V.A., Shyamsunder, N., Yuan, J.C., Lee, D.J., Assunção, W.G. and Sukotjo, C. (2011) Authorship, collaboration, and funding trends in implantology literature: analysis of five journals from 2005 to 2009. *Implant Dentistry*, 20, 68–75.
10. Kim, M.Y., Lin, J., White, R. and Niederman, R. (2001) Benchmarking the endodontic literature on MEDLINE. *Journal of Endodontics*, 27, 470–473.
11. Yang, S., Needleman, H. and Niederman, R. (2001) A bibliometric analysis of the pediatric dental literature in MEDLINE. *Pediatric Dentistry*, 23, 415–418.
12. Hua, F., Sun, H., Walsh, T., Worthington, H. and Glenny, A.M. (2016) Open access to journal articles in dentistry: prevalence and citation impact. *Journal of Dentistry*, 47, 41–48.
13. Mavropoulos, A. and Kiliaridis, S. (2003) Orthodontic literature: an overview of the last 2 decades. *American Journal of Orthodontics and Dentofacial Orthopedics*, 124, 30–40.
14. Kanavakis, G., Spinos, P., Polychronopoulou, A., Eliades, T., Papadopoulos, M.A. and Athanasiou, A.E. (2006) Orthodontic journals with impact factors in perspective: trends in the types of articles and authorship characteristics. *American Journal of Orthodontics and Dentofacial Orthopedics*, 130, 516–522.
15. Baumgartner, S., Pandis, N. and Eliades, T. (2014) Exploring the publications in three major orthodontic journals: a comparative analysis of two 5-year periods. *The Angle Orthodontist*, 84, 397–403.
16. Kanavakis, G., Dombroski, M., Malouf, D. and Athanasiou, AE. (2015) Demographic charactaristics of systematic reviews, meta-analysis, and randomized controlled trials in orthodontic journals with impact factor. *European Journal of Orthodontics*, 12, 1–9.
17. Allareddy, V., Shah, A., Lin, C.Y., Elangovan, S., Lee, M.K., Chung, K., Vasudavan, S. and Karimbux, N.Y. (2010) Randomized trials published in the journal of dental research are cited more often compared with those in other top-tier non-specialty-specific dental journals. *The Journal of Evidence-Based Dental Practice*, 10, 71–77.
18. ISI Web of Knowledge. http://thomsonreuters.com/journal-citationreports/. (January 2016, date last accessed).
19. Kokich, V.G. (2013) Do you have an evidence-based practice? *American Journal of Orthodontics and Dentofacial Orthopedics*, 143, 1.
20. Gianelly, A. (2006) Evidence-based therapy: an orthodontic dilemma. *American Journal of Orthodontics and Dentofacial Orthopedics*, 129, 596–8; discussion 598.
21. Filion, K.B. and Pless, I.B. (2008) Factors related to the frequency of citation of epidemiologic publications. *Epidemiologic Perspectives & Innovations: EP+I*, 5, 3.
22. Callaham, M., Wears, R.L. and Weber, E. (2002) Journal prestige, publication bias, and other characteristics associated with citation of published studies in peer-reviewed journals. *JAMA*, 287, 2847–2850.
23. Cappell, M.S. and Davis, M. (2008) A significant decline in the American domination of research in gastroenterology with increasing globalization from 1980 to 2005: an analysis of American authorship among 8,251 articles. *The American Journal of Gastroenterology*, 103, 1065–1074.
24. Rahman, M. and Fukui, T. (2003) Biomedical publication–global profile and trend. *Public Health*, 117, 274–280.
25. Harrison, J.E. (2003) Clinical trials in orthodontics II: assessment of the quality of reporting of clinical trials published in three orthodontic journals between 1989 and 1998. *Journal of Orthodontics*, 30, 309–15; discussion 297.
26. Fleming, P.S., Buckley, N., Seehra, J., Polychronopoulou, A. and Pandis, N. (2012) Reporting quality of abstracts of randomized controlled trials published in leading orthodontic journals from 2006 to 2011. *American Journal of Orthodontics and Dentofacial Orthopedics*, 142, 451–458.
27. Papageorgiou, S.N., Papadopoulos, M.A. and Athanasiou, A.E. (2011) Evaluation of methodology and quality characteristics of systematic reviews in orthodontics. *Orthodontics & Craniofacial Research*, 14, 116–137.
28. Papageorgiou, S.N., Papadopoulos, M.A. and Athanasiou, A.E. (2014) Assessing small study effects and publication bias in orthodontic meta-analyses: a meta-epidemiological study. *Clinical Oral Investigations*, 18, 1031–1044.
29. Papageorgiou, S.N., Papadopoulos, M.A. and Athanasiou, A.E. (2014) Reporting characteristics of meta-analyses in orthodontics: methodological assessment and statistical recommendations. *European Journal of Orthodontics*, 36, 74–85.
30. Altman, DG. (1994) The scandal of poor medical research. *British Medical Journal (Clinical Research Ed.)*, 308, 283–284.
31. Schulz, K.F., Altman, D.G. and Moher, D.; CONSORT Group. (2010) CONSORT 2010 Statement: updated guidelines for reporting parallel group randomised trials. *Journal of Clinical Epidemiology*, 63, 834–840.
32. Pandis, N., Shamseer, L., Kokich, V.G., Fleming, P.S. and Moher, D. (2014) Active implementation strategy of CONSORT adherence by a dental specialty journal improved randomized clinical trial reporting. *Journal of Clinical Epidemiology*, 67, 1044–1048.
33. Flint, H.E. and Harrison, J.E. (2010) How well do reports of clinical trials in the orthodontic literature comply with the CONSORT statement? *Journal of Orthodontics*, 37, 250–261.
34. Robinson, K.A. and Dickersin, K. (2002) Development of a highly sensitive search strategy for the retrieval of reports of controlled trials using PubMed. *International Journal of Epidemiology*, 31, 150–153.
35. McKibbon, K.A., Wilczynski, N.L. and Haynes, R.B.; Hedges Team. (2009) Retrieving randomized controlled trials from medline: a comparison of 38 published search filters. *Health Information and Libraries Journal*, 26, 187–202.
36. Royle, P. and Waugh, N. (2005) A simplified search strategy for identifying randomised controlled trials for systematic reviews of health care interventions: a comparison with more exhaustive strategies. *BMC Medical Research Methodology*, 5, 23.