

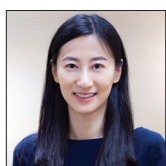


Original Article

Bibliometric analysis of research publications in three major orthodontic journals during 2012–2021

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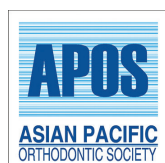
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ABSTRACT

Objectives: This study conducted a comprehensive bibliometric analysis of articles published from 2012 to 2021 in three orthodontic journals: *The American Journal of Orthodontics and Dentofacial Orthopedics* (AJODO), *The Angle Orthodontist* (AO), and *European Journal of Orthodontics* (EJO).

Material and Methods: Eligible articles published from 2012 to 2021 in AJODO, AO, and EJO were retrieved from the Web of Science Core Collection database and subsequently processed using CiteSpace software to generate their characteristics, including authorship, institution, geographic origin, keywords, and citation profiles.

Results: The three orthodontic journals published 4001 articles from 370 institutions in 95 countries from 2012 to 2021. The AJODO published the most articles (45.5%) followed by AO (31.3%) and EJO (23.2%). The most prolific country was the United States (US), followed by Brazil, South Korea, China, and Turkey. The authors from the US were heavily engaged in international collaborations, especially with South Korea and Brazil. The country and institutions with the highest citation counts per publication were Italy and the University of Bern (Switzerland), respectively. Pandis N was the most prolific author, and Proffit W was the most-cited author in the 4001 publications. The keywords that emerged most frequently were “children” followed by “orthodontic treatment” and “malocclusion.” Four of the 10 most-cited articles were related to digital dental technology.

Conclusion: This bibliometric analysis provides a complete picture of the research published in three major orthodontic journals over the past decade. It comprehensively analyzes the authorship, country of origin, institutions, keywords, and citation profiles of the articles.

Keywords: Bibliometrics, Orthodontic journals, Article characteristics, Citation analysis

INTRODUCTION

Orthodontics is a constantly evolving field of dentistry that involves exciting advancements both within and outside clinical settings. As the number of orthodontic publications grows worldwide, indicating an increasing interest in orthodontic research, the publication characteristics and citation profiles may well reveal the trends in orthodontics and thereby convey the latest discoveries and research prospects to the scientific community. Bibliometrics has emerged as a critical tool for assessing scientific activities and the publication trends of journals over time; they provide a complete picture of the general research landscape in a particular field.^[1,2] Bibliometrics involves the quantitative analysis of publication characteristics, such as authorship, institutions, countries, topics, publication journals, citation profiles, and other variables.^[1,2]

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Considered an effective approach for information retrieval and stratification, numerous bibliometric studies have been conducted in the various fields of medicine and dentistry specialties, including endodontics, periodontology, pediatric dentistry, implantology, prosthodontics, and oral and maxillofacial surgery.^[3-11] Several bibliometric studies have been conducted to gauge the performance and impact of orthodontic research in recent years. Most of these bibliometric studies have focused on the most-cited articles^[12-15] or specific parameters^[16,17] or have not included the most recent studies;^[18,19] thus, the overall orthodontic research profile of studies published in the past decade has not yet been comprehensively investigated.

To bridge this knowledge gap, this study conducted a comprehensive bibliometric analysis of all of the publications from 2012 to 2021 in three high-impact orthodontic journals: *The American Journal of Orthodontics and Dentofacial Orthopedics* (AJODO), *The Angle Orthodontist* (AO), and *European Journal of Orthodontics* (EJO). In the era of big data, the findings of this study will offer valuable insights into the past, present, and future of the orthodontic research field.

MATERIAL AND METHODS

Data acquisition

Three well-established high-impact orthodontic journals included in the Journal Citation Reports – AJODO, AO, and EJO – were selected for bibliometric analysis. The data were retrieved from the Web of Science Core Collection database on February 8, 2022, using the search strategy SO = (AJODO) OR SO = (AO) OR SO = (EJO). The search was restricted to publications within the past decade, from January 1, 2012, to December 31, 2021. Letters, editorials, corrections, meeting abstracts, biographical items, and book reviews were excluded. The records were retrieved in the “Full Records and Cited References” plain text file format. Each record contained pertinent data for analysis, such as the title, author, institution, country, keywords, abstract, and references. The 4001 eligible articles retrieved were subsequently processed using CiteSpace software (<http://cluster.ischool.drexel.edu/~cchen/citespace/download/>) to map the orthodontic research output over the past decade.

Data analysis

CiteSpace 5.8.R3, a multidimensional, time-sharing, and dynamic visualization analysis software application developed by Chen,^[20] was used to identify and analyze the countries, institutions, authors, journals, keywords, citations, and references cited in these publications. The Web of Science is the original input data source for CiteSpace. Author, institution, and country were selected for respective analyses.

The institutions and countries of all authors were counted, not limited to the first author. Keywords were selected for cooccurrence and burst analyses. Keyword bursts were used to investigate recurring keywords, analyze keywords with high citation bursts, and identify research frontier predictors. References were selected for cocitation analysis. The parameters were set as follows: Time slicing (2012–2021), year per slice (1), term source (all), and selection criteria (top 10%). The impact factors were obtained from the Journal Citation Reports. The article citations were retrieved from the Web of Science Core Collection. An online bibliometric tool (<https://bibliometric.com/>) was used to generate the country collaboration map.

RESULTS

Journal profiles

The trends in impact factors of the AJODO, AO, and EJO from 2012 to 2021 are shown in [Figure 1]. The impact factors of all three journals exhibited an upward trend over the past decade. The AJODO had the highest impact factor in 2012–2013, 2015, and 2018 before being replaced by EJO toward the end of the decade. A total of 4001 original articles published in the three journals from 2012 to 2021 were retrieved. The number of publications by AJODO (1821) was the highest, accounting for 45.5% of the total publications, followed by AO (1251, 31.3%) and EJO [929, 23.2%; Figure 2].

Country profile

Ninety-five countries contributed 4001 articles to the AJODO, AO, and EJO from 2012 to 2021. The top countries contributing the most articles are shown in [Figure 3 and Table 1]. The United States (US) published the highest number of articles (1003) and had the most citations (11,955) followed by Brazil (545 articles and

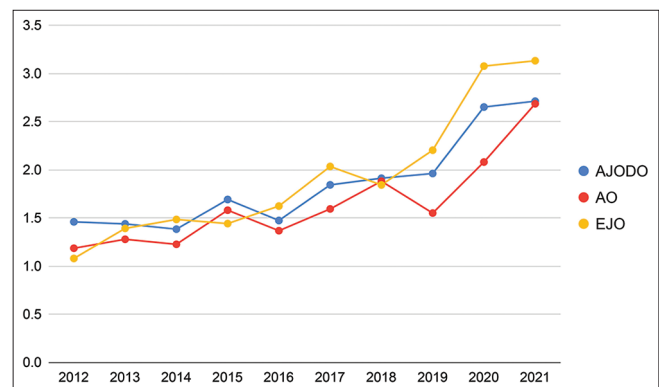


Figure 1: Trends in the impact factor of the American Journal of Orthodontics and Dentofacial Orthopedics, The Angle Orthodontist, and European Journal of Orthodontics from 2012 to 2021.

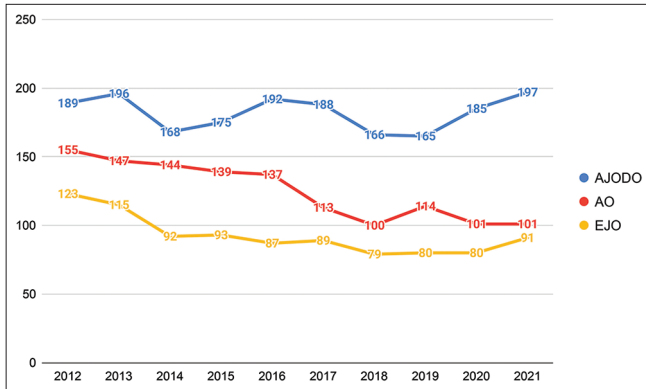


Figure 2: Number of publications and publication trends in the American Journal of Orthodontics and Dentofacial Orthopedics, The Angle Orthodontist, and European Journal of Orthodontics from 2012 to 2021.

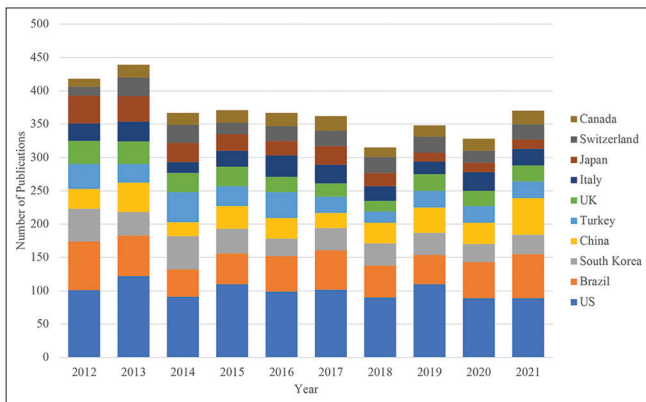


Figure 3: Trends in the number of publications by the top 10 most prolific countries from 2012 to 2021.

5416 citations). Italy ranked first in terms of the average citation/publication ratio (15.32) followed by Switzerland (13.52) and the United Kingdom (UK; 13.51). A map of the collaborative relationships between countries is shown in [Figure 4]. The US was heavily engaged in international collaborations, especially with South Korea and Brazil, whereas the UK had more collaboration with European countries.

Institution profile

From 2012 to 2021, 370 institutions contributed articles to the AJODO, AO, and EJO. The 20 most prolific institutions are listed in [Table 2]. Among the top 10, three were in South Korea, two were in Brazil, and two were in Switzerland. The University of São Paulo (Brazil) was the most prolific institution, contributing 145 articles. Articles published by the University of Bern (Switzerland) had both the highest citation counts and the highest citation to publication ratio.

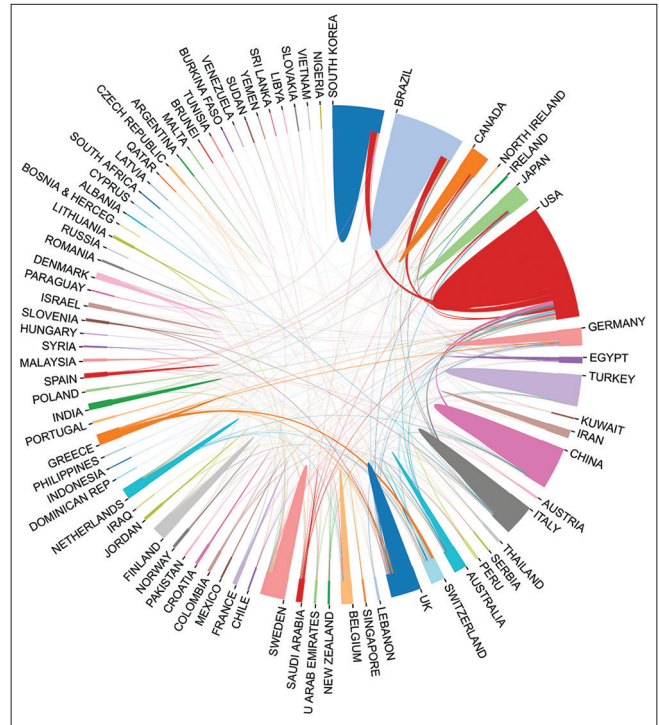


Figure 4: Collaborative relationships between countries.

Table 1: Top 20 countries with the most publications in the AJODO, AO, and EJO from 2012 to 2021.

Country	Publications	Citations	Citation/ publication ratio
United States	1003	11,995	11.96
Brazil	545	5416	9.94
South Korea	351	3643	10.38
China	301	2723	9.05
Turkey	295	3393	11.50
United Kingdom	265	3579	13.51
Italy	250	3829	15.32
Japan	244	2268	9.30
Switzerland	219	2960	13.52
Canada	179	1815	10.14
Germany	173	2856	16.51
Sweden	144	1792	12.44
Greece	112	1771	15.81
Australia	97	1011	10.42
Saudi Arabia	86	982	11.42
Netherlands	86	1251	14.55
India	82	1036	12.63
Egypt	69	827	11.99
Finland	67	641	9.57
Denmark	59	654	11.08

Author profile

The top 20 authors with the most publications in the AJODO, AO, and EJO from 2012 to 2021 are listed in [Table 3]. Their

Table 2: Top 20 institutions with the most publications in the AJODO, AO, and EJO from 2012 to 2021.

Institutions	Country	Publications	Citations	Citation/publication ratio
University of São Paulo	Brazil	145	1152	7.94
University of Bern	Switzerland	112	1795	16.03
Kyung Hee University	South Korea	111	1095	9.86
University of Alberta	Canada	110	1214	11.03
Seoul national university	South Korea	100	1120	11.20
University of Zurich	Switzerland	97	1344	13.86
University of Michigan	United States	85	1188	13.98
Yonsei University	South Korea	78	821	10.53
Sichuan University	China	77	817	10.61
Federal University of Rio De Janeiro	Brazil	72	1042	14.47
University of Athens	Greece	69	1053	15.26
University of Florence	Italy	65	996	15.32
A.T. Still University	United States	64	532	8.31
Saint Louis University	United States	63	781	12.40
University of Connecticut	United States	60	726	12.10
University of North Carolina	United States	58	778	13.41
Peking University	China	47	408	8.68
Case Western Reserve University	United States	43	396	9.21
Ohio State University	United States	42	629	14.98
Catholic University of Korea	South Korea	42	597	14.21
Kings College London	United Kingdom	42	414	9.86

Table 3: Top 20 authors with the most publications in the AJODO, EJO, and AO from 2012 to 2021.

Authors	Publications	Citations	Academic affiliation	Country
Pandis N	76	1,186	University of Bern	Switzerland
Janson G	70	466	University of São Paulo	Brazil
Park JH	66	541	Yonsei University	South Korea
Flores-Mir C	65	813	University of Alberta	United States
Franchi L	61	918	University of Florence	Italy
Eliades T	53	752	University of Zurich	Switzerland
Buschang PH	44	700	Texas A&M University Health Science Center	United States
Nanda R	41	475	University of Connecticut	United States
Fleming PS	30	614	Queen Mary University of London	United Kingdom
Katsaros C	29	541	University of Bern	Switzerland
Baek SH	29	339	Seoul National University	South Korea
Darendeliler MA	27	292	University of Sydney	Australia
Garib D	27	108	University of São Paulo	Brazil
Bondemark L	27	571	Malmö University	Sweden
Pithon MM	26	280	Southwest Bahia State University	Brazil
Kim K	26	175	Yonsei University	South Korea
Kim KB	26	390	Saint Louis University	United States
Uribe FA	26	351	University of Connecticut	United States
Cozza P	26	333	University of Rome Tor Vergata	Italy
Kook YA	25	429	Catholic University of Korea	South Korea

most recent affiliations and countries were also listed. The most prolific and cited author was Nikolaos Pandis, whose 76 articles were cited 1186 times followed by Guilherme Janson and Jae Hyun Park. The top 20 most-cited authors in the 4001 publications in the AJODO, AO, and EJO from 2012 to 2021 are shown in [Table 4]. William Proffit was the most-cited author among these publications, cited 601 times in the

AJODO, AO, or EJO from 2012 to 2021 followed by Samir E. Bishara and James A. McNamara, Jr.

Keywords

The top 20 most common keywords in the AJODO, AO, and EJO from 2012 to 2021 are listed in [Table 5]. The

Table 4: Top 20 most-cited authors by the publications in the AJODO, EJO, and AO from 2012 to 2021.

Authors	Cocitations	Academic affiliation	Country
Proffit	601	University of North Carolina	United States
Bishara	396	University of Iowa	United States
McNamara Jr. JA	395	University of Michigan	United States
Baccetti T	353	University of Florence	Italy
Dahlberg D	272	State Institute for Race Biology	Sweden
Björk A	236	Royal Dental College	Denmark
Thilander B	225	Göteborg University	Sweden
Pandis N	223	University of Bern	Switzerland
Melsen B	222	Aarhus University	Denmark
Fleming PS	199	Queen Mary University of London	United Kingdom
Kuroda S	195	Okayama University	Japan
Artun J	191	Kuwait University	Kuwait
Zachrisson BU	188	University Oslo	Norway
Janson G	175	University of São Paulo	Brazil
Franchi L	174	University of Florence	Italy
Little RM	171	University of Washington	United States
Peck S	163	University of North Carolina	United States
Houston WJB	160	Royal Dental Hospital School of Dental Surgery	United Kingdom
Burstone CJ	155	University of Connecticut	United States
Park HS	148	Kyungpook National University	South Korea

Table 5: Top 20 most frequent keywords in the AJODO, EJO, and AO from 2012 to 2021.

Key words	Frequency
Children	348
Orthodontic treatment	296
Malocclusion	291
Prevalence	229
Skeletal	222
Stability	213
Growth	213
Appliance	199
Tooth movement	187
Teeth	187
Accuracy	187
Cone-beam computed tomography	182
Reliability	179
Anchorage	151
Therapy	150
Morphology	134
Adult	134
Perception	121
Force	117
Extraction	110

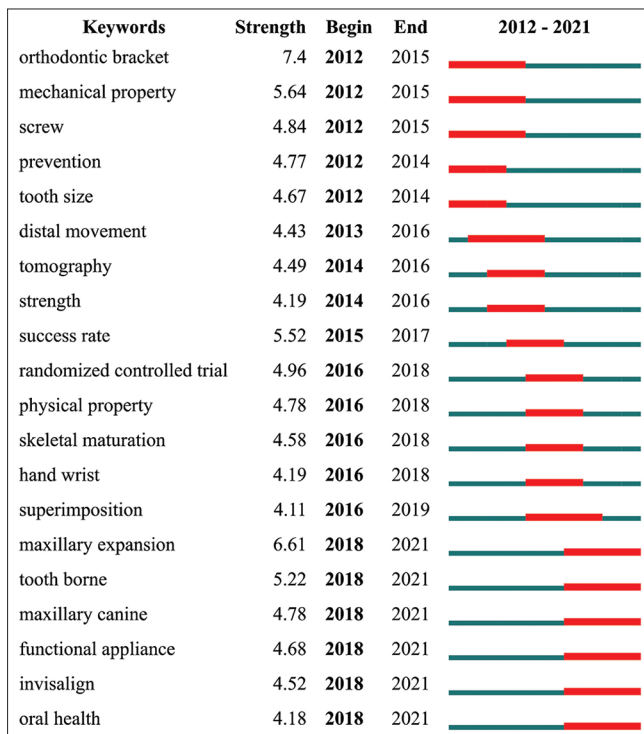


Figure 5: Top 20 keywords with the strongest citation bursts. The green line represents the whole period and the red line represents the citation burst period.

most frequently used keyword was “children” followed by “orthodontic treatment” and “malocclusion.” The top 20 keywords with the strongest citation bursts revealed a shift in research interests over the past decade [Figure 5]. Early in this decade, research related to “orthodontic bracket,” “mechanical property,” and “screw” attracted the

most interest. Toward 2021, the research frontiers shifted to “maxillary expansion,” “maxillary canines,” “functional appliance,” “invisalign,” and “oral health.”

Most-cited articles

Among the 4001 articles published in the AJODO, AO, and EJO from 2012 to 2021, the top 10 most-cited articles are listed in [Table 6]. Furthermore, the articles cited in the 4001 articles were analyzed. The top 10 articles most cited by the 4001 publications in the AJODO, AO, and EJO from 2012 to 2021 are listed in [Table 7]. The number of citations, citations per year, study types, and countries of all authors are also presented.

DISCUSSION

This bibliometric study mapped the publication output across three high-impact orthodontic journals – AJODO, AO, and EJO – from 2012 to 2021. In this period, the authors from 95 countries and 370 institutions contributed 4001 original articles to these three orthodontic journals. The publication characteristics during this time can represent the current

research trends and predict the prospects in the field of orthodontics.

The US had the highest number of publications, followed by Brazil, South Korea, China, and Turkey. This finding is largely consistent with a previous study conducted by Baumgartner *et al.*, which identified the US, Brazil, Japan, Turkey, and South Korea as the top publishing countries in the AJODO, AO, and EJO between 2008 and 2012.^[19] The number of articles from China has increased in recent years, resulting in a spot among the top five countries with the most publications. In addition to quantifying the publications, we also measured the recognition and impact of publications by calculating the citation counts per article. Italy (15.32), Switzerland (13.52), and the UK (13.51) were the countries with the highest average citation to publication ratios.

Although the US ranks first in terms of article output, when the contributing institutions of the publications

Table 6: Top 10 most-cited articles published in the AJODO, EJO, and AO from 2012 to 2021.

No.	Article titles	Authors	Journals	Study type	Countries of authors	Year	Citations	Citations per year
1	Precision of intraoral digital dental impressions with iTero and extraoral digitization with the iTero and a model scanner ^[21]	Flügge <i>et al.</i>	AJODO	Cross-sectional study	Germany	2013	249	31.13
2	Efficacy of clear aligners in controlling orthodontic tooth movement: A systematic review ^[22]	Rossini <i>et al.</i>	AO	Systematic review	Italy	2015	154	25.67
3	Failure rates and associated risk factors of orthodontic miniscrew implants: A meta-analysis ^[23]	Papageorgiou <i>et al.</i>	AJODO	Systematic review	Germany Israel Greece	2012	154	17.11
4	Effect of micro-osteoperforations on the rate of tooth movement ^[24]	Alikhani <i>et al.</i>	AJODO	Randomized control trial	United States	2013	139	17.38
5	Accuracy and reproducibility of dental replica models reconstructed by different rapid prototyping techniques ^[25]	Hazeveld <i>et al.</i>	AJODO	Cross-sectional study	The Netherlands	2014	138	19.71
6	Prevalence of white spot lesion formation during orthodontic treatment ^[26]	Julien <i>et al.</i>	AO	Retrospective cohort study	United States	2013	137	17.13
7	The effect of sample size and bias on the reliability of estimates of error: A comparative study of Dahlberg's formula ^[27]	Springate	EJO	Methodological study	United Kingdom	2012	137	15.22
8	The impact of malocclusion on the quality of life among children and adolescents: A systematic review of quantitative studies ^[28]	Dimberg <i>et al.</i>	EJO	Systematic review	Sweden	2015	130	21.67
9	Imaging software accuracy for three-dimensional analysis of the upper airway ^[29]	Weissheimer <i>et al.</i>	AJODO	Cross-sectional study	Brazil United States	2012	127	14.11
10	Clinical use of a direct chairside oral scanner: An assessment of accuracy, time, and patient acceptance ^[30]	Grünheid <i>et al.</i>	AJODO	Cross-sectional study	United States	2014	125	17.86

Table 7: Top 10 articles most cited by the AJODO, EJO, and AO from 2012 to 2021.

No.	Article titles	Authors	Journals	Study type	Countries of authors	Year	Cocitations	Citations per year
1	Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: Elaboration and explanation ^[33]	Shamseer <i>et al.</i>	BMJ	Reporting guideline	Canada Ireland Australia Italy United Kingdom United States	2015	29	4.83
2	Prevalence of white spot lesions during orthodontic treatment with fixed appliances ^[34]	Tufekci <i>et al.</i>	AO	Cross-sectional study	United States	2011	28	2.80
3	Orthodontic measurements on digital study models compared with plaster models: A systematic review ^[35]	Fleming <i>et al.</i>	OCR	Systematic review	United Kingdom	2011	27	2.70
4	Retention procedures for stabilizing tooth position after treatment with orthodontic braces ^[36]	Littlewood <i>et al.</i>	Cochrane	Systematic review	United Kingdom Ireland	2016	24	4.80
5	Treatment effects of removable functional appliances in patients with Class II malocclusion: A systematic review and meta-analysis ^[37]	Koretsi <i>et al.</i>	EJO	Systematic review	Greece Germany	2015	24	4.00
6	Clinical recommendations regarding use of cone-beam computed tomography in orthodontics. Position statement by the American Academy of Oral and Maxillofacial Radiology ^[38]	American Academy of Oral and Maxillofacial Radiology	OOOO	Clinical guideline	United States	2013	23	2.88
7	The impact of malocclusion on the quality of life among children and adolescents: A systematic review of quantitative studies ^[28]	Dimberg <i>et al.</i>	EJO	Systematic review	Sweden	2015	23	3.83
8	Contemporary orthodontics ^[39]	Proffit <i>et al.</i>	Book	N/A	United States	2012	21	2.63
9	Effectiveness of comprehensive fixed appliance treatment used with the Forsus fatigue resistant device in class II patients ^[40]	Franchi <i>et al.</i>	AO	Retrospective cohort study	Italy United States	2011	21	2.10
10	Treatment effects of fixed functional appliances alone or in combination with multibracket appliances: A systematic review and meta-analysis ^[41]	Perinetti <i>et al.</i>	AO	Systematic review	Italy Slovenia United States	2015	21	3.50

BMJ: British Medical Journal, Cochrane: Cochrane Database of Systematic Reviews, OCR: Orthodontics and Craniofacial Research, OOOO: Oral Surgery, Oral Medicine, Oral Pathology, and Oral Radiology

were analyzed, institutions in South Korea and Brazil were found to be more productive than those in the US. This was probably because the US has more institutions than any other country and therefore contributed the highest number of

publications, whereas some institutions in Korea and Brazil published more articles per institution. Specifically, the University of São Paulo was the most prolific, contributing 145 articles followed by the University of Bern (112 articles)

and Kyung Hee University (111 articles). Interestingly, three of the top 10 institutions were in South Korea, two were in Brazil, and two were in Switzerland. Aura-Tormos *et al.* analyzed the top 10 institutions published in seven orthodontic journals and found that the top three most prolific institutions were Seoul National University (South Korea), Yonsei University (South Korea), and the Federal University of São Paulo (Brazil).^[18] In their results, six of the top 10 most prolific institutions were Asian, with four from Korea, one from China, and one from Japan.^[18] Their study included the *Korean Journal of Orthodontics*, in which nearly 30% of the publications were from the same four Korean universities, which is one reason their list of the top 10 most prolific institutions differs from ours.^[18] Moreover, they only counted the institution of the first author, whereas we counted the institutions of all co-authors.^[18] Furthermore, the present study innovatively analyzed the total number of citations and the average number of citations per article for the top 10 institutions. The University of Bern was the most cited and had the highest average number of citations per article (16.03), reflecting the recognition and impact of their publications.

Two other studies analyzed only the most-cited articles in the field of orthodontics, and their results were different from those of this study.^[12,15] Fernandes *et al.* analyzed the publishing institutions of the top 100 most-cited orthodontic articles published between 2000 and 2020 and found that the University of North Carolina (US) contributed the most articles (six articles and 978 citations) followed by Okayama University (Japan; four articles and 1169 citations) and the University of Illinois (US; four articles and 588 citations).^[12] In contrast, Tarazona *et al.* analyzed the top 100 most-cited articles in orthodontics published between 1946 and 2016 and discovered that the most productive institutions were the University of Oslo (Norway; 10 articles), Ohio State University (US; nine articles), and the University of North Carolina (US; nine articles).^[15] There were 21 US universities among the 42 institutions that contributed two or more articles.^[15]

Unlike other studies,^[18,19] we counted the profiles of all authors rather than just the first authors of the publications to map the research collaborations among different countries. The country collaboration map revealed that a large proportion of research output from 2012 to 2021 was from international collaborative efforts. In addition to publishing the most articles, the US had the most international collaborations, especially with South Korea and Brazil. Most Swiss publications were in collaboration with other countries. The UK mostly collaborated with other European countries, whereas other prolific countries, such as Turkey and China, tended to conduct research independently. The varied collaborative patterns among countries might be explained by differences in regional practices, research interests, funding resources, and the English proficiency of authors.

The top 20 most prolific authors are shown in [Table 3], representing the most active researchers in the field of clinical orthodontics. From 2012 to 2021, the most prolific author was Pandis N (76 articles and 1176 citations) followed by Janson G (70 articles and 466 citations) and Park JH (66 articles and 541 citations). However, when assessing citations, we did not consider the year of publication. Articles published in recent years are likely to be less cited than those published closer to 2012. Therefore, some authors whose publications are more recent may have received fewer citations. The top 20 authors most cited in the AJODO, AO, and EJO publications from 2012 to 2021, shown in [Table 4], represent the most influential orthodontic researchers in the field in recent decades. Their articles or books have been cited hundreds of times in the AJODO, AO, and EJO articles in the past decade, regardless of their year of publication. The top three most-cited authors were Proffit W, Bishara SE, and McNamara, JA Jr. from the US followed by Baccetti T from Italy. Notably, three authors – Pandis N, Janson G, and Fleming PS – were among the most prolific and most-cited authors.

The top 10 most-cited articles were all published during the first 3 years (2012–2015) included in our analysis.^[21-30] Flügge *et al.* were cited over 200 times, with an average of 31.13 citations per year, indicating its high scientific impact.^[21] Among these top 10 most-cited articles, four were related to digital dental techniques, that is, intraoral scanners, digital dental casts, and imaging software;^[21,25,29,30] two investigated the risks of orthodontic treatments, namely, white spot lesions and mini-screw failure;^[23,26] two assessed the efficacy of tooth movement, one using clear aligners and one using micro-osteoperforations;^[22,24] and the remaining two were related to dental public health and statistics.^[27,28] These topics reflect the most popular research hotspots in the past decade. The top 100 most-cited articles in the three journals from 2012 to 2021 were shown in the supplementary file. Unlike our results, Aura-Tormos *et al.* reported bone anchorage to be the most recurrent topic in articles published from 2007 to 2017.^[18] A recent study analyzed the 100 most-cited articles in orthodontics in the past 20 years and found that anchorage (16 articles) was the most frequent thematic field followed by root resorption (eight articles) and rapid maxillary expansion (seven articles).^[12] Another study analyzed the 100 most-cited orthodontic articles between 1946 and 2016 and found that mini-implant (18 articles) was the most frequently cited topic followed by biomechanics and biology (15 articles).^[15] These differences could be explained by the difference in periods and journals analyzed. Based on our results, digital orthodontics was a more popular research topic in the past decade, probably because the three orthodontic journals we analyzed were more accepting of orthodontic clinical studies. In contrast, biology, material, or basic science studies in orthodontics were published in a broader range of scientific journals.

Regarding the study types of the most-cited studies, three were systematic reviews, representing the highest level of evidence because they summarized all valid scientific evidence at the time of publication.^[31] Four were cross-sectional studies, one was a randomized and controlled trial, and one was a retrospective case series. Cross-sectional studies are an excellent option for research in dentistry, considering their effectiveness, benefit-to-cost ratio, rapid implementation, and roles as sources for planning and organizing oral health programs.^[32] Gibson and Harrison found that surveys were the most prevalent research method, accounting for 33.9% of the publications in the AJODO, AO, EJO, and the *Journal of Orthodontics* from 1999 to 2008.^[17] Among the 100 most-cited articles in orthodontics from 2000 to 2020, cross-sectional studies were the most common study type (37 articles); this study design is more relevant to research topics in anchorage, digital models, and cone-beam computed tomography.^[12]

The top 10 articles most cited by AJODO, AO, and EJO publications from 2012 to 2021 are shown in [Table 7].^[28,33-41] Among these articles, three were related to functional appliances or Class II correctors,^[37,40,41] and the rest described retention protocols,^[36] white spot lesions,^[34] digital models,^[35] quality of life,^[28] and cone-beam computed tomography.^[38] Regarding the study types, five were systematic reviews, one was a non-randomized controlled trial, one was a cross-sectional study, and the other three could not be classified.

One of the limitations of this study is that we only included articles published in the three major orthodontic journals, namely, AJODO, AO, and EJO; other orthodontic-related studies published in other scientific journals or other languages were not included in the study. In addition, we analyzed all coauthors of each publication, allowing for country collaboration analysis; however, this approach does not consider the level of contributions made by each author. Furthermore, when assessing the citation profiles of articles, the most-cited articles are ranked according to the total number of citations. It is acknowledged that older articles are highly likely to receive more citations than those published recently. The results would be different if articles were ranked according to the average number of citations per year, which would reflect a more objective and up-to-date impact. Finally, the present study did not provide information about the quality of the included publications, as the quality may vary greatly among studies.^[42]

CONCLUSION

This bibliometric analysis provides a complete picture of orthodontic publications over the past decade (2012–2021). It reveals the most prolific and influential journals, countries, institutions, authors, and keywords in three major orthodontic journals.

1. The AJODO, AO, and EJO published 4001 articles from 370 institutions in 95 countries from 2012 to 2021. The AJODO published the most articles (45.5%) followed by AO (31.3%) and EJO (23.2%)
2. The country with the most publications was the US, while the country and institution with the highest citation counts per publication were Italy and the University of Bern (Switzerland), respectively
3. Pandis N was the most prolific author with the most publications and citations, and Proffit W was the most-cited author
4. Four of the 10 most-cited articles were related to digital dental technology. Cross-sectional studies and systematic reviews were the most common study types among the 10 most-cited articles and the 10 articles most cited by the 4001 publications analyzed, respectively.

Declaration of patient consent

Patient's consent not required as there are no patients in this study.

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Conflicts of interest

There are no conflicts of interest.

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