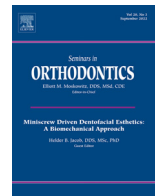




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A bibliometric analysis of the 100 most–cited articles on orthodontic retention and retainers

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ABSTRACT

Bibliometric analysis can help identify areas within research domains where potentially impactful research has been carried out and can also inform future relevant scholarly activity.

Analysis of this kind has not yet been conducted in the domain of orthodontic retention and retainers. The aim of this investigation was to undertake a bibliometric analysis of the 100 most–cited articles on orthodontic retention and retainers. The study was carried out in accordance with the bibliometric reviews of the biomedical literature (BIBLIO) preliminary guidelines. A search of the Web of Science Core Collection (Clarivate Analytics, Philadelphia, Pa) [WoS] database, via a customised keyword–based search string using Boolean logic developed in collaboration with a university librarian, was undertaken. Two reviewers independently screened articles for inclusion and recorded relevant data from the WoS and Journal Citation Reports (Clarivate Analytics) databases. Additional analysis was via VOSviewer (Centre for Science and Technology Studies, Leiden University, Leiden, The Netherlands). The 100 included articles were published in 21 journals or other sources and recorded a total of 9613 citations. The 2016 iteration of the relevant Cochrane review was the most cited article with 220 citations. The 100 articles were authored by 329 individuals, and more than half of the included articles were published either in the American Journal of Orthodontics and Dentofacial Orthopedics (43%) or the European Journal of Orthodontics (16%). The United States (23%) was the country to which first named authors were most affiliated. Almost one in six ($n = 1449$; 15.1%) of the total citations were associated with RCT articles, with 9.1% ($n = 872$) of the citations related to systematic review articles and 875 (9.1%) citations allied with narrative review articles. The bonded retainer was the retainer type upon which most focus was applied in the 100 most cited articles. The relatively small number of connected authors suggested that there is room for increased collaboration between centres concerning orthodontic retention research.

Introduction

Orthodontic retention is a key consideration of the orthodontic treatment process with almost all patients on the completion of active treatment being provided with a removable retainer (RR) and/or bonded retainer (BR).¹ The objective of retainers is to maintain the end of treatment intra– and inter– arch dental relationships.² The most prescribed RRs appear to be the clear plastic retainer (CPR) and the Hawley retainer (HR).^{3–5}

Bibliometrics refers to the statistical analysis of academic publications related to a particular research subject(s).⁶ It includes the use of quantitative measures such as the Eigenfactor, the normalized Eigenfactor, the journal impact factor (JIF) and the 5–year journal impact factor (5–JIF). These metrics are derived from the quality and number of citations that an article published in a journal receives and are key factors in the perception of a journal's position within its research domain.⁷ The

number of citations an article receives can, therefore, be used as an indication of the significance that it has had within the research landscape and can be employed as a performance indicator for authors' research activity.⁸

Bibliometrics can also provide insight related to publication and authorial features concerning specific research domains. Although bibliometric analysis does not determine clinical effectiveness, it can map influence and citation impact. Study characteristics and research methodologies used by investigators in articles with high numbers of citations can be identified. Consequently, the trends, patterns and impacts of relevant published literature can be determined. Furthermore, it may enable the identification of research areas in which a greater emphasis is being placed to better inform the evidence base.

Numerous bibliometric investigations have been undertaken in orthodontic domains such as clear aligner therapy, temporary anchorage devices, accelerated orthodontics and lingual orthodontics.^{6,9–11} None,

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however, appear to have been undertaken in relation to orthodontic retention and retainers.

The aim of the investigation was to undertake a bibliometric analysis of the 100 most-cited articles on orthodontic retention and retainers. The findings may help identify the research areas within this domain where potentially impactful research has been carried out, inform future relevant scholarly activity and may help identify current unresolved clinical questions.

Methods

The study was undertaken in accordance with the bibliometric reviews of the biomedical literature (BIBLIO) preliminary guidelines (Appendix 1).¹²

A search of the Web of Science Core Collection (Clarivate Analytics, Philadelphia, Pa) database was conducted to determine all potentially relevant articles, irrespective of publication type or language in which the articles were written. The customised keyword-based search string using Boolean logic was developed in collaboration with a university librarian to search the Web of Science Database ((orthodontic* OR fixed OR removable OR Hawley OR "vacuum-formed" OR bonded) NEAR/2 retainer*) OR (retention NEAR/2 orthodontic*) OR "fixed retainer*" OR "fixed lingual retainer*" OR ((Spring OR thermoplastic OR Begg OR Essix OR "clear plastic" OR Barrer) NEAR/2 retainer*). Search fields included 'Title', 'Abstract' and 'Keywords'.

The search and data documentation was carried out on one date, February 3rd, 2026, to reduce the risk of possible bias associated with continuous database updates.

Eligibility for inclusion was undertaken by the screening of titles, abstracts and full texts by two reviewers independently. Where disagreement occurred, agreement was obtained via discussion. Initial screening involved the exclusion of articles not written in the English language, animal studies and non-orthodontic related articles. Further screening involved the exclusion of editorials, letters to the editor, news items, book reviews, and other non-pertinent published material.

Relevant data related to the 100 most-cited articles were sourced from the Web of Science Core Collection and were recorded on Microsoft (Redmond, Wash) Excel spreadsheets. These included article titles, names and number of authors per article, journal of publication, country of affiliation of first named author, year of publication and citation number.

The two reviewers determined the study design by assessing the abstract and the methodology section of each article. Following a preliminary assessment of the 30 most highly cited articles, each study was categorised according to one of the following study types:

- Review.
- Clinical.
- In-vitro.
- Cross-sectional questionnaire surveys.
- Other.

Additional classification of articles included that related to the key focus of the articles and a determination of whether the article focus related to BRs and/or RRs.

The Journal Citation Reports (Clarivate Analytics) database was sourced to retrieve information regarding the 2025 Journal Impact Factor (JIF), 5-year Journal Impact Factor (5-JIF), Eigenfactor Score, Normalized Eigenfactor, Article influence score, Immediacy Index and the position within the Category of "Dentistry, Oral Surgery & Medicine," or other, according to Web of Science Core Collection.

Mapping of key author collaboration networks was undertaken by VOSviewer (Centre for Science and Technology Studies, Leiden University, Leiden, The Netherlands).

Statistical analysis was conducted with SPSS (version 29; IBM, New York, US).

Inter-reviewer agreement for screening and classification was undertaken using the Cohen Kappa coefficient.

Results

Table 1 shows that clinical studies ($n = 52$; 52%) comprised over half of the most cited articles. Nineteen (19%) studies were RCTs.

Forty-two (42%) studies focused solely on BRs and 34 (34%) focused on RRs. Fifteen (15%) articles included investigation of patient satisfaction and experiences, and six (6%) were cross-sectional questionnaire survey studies carried out among orthodontists regarding their retention practices and protocols Fig. 1.

The 100 most cited articles were published in a total of 21 journals or other sources with the articles recording a total of 9613 citations. The mean (standard deviation [SD]) number of citations per article was 96.13 (41.3).

Table 2 shows the characteristics of the journals in which two or more of the top 100 most-cited articles were published.

Articles published in the AJO-DO had a total of 4293 (44.7%) citations followed by articles published in the EJO which recorded an overall number of 1424 (14.8%) citations. Articles in the JCO ($n = 833$; 8.7%) recorded the next highest number of citations followed by the Angle Orthodontist ($n = 618$; 6.4%) and the Journal of Orthodontics ($n = 284$; 3.0%) Fig. 2.

Almost one in six ($n = 1449$; 15.1%) of the total citations were associated with RCT articles, with 9.1% ($n = 872$) of the citations related to systematic review articles and 875 (9.1%) citations allied with narrative review articles Fig. 3.

The mean (SD) number of authors per article was 3.29 (1.9) [Maximum 10; Minimum 1]. The number of countries to which first authors were affiliated totalled 21 Fig. 4.

Table 3 shows that the United States (US) and the United Kingdom each had three institutions from which two or more articles were within the top 100 cited articles.

Table 4 shows the top 10 authors by times cited.

The Cohen Kappa coefficient for screening and classification was 0.91 and 0.93 respectively, indicating excellent inter-rater agreement Fig. 5.

Discussion

The objective of the present investigation was to carry out a bibliometric analysis to identify and assess research articles concerning orthodontic retention and retainers. Investigation of the most-cited articles on a research topic can be a valuable data-led mode of determining influential research, authors, collaborations and to map the topic's evolution. That orthodontic retention is a key stage following fixed appliance and clear aligner therapy for almost all patients highlights the relevance of this analysis. The relatively high number of citations within the cohort mixes robust experimental methodologies, such as RCTs with large observational datasets and methodological syntheses, indicating a developed research area with both theoretical and practical aspects. The findings indicated that the AJO-DO was the journal in which most articles were published, and the United States was the country with which first-named authors were most frequently affiliated. The findings also included new data regarding the types of relevant research that is most cited.

That the AJO-DO was the journal in which articles were most frequently published aligned with similar bibliometric studies concerning orthodontic research domains.^{6,8,10,11,112–117} That a relatively small number of journals published the majority of articles and were the recipients of most citations was suggestive of Bradford's Law.¹⁰ This Law relates to the phenomenon in library science whereby a small "nucleus" group of journals publish most articles related to a specific topic with a greater number of journals producing a lesser number of relevant articles.

Table 1

100 most-cited articles in descending order of the total number of citations received.

Rank	Author and year of publication	Title	Type of Study	Times Cited, WoS Core	Journal title/ source	Citation Density (citations per year)
1	Littlewood et al. ¹³ 2016	Retention procedures for stabilising tooth position after treatment with orthodontic braces	Rev	220	CDSR	22
2	Sheridan et al. ¹⁴ 1993	Essix retainers: fabrication and supervision for permanent retention.	Rev	195	JCO	5.91
3	Zachrisson ¹⁵ 1977	Clinical experience with direct-bonded orthodontic retainers	Other	188	JCO	3.92
4	Artun et al. ¹⁶ 1997	A 3-year follow-up study of various types of orthodontic canine-to-canine retainers	Clinical	185	EJO	6.61
5	Delacruz et al. ¹⁷ 1995	Long-term changes in arch form after orthodontic treatment and retention	Clinical	183	AJO-DO	6.1
6	Hichens et al. ¹⁸ 2007	Cost-effectiveness and patient satisfaction: Hawley and vacuum-formed retainers	Clinical	179	EJO	9.94
7	Katsaros et al. ¹⁹ 2007	Unexpected complications of bonded mandibular lingual retainers	Other	172	AJO-DO	9.56
8 =	Beam ²⁰ 1995	Bonded orthodontic retainers – a review	Rev	168	AJO-DO	5.6
8 =	Dahl and Zachrisson ²¹ 1991	Long-term experience with direct-bonded lingual retainers.	Other	168	JCO	4.94
10	Al Yami et al. ²² 1999	Stability of orthodontic treatment outcome: Follow-up until 10 years postretention	Clinical	165	AJO-DO	6.35
11	Sharpe et al. ²³ 1987	Orthodontic relapse, apical root resorption, and crestal alveolar bone levels	Clinical	163	AJO-DO	4.29
12	Booth et al. ²⁴ 2008	Twenty-year follow-up of patients with permanently bonded mandibular canine-to-canine retainers	Clinical	162	AJO-DO	9
13 =	Littlewood et al. ²⁵ 2017	Retention and relapse in clinical practice	Rev	157	ADJ	19.63
13 =	Sadowsky et al. ²⁶ 1994	Long-term stability after orthodontic treatment – nonextraction with prolonged retention	Clinical	157	AJO-DO	5.06
15	Rowland et al. ²⁷ 2007	The effectiveness of Hawley and vacuum-formed retainers: A single-center randomized controlled trial	Clinical	154	AJO-DO	8.56
16	Johnston and Littlewood ²⁸ 2015	Retention in orthodontics	Rev	151	BDJ	16.78
17	Renkema et al. ²⁹ 2011	Long-term effectiveness of canine-to-canine bonded flexible spiral wire lingual retainers	Clinical	150	AJO-DO	10.71
18	Pandis et al. ³⁰ 2007	Long-term periodontal status of patients with mandibular lingual fixed retention	Clinical	137	EJO	7.61
19	Melrose and Millett ³¹ 1998	Toward a perspective on orthodontic retention?	Rev	135	AJO-DO	4.82
20	Al-Omiri and Abu Alhaija ³² 2006	Factors affecting patient satisfaction after orthodontic treatment	CSQ	132	Angle Orthod.	6.95
21	Pratt et al. ³³ 2011	Evaluation of retention protocols among members of the American Association of Orthodontists in the United States	CSQ	127	AJO-DO	9.07
22	Al-Moghrabi et al. ³⁴ 2017	Compliance with removable orthodontic appliances and adjuncts: A systematic review and meta-analysis	Rev	126	AJO-DO	15.75
23 =	Artun et al. ³⁵ 1996	Long-term stability of mandibular incisors following successful treatment of class II, division 1, malocclusions	Clinical	124	Angle Orthod.	4.28
23 =	Renkema et al. ³⁶ 2013	Gingival labial recessions in orthodontically treated and untreated individuals: a case control study	Clinical	124	JCP	10.33
25	Stormann and Ehmer ³⁷ 2002	A prospective randomized study of different retainer types.	Clinical	123	JO	5.13
26 =	Levin, et al. ³⁸	The association of orthodontic treatment and fixed retainers with gingival health	Clinical	118	JP	6.94
26 =	Littlewood, et al. ³⁹	Orthodontic retention: A systematic review	Rev	118	JO	6.21
26 =	Renkema et al. ⁴⁰ 2009	A survey on orthodontic retention procedures in the Netherlands	CSQ	118	EJO	7.38
26 =	Valiathan and Hughes ⁴¹ 2010	Results of a survey-based study to identify common retention practices in the United States	CSQ	118	AJO-DO	7.38
30	Gardner and Chaconas ⁴² 1984	Posttreatment and post-retention changes following orthodontic therapy	Clinical	116	Angle Orthod.	2.37
31	Padmos et al. ⁴³ 2018	Epidemiologic study of orthodontic retention procedures	CSQ	114	AJO-DO	16.29
32	Shaughnessy et al. ⁴⁴ 2016	Inadvertent tooth movement with fixed lingual retainers	Other	112	AJO-DO	11.2
33	Pratt et al. ⁴⁵ 2011	Patient compliance with orthodontic retainers in the postretention phase	CSQ	106	AJO-DO	7.57
34	Tsamos et al. ⁴⁶ 2014	Objective assessment of patient compliance with removable orthodontic appliances A cross-sectional cohort study	Other	104	Angle Orthod.	8.67
35	Artun ⁴⁷ 1984	Caries and periodontal reactions associated with long-term use of different types of bonded lingual retainers	Clinical	102	AJO-DO	7.85
36	Pazera et al. ⁴⁸ 2012	Severe complication of a bonded mandibular lingual retainer	Other	101	AJO-DO	7.77
37 =	Al-Moghrabi, et al. ⁴⁹ 2018	Effects of fixed vs removable orthodontic retainers on stability and periodontal health: 4-year follow-up of a randomized controlled trial	Clinical	100	AJO-DO	14.29
37 =	Sauget et al. ⁵⁰ 1997	Comparison of occlusal contacts with use of Hawley and clear overlay retainers	Clinical	100	AJO-DO	3.57
39	Vaden et al. ⁵¹ 1997	Relapse revisited	Other	98	AJO-DO	3.5
40	Al-Moghrabi et al. ⁵² 2016	The effects of fixed and removable orthodontic retainers: a systematic review	Rev	95	Prog Orthod.	10.56
41 =	Kucera and Marek ⁵³ 2016	Unexpected complications associated with mandibular fixed retainers: A retrospective study	Clinical	93	AJO-DO	9.3
41 =	Tacke et al. ⁵⁴ 2010	Glass fibre reinforced versus multistranded bonded orthodontic retainers: a 2 year prospective multi-centre study	Clinical	93	EJO	6.2
43	Singh et al. ⁵⁵ 2009	Orthodontic retention patterns in the United Kingdom	CQS	91	JO	5.35
44	Forde et al. ⁵⁶ 2018	Bonded versus vacuum-formed retainers: a randomized controlled trial. Part 1: stability, retainer survival, and patient satisfaction outcomes after 12 months	Clinical	90	EJO	12.86
45 =	Cole et al. ⁵⁷ 2019	Evaluation of fit for 3D-printed retainers compared with thermoform retainers	IV	89	AJO-DO	14.83
45 =	Littlewood, et al. ⁵⁸ 2006	Retention procedures for stabilising tooth position after treatment with orthodontic braces	Rev	89	CDSR	4.45
47 =	Lai et al. ⁵⁹ 2013	Orthodontic retention procedures in Switzerland.	CQS	85	Swiss Dent J	7.73
47 =	Lindauer and Shoff ⁶⁰	Comparison of Essix and Hawley retainers.	Other	85	JCO	3.04
49	Mai et al. ⁶¹ 2014	Comparison of vacuum-formed and Hawley retainers: A systematic review	Rev	82	AJO-DO	7.45
50	Little et al. ⁶² 1990	Serial extraction of 1st premolars – postretention evaluation of stability and relapse	Clinical	81	Angle Orthod.	2.31
51 =	Iliadi, et al. ⁶³ 2015	Failure of fixed orthodontic retainers: A systematic review	Rev	77	J Dent	7.7
51 =	Kravitz et al. ⁶⁴ 2017	Memotain: A CAD/CAM nickel-titanium lingual retainer	Other	77	AJO-DO	9.63
53	Zachrisson ⁶⁵ 2007	Long-term experience with direct-bonded retainers: update and clinical advice.	Other	77	JCO	4.28
54 =	Gardner et al. ⁶⁶ 2003	Wear comparison of thermoplastic materials used for orthodontic retainers	IV	75	AJO-DO	3.41
54 =	Heier et al. ⁶⁷ 1997	Periodontal implications of bonded versus removable retainers	Clinical	75	AJO-DO	2.68
54 =	Meade and Millett ⁴ 2013	Retention protocols and use of vacuum-formed retainers among specialist orthodontists	CQS	75	JO	5.77
57 =	Foek et al. ⁶⁸ 2008	Survival of flexible, braided, bonded stainless steel lingual retainers: a historic cohort study	Clinical	74	EJO	4.35
57 =	Strunga et al. ⁶⁹ 2023	Artificial intelligence systems assisting in the assessment of the course and retention of orthodontic treatment	Rev	74	HEALTHCARE	37
59 =	Karaman et al. ⁷⁰ 2002	Four applications of reinforced polyethylene fiber material in orthodontic practice	Other	72	AJO-DO	3.13

(continued)

Table 1 (Continued)

Rank	Author and year of publication	Title	Type of Study	Times Cited, WoS Core	Journal title/ source	Citation Density (citations per year)
59 =	Rose et al. ⁷¹ 2002	Clinical comparison of a multistranded wire and a direct-bonded polyethylene ribbon-reinforced resin composite used for lingual retention	Clinical	72	QI	3.13
59 =	Thickett and Power ⁷² 2010	A randomized clinical trial of thermoplastic retainer wear	Clinical	72	EJO	4.5
62	Bearn et al. ⁷³ 1997	Bonded orthodontic retainers: The wire-composite interface	IV	70	AJO-DO	2.41
63 =	Farhadian et al. ⁷⁴ 2016	Streptococcus mutans counts in patients wearing removable retainers with silver nanoparticulates vs those wearing conventional retainers: A randomized clinical trial	Clinical	69	AJO-DO	6.9
63 =	Kartal and Kaya ⁷⁵ 2019	Fixed Orthodontic Retainers: A Review	Rev	69	TJO	11.5
65	Karaman, et al. ⁷⁶ 2003	A practical method of fabricating a lingual retainer	Other	68	AJO-DO	3.09
66 =	Artun et al. ⁷⁷ 1987	Hygiene status associated with different types of bonded, orthodontic canine-to-canine retainers – a clinical-trial	Clinical	66	JCP	1.69
66 =	Gill et al. ⁷⁸ 2007	Part-time versus full-time retainer wear following fixed appliance therapy: a randomized prospective controlled trial.	Clinical	66	WJO	3.47
66 =	Zachrisson ⁷⁹ 1997	Important aspects of long-term stability.	Other	66	JCO	2.36
69	Arn et al. ⁸⁰ 2020	The effects of fixed orthodontic retainers on periodontal health: A systematic review	Rev	65	AJO-DO	10.83
70 =	Tynelius et al. ⁸¹ 2010	Five-year postretention outcomes of three retention methods—a randomized controlled trial	Clinical	64	EJO	6.4
70 =	Zachrisson ⁸² 2015	Multistranded wire bonded retainers: From start to success	Other	64	AJO-DO	6.4
72 =	Jaderberg et al. ⁸³ 2012	Removable thermoplastic appliances as orthodontic retainers—a prospective study of different wear regimens	Clinical	62	EJO	4.77
72 =	Storey et al. ⁸⁴ 2018	Bonded versus vacuum-formed retainers: a randomized controlled trial. Part 2: periodontal health outcomes after 12 months	Clinical	62	EJO	8.86
74 =	Aasen and Espeland ⁸⁵ 2005	An approach to maintain orthodontic alignment of lower incisors without the use of retainers	Clinical	61	EJO	3.05
74 =	Mollov et al. ⁸⁶ 2010	Patient attitudes toward retention and perceptions of treatment success	CQS	61	Angle Orthod.	4.07
74 =	Nasef et al. ⁸⁷ 2014	Virtual techniques for designing and fabricating a retainer	Other	61	AJO-DO	5.55
77 =	Egli et al. ⁸⁸ 2017	Indirect vs direct bonding of mandibular fixed retainers in orthodontic patients: Comparison of retainer failures and posttreatment stability. A 2-year follow-up of a single-center randomized controlled trial	Clinical	60	AJO-DO	6.67
77 =	Kang et al. ⁸⁹ 2011	Release of bisphenol A from resin composite used to bond orthodontic lingual retainers	Other	60	AJO-DO	4.29
77 =	Pandis et al. ⁹⁰ 2013	Survival of bonded lingual retainers with chemical or photo polymerization over a 2-year period: A single-center, randomized controlled clinical trial	Clinical	60	AJO-DO	5
77 =	Taner and Aksu ⁹¹ 2012	A prospective clinical evaluation of mandibular lingual retainer survival	Clinical	60	EJO	4.62
77 =	Taner et al. ⁹² 2004	Evaluation of dental arch width and form changes after orthodontic treatment and retention with a new computerized method	Clinical	60	AJO-DO	2.86
77 =	Tynelius et al. ⁹³ 2013	A randomized controlled trial of three orthodontic retention methods in Class I four pre-molar extraction cases – stability after 2 years in retention	Clinical	60	OCR	5
83 =	Al-Nimri et al. ⁹⁴ 2009	Gingival health and relapse tendency: a prospective study of two types of lower fixed retainers	Clinical	59	AOJ	3.69
83 =	Demir et al. ⁹⁵ 2012	Comparison of retention characteristics of Essix and Hawley retainers	Clinical	59	KJO	4.54
83 =	O'Rourke et al. ⁹⁶ 2016	Effectiveness of bonded and vacuum-formed retainers: A prospective randomized controlled clinical trial	Clinical	59	AJO-DO	6.56
83 =	Saleh et al. ⁹⁷ 2017	Acceptability comparison between Hawley retainers and vacuum-formed retainers in orthodontic adult patients: a single-centre, randomized controlled trial	Clinical	59	EJO	7.38
87 =	Sun et al. ⁹⁸ 2011	Survival Time Comparison between Hawley and Clear Overlay Retainers: A Randomized Trial	Clinical	58	JDR	4.14
88	Zachrisson ⁹⁹ 1982	The bonded lingual retainer and multiple spacing of anterior teeth.	Other	58	Sw Dent J	1.32
89 =	Di Venere et al. ¹⁰⁰ 2017	Correlation between parodontal indexes and orthodontic retainers: prospective study in a group of 16 patients.	Clinical	57	Oral & Implantology	7.13
89 =	Salehi et al. ¹⁰¹ 2013	Comparison of survival time between two types of orthodontic fixed retainer: a prospective randomized clinical trial	Clinical	57	Prog Orthod	4.75
89 =	Steinnes et al. ¹⁰² 2017	Stability of orthodontic treatment outcome in relation to retention status: An 8-year follow-up	Clinical	57	AJO-DO	7.13
89 =	Wolf et al. ¹⁰³ 2015	Novel lingual retainer created using CAD/CAM technology. Evaluation of its positioning accuracy	Other	57	JOO	5.7
93	Dyer et al. ¹⁰⁴ 2012	Relapse revisited—again	Other	56	AJO-DO	4.31
94 =	Baysal et al. ¹⁰⁵ 2012	Comparison of three different orthodontic wires for bonded lingual retainer fabrication	IV	55	KJO	3.93
94 =	Shawesh et al. ¹⁰⁶ 2010	Hawley retainers full- or part-time? A randomized clinical trial	Clinical	55	EJO	3.67
94 =	Vandevska-Radunovic et al. ¹⁰⁷ 2013	Retention: type, duration and need for common guidelines. A survey of Norwegian orthodontists.	CQS	55	Orthod (Chic)	4.58
97 =	Eliades et al. ¹⁰⁸ 2011	Release of bisphenol-A from a light-cured adhesive bonded to lingual fixed retainers	IV	54	AJO-DO	3.6
97 =	Turkoz et al. ¹⁰⁹ 2012	Influence of thermoplastic retainers on Streptococcus mutans and Lactobacillus adhesion	Clinical	54	AJO-DO	4.15
97 =	Zachrisson ¹¹⁰ 1995	Third-generation mandibular bonded lingual 3–3 retainer.	Other	54	JCO	1.74
100	Tynelius et al. ¹¹¹ 2010	Evaluation of orthodontic treatment after 1 year of retention—a randomized controlled trial	Clinical	53	EJO	3.53

Key: WoS: Web of Science. SR: Systematic review. CDSR: Cochrane Database of Systematic Reviews. RR: Removable retainer. BR: Bonded retainer. JCO: Journal of Clinical Orthodontics. PCS: Prospective cohort study. EJO: European Journal of Orthodontics. AJO-DO: American Journal of Orthodontics and Dentofacial Orthopaedics. ADJ: Australian Dental Journal. BDJ: British Dental Journal. CSQ: Cross-sectional questionnaire. Angle Orthod: Angle Orthodontist. CQS: Cross-sectional questionnaire survey. JP: Journal of Periodontology. JO: Journal of Orthodontics. Prog Orthod: Progress in Orthodontics. IV: In-vitro. Swiss Dent J: Swiss Dental Journal. J Dent: Journal of Dentistry. QI: Quintessence International. TJO: Turkish Journal of Orthodontics. WJO: World Journal of Orthodontics. OCR: Orthodontics and Craniofacial Research. AOJ: Australian Orthodontic Journal. KJO: Korean Journal of Orthodontics. JDR: Journal of Dental Research. Sw Dent J: Swedish Dental Journal. JOO: Journal of Orofacial Orthopedics. Orthod (Chic): Orthodontics: The Art and Practice of Dentofacial Enhancement.

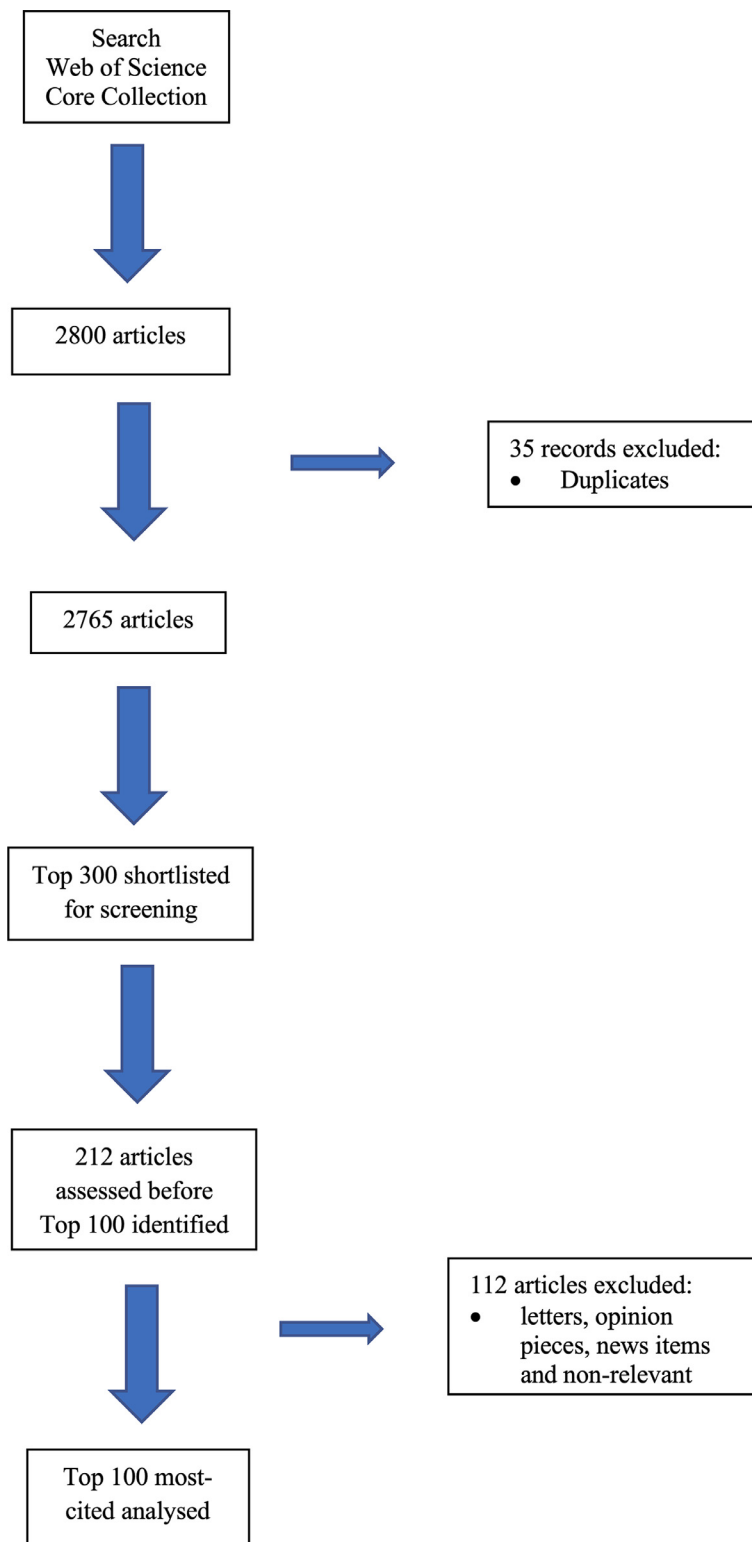


Fig. 1. Flow chart to show article selection. Outlines the selection process for the 100 most-cited articles. Flow chart to show article selection. Table 1 lists the articles included in the present study in descending order of the total number of citations received. Not only did the 2016 iteration of the Cochrane review on 'Retention procedures for stabilising tooth position after treatment with orthodontic braces' by Littlewood and colleagues¹³ was the most highly cited article, it also recorded the highest citation density.

It is likely that iterations of the relevant Cochrane reviews were so highly cited is not a surprise as these reviews are generally considered to be gold standard by many.¹¹⁸

The 2016 version of the review by Littlewood and colleagues¹³ was the most highly cited article. It also recorded the highest citation density in the present study. The citation density relates to the mean number of citations an article receives each year since the year of publication. By accounting for the number of years since publication, the citation

density metric can enable a potentially more contextually accurate assessment of an article's impact.

The present review indicated that 19% of the studies were RCTs. This contrasted with 4% among the top 50 most-cited studies concerning temporary anchorage devices¹⁰ and 12% of the top 50 most-cited investigations related to CAT¹¹² and accelerated orthodontics.¹¹⁹ The relatively larger number in this study may have been indicative of the relatively shorter timeframe in which those newer technologies have

Table 2

Top 10 journals, and journal metrics, by frequency of number of cited retention publications (N = 100).

Source	N (%)	2025 JIF	Dentistry, Oral Surgery & Medicine Rank by IF	Eigenfactor Score	Normalized Eigenfactor	Article influence score	5-Year JIF	Immediacy Index
AJO–DO	43 (43)	3.0	31/163	0.00577	1.29294	0.735	3.3	1.0
EJO	16 (16)	2.7	40/163	0.00244	0.54833	0.708	3.1	0.9
JCO ⁺	7 (7.0)	+	+	+	+	+	+	+
Angle Orthod	6 (6.0)	3.2	27/163	0.00319	0.71599	0.818	3.7	1.1
JO	3 (3.0)	1.5	101/163	0.00089	0.20098	0.426	1.6	0.4
CDSR	2 (2.0)	9.4	17/332*	0.06671	14.94377	3.51	10.3	1.8
KJO	2 (2.0)	2.3	54/163	0.00087	0.19491	0.538	2.3	0.6
JOO	2 (2.0)	2.1	97/163	0.00106	0.23773	0.472	2.1	0.3
Prog Orthod	2 (2.0)	5.0	10/163	0.00209	0.46949	1.107	4.8	0.8
J Clin Period	2 (2.0)	6.8	4/163	0.01037	2.32473	1.71	8.2	1.1
Others	15 (15.0)							

N: number. JIF: Journal Impact Factor. IF: Impact factor. AJO–DO: American Journal of Orthodontics and Dentofacial Orthopedics. EJO: European Journal of Orthodontics. JCO: Journal of Clinical Orthodontics; +: information not available. Angle Orthod: Angle Orthodontist. JO: Journal of Orthodontics. CDSR: Cochrane Database of Systematic Reviews. KJO: Korean Journal of Orthodontics. JOO: Journal of Orofacial Orthopedics. Prog Orthod: Progress in Orthodontics. J Clin Period: Journal of Clinical Periodontology. Metrics as per 2025 data from Clarivate Analytics.

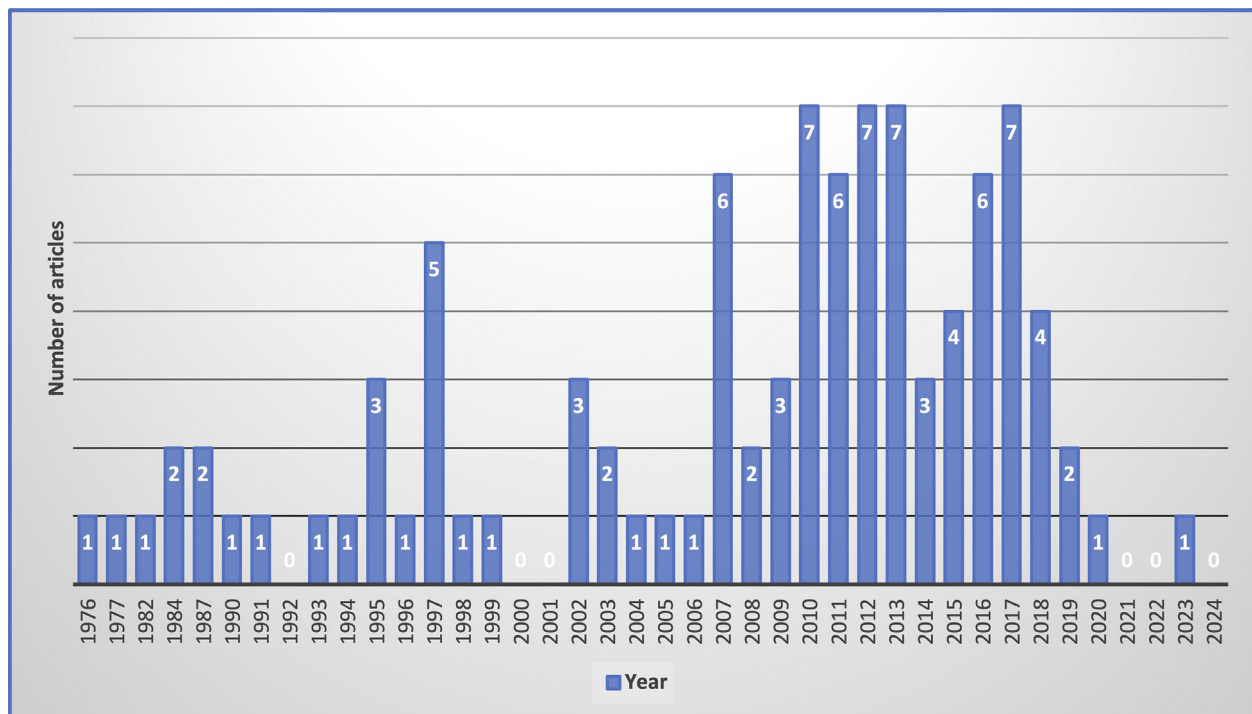


Fig. 2. Number of articles by year (N = 100). Shows that the articles were published between 1976 and 2023 and that 58% of the articles were published in the eleven-year period from 2007 to 2017.

been employed in orthodontics and, consequently, the period in which this study type could have been undertaken.

Research concerning BRs appeared to be commonplace among the articles. This may have reflected the ongoing relevant research in this domain where evolving technology, new materials and modes of manufacture have prompted investigations into the development of more efficacious bonded retention protocols. It may have also reflected that the increasing use of BRs reported by orthodontists in cross-sectional surveys.¹²⁰ It may also be indicative of the complications associated with BRs reported in highly cited papers^{19,44} are driving research interest in the role of computer-aided design and computer-aided manufacturing in the manufacture of retainers.¹²¹

The total number of authors of the top 100 cited articles in the present review was 329. This was greater than the 251 recorded in Tarazona and colleagues' analysis of the 100 most-cited articles in orthodontics.⁷ However, it was less than the 351 to 458 recorded in the analysis of the top 100 cited articles related to orthodontic RCTs,¹¹⁶ artificial intelligence in orthodontics and orthognathic surgery,¹²² and systematic reviews and meta-analyses in orthodontics.¹²³ The higher authorial numbers in these studies may have reflected the trend towards increased numbers of authors observed in the biomedical literature over the past two decades.¹²⁴ Bigger research centres, superior methodological processes and collaboration between centres are thought to have played a role in this phenomenon.¹²⁵ That there is room for increased collaboration between centres concerning orthodontic retention research is

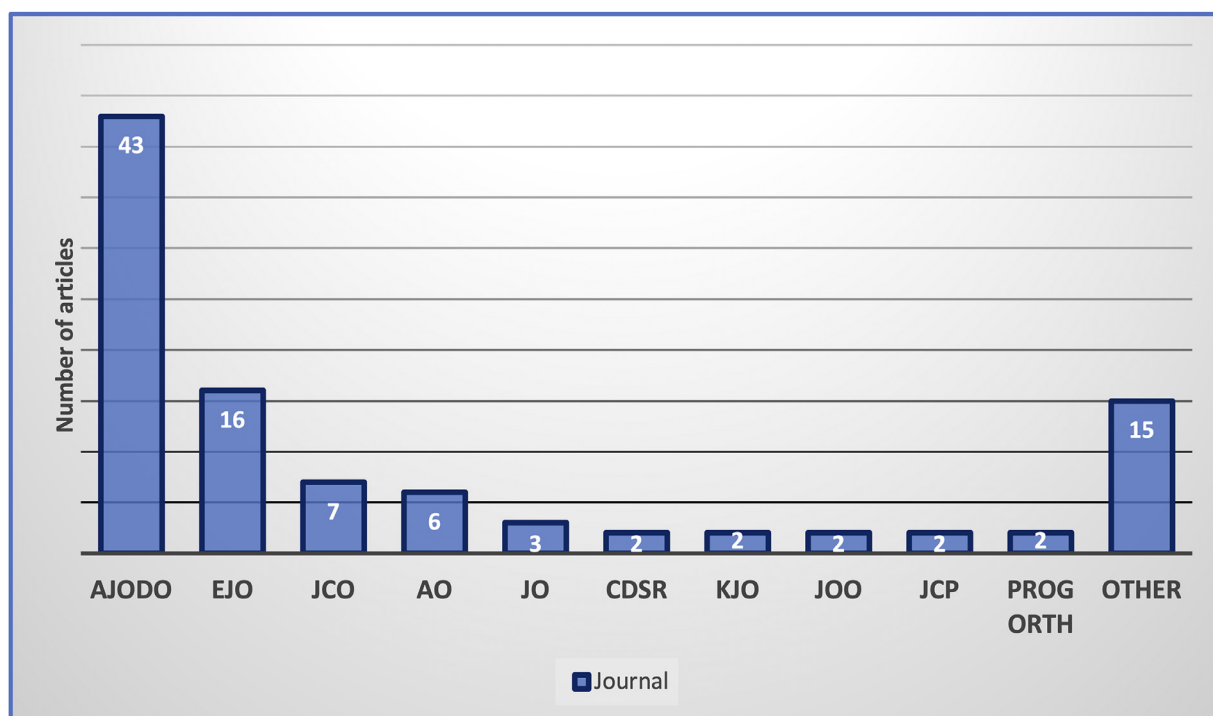


Fig. 3. Number of articles by journal of publication (N = 100). Illustrates that the AJO–DO was the journal in which articles were most frequently published.

[Key: AJODO: American Journal of Orthodontics/American Journal of Orthodontics and Dentofacial Orthopaedics; EJO: European Journal of Orthodontics; JCO: Journal of Clinical Orthodontics; AO: Angle Orthodontist; CDSR: Cochrane Database of Systematic Reviews; KJO: Korean Journal of Orthodontics; JCP: Journal of Clinical Periodontology; Prog Orth: Progress in Orthodontics].

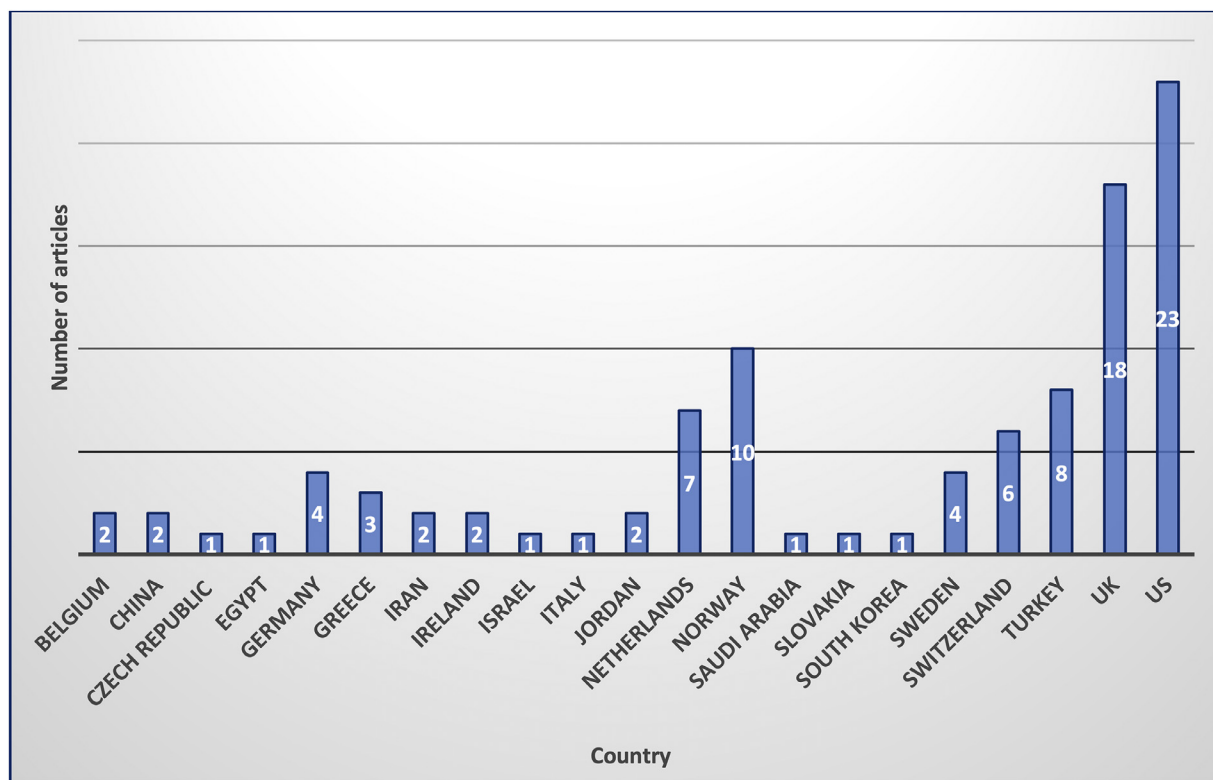


Fig. 4. Number of articles by country (N = 100). Show that the United States (n = 23; 23%) and the United Kingdom (n = 18; 18%) were the two countries which recorded most first author affiliations. [Note that only years prior to 1990 in which articles were published are shown].

Table 3**Institutions with 2 or more cited articles in the top 100.**

Rank	Institution	Country	Articles in top 100 (N)
1.	University of Oslo	Norway	8
2.	Queen Mary University London	UK	6
3. =	St Lukes Hospital	UK	4
3. =	University of Bern	Switzerland	4
5. =	University of Washington	US	3
5. =	Radboud University Nijmegen	Netherlands	3
5. =	Virginia Commonwealth University	US	3
8. =	University of North Carolina	US	2
8. =	University of Athens	Greece	2
8. =	Jordan Science University	Jordan	2
8. =	University of Tennessee	Tennessee	2
8. =	Free University Brussels	Belgium	2
8. =	University of Manchester	UK	2
8. =	Malmö University	Sweden	2
8. =	Hacettepe University	Turkey	2

Table 4**Top 10 authors by number of citations**

Rank	Author	Times cited (n)	Articles in Top 100 (n)
1	Simon J. Littlewood	887	7
2	Christos Katsaros	823	8
3	Anne-Marie Renkema	763	6
4	Bjorn U Zachrisson	675	7
5	David R Bearn	665	5
6	Nikolaos Pandis	660	7
7	Jon Artun	660	5
8	Declan Millett	637	5
9	Ewald Bronkhorst	477	4
10	Peter A Shapiro	434	3

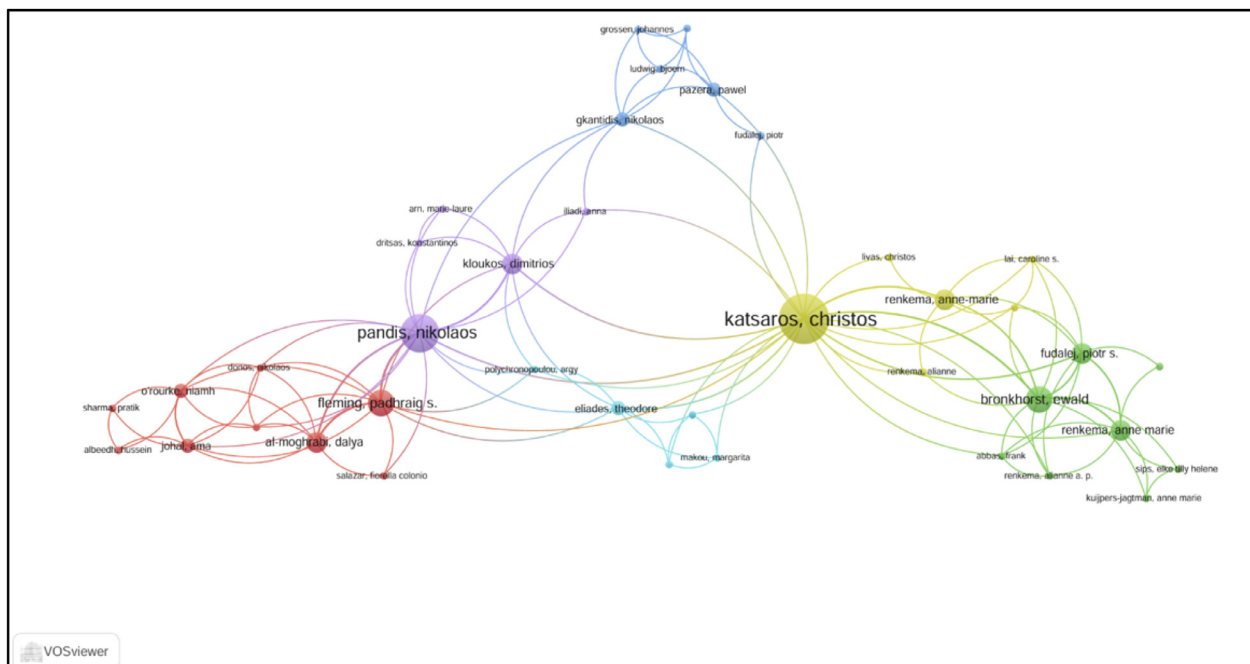


Fig. 5. Author collaboration network. Indicates the author collaboration network which includes 39 connected authors categorised into six distinct clusters. [Collaboration networks between authors (defined as more than one collaboration). The size of the nodes is proportional to the number of articles published by each author. The thickness of the connecting line indicates the strength of the connection.]

indicated in the relatively small number of connected authors noted in the present bibliometric review.

The number of countries to which first authors were affiliated was 21. This was similar to the 22 recorded in investigations related to the 100 most-cited articles in orthodontics,⁷ 23 in a similar analysis of RCTs in orthodontics,¹¹⁶ and 24 in a bibliometric analysis of artificial intelligence in orthodontics and orthognathic surgery.¹²² The US was the most common country of affiliation for the first named author. This aligned with the findings of several bibliometric analyses in related to different orthodontic topics.^{7,8,116,117,126} However, the institute with the most articles in the top 100 was based in Norway – University of Oslo, with eight. The same institute also had the distinction of having the third most¹²⁶ and most⁷ articles in two bibliometric studies of the 100 most-cited articles in orthodontics.⁷

The limitations of the present study require acknowledgement. The search for the 100 most-cited articles was undertaken via one database only. Although this corresponded with the predominant methodology undertaken within the orthodontic bibliometric research landscape, and employed the database used in numerous other bibliometric investigations,^{6,8,11,112–114,127} searches in additional databases may have changed the list of studies presented here. However, by employing one database only, it minimised the risk of data duplication, averted potential discrepancies in the formatting of metadata, and enabled predictable tracking of citations without requiring sophisticated merging applications. Articles written in non-English languages were excluded from evaluation. In addition, it must be noted that even if the number of citations is suggestive of the influence of an article, time is required for an article to accrue citations which means that recently published articles of importance cannot be yet considered for inclusion and that highly cited articles are not indicative of retention protocols that must be employed. Moreover, the presence of self-citations, which was not investigated here, and the possible tendency by some researchers to cite articles from specific sources means that the use of the number of citations only is not adequate in the judgment of the value of an article.

However, the findings of the analysis presented here provide researchers with new data on which to reflect when undertaking relevant investigations.

Conclusions

This appeared to be the first investigation to undertake a bibliometric evaluation of the 100 most-cited articles on orthodontic retention and retainers. More than half of the included articles were published in the AJODO and the EJO and the US was the country to which first named authors were most affiliated. A wide range of article types were highly cited with almost one in six ($n = 1449$; 15.1%) of the total citations were associated with RCT articles.

And while acknowledging the limitations of bibliometric research, the relatively small number of connected authors suggested that there is room for increased collaboration between centres concerning orthodontic retention research.

Patient consent

This study did not involve any human participants or patient data so patient consent is not required.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT authorship contribution statement

Maurice J. Meade: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Edward Davies:** Writing – original draft, Methodology, Investigation, Formal analysis, Data curation.

Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1053/j.sodo.2026.07.006.

References

- Meade MJ, Millett DT. Orthodontic bonded retainers: a narrative review. *Dent Update*. 2020;47:421–432.
- Millett D. The rationale for orthodontic retention: piecing together the jigsaw. *Br Dent J*. 2021;230:739–749.
- Meade MJ, Millett DT. Vacuum-formed retainers: an overview. *Dent Update*. 2015;42:24–34.
- Meade MJ, Millett D. Retention protocols and use of vacuum-formed retainers among specialist orthodontists. *J Orthod*. 2013;40:318–325.
- Carneiro NC, Nóbrega MT, Meade MJ, Flores-Mir C. Retention decisions and protocols among orthodontists practicing in Canada: a cross-sectional survey. *Am J Orthod Dentofacial Orthop*. 2022;162:51–57.
- Meade MJ, Lin TH, Weir T. A bibliometric analysis of clear aligner therapy research articles published over 5 years–2020–2024. *Int Orthod*. 2025;23:101039.
- Tarazona B, Lucas-Dominguez R, Paredes-Gallardo V, Alonso-Arroyo A, Vidal-Infer A. The 100 most-cited articles in orthodontics: a bibliometric study. *Angle Orthod*. 2018;88:785–796.
- Cheng L, Feng Z, Hao Z, Si M, Yuan R, Feng Z. Molar distalization in orthodontics: a bibliometric analysis. *Clin Oral Investig*. 2024;28(2):123.
- Tarazona B, Alvarez B, Lucas-Dominguez R, Paredes-Gallardo V, Alonso-Arroyo A, Vidal-Infer A. A bibliometric analysis of scientific production in the field of lingual orthodontics. *Head Face Med*. 2019;15:0–1.
- Ferrillo M, Nucci L, Gallo V, Bruni A, Montrella R, Fortunato L, Giudice A, Perillo L. Temporary anchorage devices in orthodontics: a bibliometric analysis of the 50 most-cited articles from 2012 to 2022. *Angle Orthod*. 2023;93(5):591–602.
- Zheng Y, Lam XY, Wu M, Lin Y. Acceleration of orthodontic tooth movement: a bibliometric and visual analysis. *Int Dent J*. 2025;75:1223–1233.
- Montazeri A, Mohammadi S, Hesari P M, Ghaemi M, Riazhi H, Sheikhi–Mobarakeh Z. Preliminary guideline for reporting bibliometric reviews of the biomedical literature (BIBLIO): a minimum requirements. *Syst Rev*. 2023;12:239.
- Littlewood SJ, Millett DT, Doubleday B, Beam DR, Worthington HV. Retention procedures for stabilising tooth position after treatment with orthodontic braces. *Cochrane Database Syst Rev*. 2016;2016(1):CD002283.
- Sheridan JJ, LeDoux W, McMinn R. Essix retainers: fabrication and supervision for permanent retention. *J Clin Orthod*. 1993;27:37–45.
- Zachrisson BU. Clinical experience with direct-bonded orthodontic retainers. *Am J Orthod*. 1977;71:440–448.
- Artun J, Spadafora AT, Shapiro PA. A 3-year follow-up study of various types of orthodontic canine-to-canine retainers. *Eur J Orthod*. 1997;19:501–509.
- De L, Cruz A, Sampson P, Little RM, Artun J, Shapiro PA. Long-term changes in arch form after orthodontic treatment and retention. *Am J Orthod Dentofacial Orthop*. 1995;107:518–530.
- Hichens L, Rowland H, Williams A, Hollinghurst S, Ewings P, Clark S, et al. Cost-effectiveness and patient satisfaction: hawley and vacuum-formed retainers. *Eur J Orthod*. 2007;29:372–378.
- Katsaros C, Livas C, Renkema AM. Unexpected complications of bonded mandibular lingual retainers. *Am J Orthod Dentofacial Orthop*. 2007;132:838–841.
- Beam DR. Bonded orthodontic retainers: a review. *Am J Orthod Dentofacial Orthop*. 1995;108:207–213.
- Dahl EH, Zachrisson BU. Long-term experience with direct-bonded lingual retainers. *J Clin Orthod*. 1991;25:619–630.
- Al Yami EA, Kuijpers–Jagtman AM, van 't Hof MA. Stability of orthodontic treatment outcome: follow-up until 10 years postretention. *Am J Orthod Dentofacial Orthop*. 1999;115:300–304.
- Sharpe W, Reed B, Subtelny JD, Polson A. Orthodontic relapse, apical root resorption, and crestal alveolar bone levels. *Am J Orthod Dentofacial Orthop*. 1987;91:252–258.
- Booth FA, Edelman JM, Proffit WR. Twenty-year follow-up of patients with permanently bonded mandibular canine-to-canine retainers. *Am J Orthod Dentofacial Orthop*. 2008;133:70–76.
- Littlewood SJ, Kandasamy S, Huang G. Retention and relapse in clinical practice. *Aust Dent J*. 2017;62(Suppl 1):51–57.
- Sadowsky C, Schneider BJ, BeGole EA, Tahir E. Long-term stability after orthodontic treatment: nonextraction with prolonged retention. *Am J Orthod Dentofacial Orthop*. 1994;106:243–249.

27. Rowland H, Hichens L, Williams A, et al. The effectiveness of Hawley and vacuum-formed retainers: a single-center randomized controlled trial. *Am J Orthod Dentofacial Orthop.* 2007;132:730–737.
28. Johnston CD, Littlewood SJ. Retention in orthodontics. *Br Dent J.* 2015;218:119–122.
29. Renkema AM, Renkema A, Bronkhorst E, Katsaros C. Long-term effectiveness of canine-to-canine bonded flexible spiral wire lingual retainers. *Am J Orthod Dentofacial Orthop.* 2011;139:614–621.
30. Pandis N, Vlahopoulos K, Madianos P, Eliades T. Long-term periodontal status of patients with mandibular lingual fixed retention. *Eur J Orthod.* 2007;29:471–476.
31. Melrose C, Millett DT. Toward a perspective on orthodontic retention? *Am J Orthod Dentofacial Orthop.* 1998;113:507–514.
32. Al-Omiri MK, Abu Alhaija ES. Factors affecting patient satisfaction after orthodontic treatment. *Angle Orthod.* 2006;76:422–431.
33. Pratt MC, Kluemper GT, Hartsfield JK, Fardo D, Nash DA. Evaluation of retention protocols among members of the American Association of Orthodontists in the United States. *Am J Orthod Dentofac Orthop.* 2011;140:520–526.
34. Al-Moghrabi D, Salazar FC, Pandis N, Fleming PS. Compliance with removable orthodontic appliances and adjuncts: a systematic review and meta-analysis. *Am J Orthod Dentofacial Orthop.* 2017;152:17–32.
35. Artun J, Garol JD, Little RM. Long-term stability of mandibular incisors following successful treatment of class II, division 1, malocclusions. *Angle Orthod.* 1996;66:229–238.
36. Renkema AM, Fudalej PS, Renkema AA, Abbas F, Bronkhorst E, Katsaros C. Gingival labial recessions in orthodontically treated and untreated individuals: a case – control study. *J Clin Periodontol.* 2013;40:631–637.
37. Störmann I, Ehmer U. A prospective randomized study of different retainer types. *J Orthod Dentofacial Orthop.* 2002;63:42–50.
38. Levin L, Samorodnitsky-Naveh GR, Machtei EE. The association of orthodontic treatment and fixed retainers with gingival health. *J. Periodontol.* 2008;79:2087–2092.
39. Littlewood SJ, Millett DT, Doubleday B, Bearn DR, Worthington HV. Orthodontic retention: a systematic review. *J Orthod.* 2006;33:205–212.
40. Renkema AM, Hélène Sips ET, Bronkhorst E, Kuijpers–Jagtman AM. A survey on orthodontic retention procedures in the Netherlands. *Eur J Orthod.* 2009;31(4):432–437.
41. Valiathan M, Hughes E. Results of a survey-based study to identify common retention practices in the United States. *Am J Orthod Dentofacial Orthop.* 2010;137:170–177.
42. Gardner SD, Chaconas SJ. Posttreatment and postretention changes following orthodontic therapy. *Angle Orthod.* 1976;46:151–161.
43. Padmos JA, Fudalej PS, Renkema AM. Epidemiologic study of orthodontic retention procedures. *Am J Orthod Dentofacial Orthop.* 2018;153:496–504.
44. Shaughnessy TG, Proffit WR, Samara SA. Inadvertent tooth movement with fixed lingual retainers. *Am J Orthod Dentofacial Orthop.* 2016;149:277–286.
45. Pratt MC, Kluemper GT, Lindstrom AF. Patient compliance with orthodontic retainers in the postretention phase. *Am J Orthod Dentofacial Orthop.* 2011;140:196–201.
46. Tsomos G, Ludwig B, Grossen J, Pazera P, Gkantidis N. Objective assessment of patient compliance with removable orthodontic appliances: a cross-sectional cohort study. *Angle Orthod.* 2014;84:56–61.
47. Artun J. Caries and periodontal reactions associated with long-term use of different types of bonded lingual retainers. *Am J Orthod.* 1984;86:112–118.
48. Pazera P, Fudalej P, Katsaros C. Severe complication of a bonded mandibular lingual retainer. *Am J Orthod Dentofacial Orthop.* 2012;142:406–409.
49. Al-Moghrabi D, Johal A, O'Rourke N, Donos N, Pandis N, Gonzales–Marin C, Fleming PS. Effects of fixed vs removable orthodontic retainers on stability and periodontal health: 4-year follow-up of a randomized controlled trial. *Am J Orthod Dentofacial Orthop.* 2018;154:167–174.
50. Sauget E, Jr CDA, Boero RP, Lieber WS. Comparison of occlusal contacts with use of Hawley and clear overlay retainers. *Angle Orthod.* 1997;67:223–230.
51. Vaden JL, Harris EF, Gardner RL. Relapse revisited. *Am J Orthod Dentofacial Orthop.* 1997;111:543–553.
52. Al-Moghrabi D, Pandis N, Fleming PS. The effects of fixed and removable orthodontic retainers: a systematic review. *Prog. Orthod.* 2016;17:24.
53. Kučera J, Marek I. Unexpected complications associated with mandibular fixed retainers: a retrospective study. *Am J Orthod Dentofacial Orthop.* 2016;149:202–211.
54. Tacke MP, Cosyn J, De Wilde P, Aerts J, Govaerts E, Vannet BV. Glass fibre reinforced versus multistranded bonded orthodontic retainers: a 2 year prospective multi-centre study. *Eur J Orthod.* 2010;32:117–123.
55. Singh P, Grammati S, Kirschen R. Orthodontic retention patterns in the United Kingdom. *J Orthod.* 2009;36:115–121.
56. Forde K, Storey M, Littlewood SJ, Scott P, Luther F, Kang J. Bonded versus vacuum-formed retainers: a randomized controlled trial. Part 1: stability, retainer survival, and patient satisfaction outcomes after 12 months. *Eur J Orthod.* 2018;40:387–398.
57. Cole D, Bencharit S, Carrico CK, Arias A, Tüfekci E. Evaluation of fit for 3D-printed retainers compared with thermoform retainers. *Am J Orthod Dentofacial Orthop.* 2019;155:592–599.
58. Littlewood SJ, Millett DT, Doubleday B, Bearn DR, Worthington HV. Retention procedures for stabilising tooth position after treatment with orthodontic braces. *Cochrane Database Syst Rev.* 2006;(1):CD002283.
59. Lai CS, Grossen JM, Renkema AM, Bronkhorst E, Fudalej PS, Katsaros C. Orthodontic retention procedures in Switzerland. *Swiss Dent J.* 2013;124:655–661.
60. Lindauer SJ, Shoff RC. Comparison of Essix and Hawley retainers. *J Clin Orthod.* 1998;32:95–97.
61. Mai W, He J, Meng H, Jiang Y, Huang C, Li M, Yuan K, Kang N. Comparison of vacuum-formed and Hawley retainers: a systematic review. *Am J Orthod Dentofacial Orthop.* 2014;145:720–727.
62. Little RM, Riedel RA, Engst ED. Serial extraction of first premolars—postretention evaluation of stability and relapse. *Angle Orthod.* 1990;60:255–262.
63. Iliadi A, Kloukos D, Gkantidis N, Katsaros C, Pandis N. Failure of fixed orthodontic retainers: a systematic review. *J Dent.* 2015;43:876–896.
64. Kravitz ND, Grauer D, Schumacher P, Jo YM. Memotain: a CAD/CAM nickel–titanium lingual retainer. *Am J Orthod Dentofacial Orthop.* 2017;151:812–815.
65. Zachrisson BU. Long-term experience with direct-bonded retainers: update and clinical advice. *J Clin Orthod.* 2007;41:728–737.
66. Gardner GD, Dunn WJ, Taloumis L. Wear comparison of thermoplastic materials used for orthodontic retainers. *Am J Orthod Dentofacial Orthop.* 2003;124:294–297.
67. Heier EE, De Smit AA, Wijngaerts IA, Adriaens PA. Periodontal implications of bonded versus removable retainers. *Am J Orthod Dentofacial Orthop.* 1997;112:607–616.
68. Lie Sam Foek DJ, Ozcan M, Verkerke GJ, Sandham A, Dijkstra PU. Survival of flexible, braided, bonded stainless steel lingual retainers: a historic cohort study. *Eur J Orthod.* 2008;30:199–204.
69. Strunga M, Urban R, Surovková J, Thurzo A. Artificial intelligence systems assisting in the assessment of the course and retention of orthodontic treatment. *Healthcare (Basel).* 2023;11:683.
70. Karaman AI, Kir N, Belli S. Four applications of reinforced polyethylene fiber material in orthodontic practice. *Am J Orthod Dentofacial Orthop.* 2002;121:650–654.
71. Rose E, Frucht S, Jonas IE. Clinical comparison of a multistranded wire and a direct-bonded polyethylene ribbon-reinforced resin composite used for lingual retention. *Quintessence Int.* 2002;33:579–583.
72. Thickett E, Power S. A randomized clinical trial of thermoplastic retainer wear. *Eur J Orthod.* 2010;32:1–5.
73. Bearn DR, McCabe JF, Gordon PH, Aird JC. Bonded orthodontic retainers: the wire – composite interface. *Am J Orthod Dentofacial Orthop.* 1997;111:67–74.
74. Farhadian N, Usefi Mashoof R, Khanizadeh S, Ghaderi E, Farhadian M, Miresmaeili A. Streptococcus mutans counts in patients wearing removable retainers with silver nanoparticles vs those wearing conventional retainers: a randomized clinical trial. *Am J Orthod Dentofacial Orthop.* 2016;149:155–160.
75. Kartal Y, Kaya B. Fixed Orthodontic Retainers: a Review. *Turk J Orthod.* 2019;32:110–114.
76. Karaman AI, Polat O, Büyükyılmaz T. A practical method of fabricating a lingual retainer. *Am J Orthod Dentofacial Orthop.* 2003;124:327–330.
77. Artun J, Spadafora AT, Shapiro PA, McNeill RW, Chapko MK. Hygiene status associated with different types of bonded, orthodontic canine-to-canine retainers. A clinical trial. *J Clin Periodontol.* 1987;14:89–94.
78. Gill DS, Naini FB, Jones A, Tredwin CJ. Part-time versus full-time retainer wear following fixed appliance therapy: a randomized prospective controlled trial. *World J Orthod.* 2007;8:300–306.
79. Zachrisson BU. Important aspects of long-term stability. *J Clin Orthod.* 1997;31:562–583.
80. Arn ML, Dritsas K, Pandis N, Kloukos D. The effects of fixed orthodontic retainers on periodontal health: a systematic review. *Am J Orthod Dentofacial Orthop.* 2020;157:e17.
81. Edman Tynelius G, Petrén S, Bondemark L, Lilja–Karlander E. Five-year postretention outcomes of three retention methods—a randomized controlled trial. *Eur J Orthod.* 2014;37:345–353.
82. Zachrisson BU. Multistranded wire bonded retainers: from start to success. *Am J Orthod Dentofacial Orthop.* 2015;148:724–727.
83. Jäderberg S, Feldmann I, Engström C. Removable thermoplastic appliances as orthodontic retainers—a prospective study of different wear regimens. *Eur J Orthod.* 2012;34:475–479.
84. Storey M, Forde K, Littlewood SJ, Scott P, Luther F, Kang J. Bonded versus vacuum-formed retainers: a randomized controlled trial. Part 2: periodontal health outcomes after 12 months. *Eur J Orthod.* 2018;40:399–408.
85. Aasen TO, Espeland L. An approach to maintain orthodontic alignment of lower incisors without the use of retainers. *Eur J Orthod.* 2005;27:209–214.
86. Molloy ND, Lindauer SJ, Best AM, Shroff B, Tufekci E. Patient attitudes toward retention and perceptions of treatment success. *Angle Orthod.* 2010;80:656–661.
87. Nasef AA, El-Beialy AR, Mostafa YA. Virtual techniques for designing and fabricating a retainer. *Am J Orthod Dentofacial Orthop.* 2014;146:394–398.
88. Egli F, Bovali E, Kiliaridis S, Cornelis MA. Indirect vs direct bonding of mandibular fixed retainers in orthodontic patients: comparison of retainer failures and posttreatment stability. A 2-year follow-up of a single-center randomized controlled trial. *Am J Orthod Dentofacial Orthop.* 2017;151:15–27.
89. Kang YG, Kim JY, Kim J, Won PJ, Nam JH. Release of bisphenol A from resin composite used to bond orthodontic lingual retainers. *Am J Orthod Dentofacial Orthop.* 2011;140:779–789.
90. Pandis N, Fleming PS, Kloukos D, Polychronopoulou A, Katsaros C, Eliades T. Survival of bonded lingual retainers with chemical or photo polymerization over a 2-year period: a single-center, randomized controlled clinical trial. *Am J Orthod Dentofacial Orthop.* 2013;144:169–175.
91. Taner T, Aksu M. A prospective clinical evaluation of mandibular lingual retainer survival. *Eur J Orthod.* 2012;34:470–474.
92. Taner TU, Ciger S, El H, Germeç D, Es A. Evaluation of dental arch width and form changes after orthodontic treatment and retention with a new computerized method. *Am J Orthod Dentofacial Orthop.* 2004;126:464–475.
93. Edman Tynelius G, Bondemark L, Lilja–Karlander E. A randomized controlled trial of three orthodontic retention methods in Class I four premolar extraction cases—stability after 2 years in retention. *Orthod Craniofac Res.* 2013;16:105–115.

94. Al-Nimri K, Al Habashneh R, Obeidat M. Gingival health and relapse tendency: a prospective study of two types of lower fixed retainers. *Aust Orthod J*. 2009;25:142–146.
95. Demir A, Babacan H, Nalcaci R, Topcuoglu T. Comparison of retention characteristics of Essix and Hawley retainers. *Kor J Orthod*. 2012;42:255–262.
96. O'Rourke N, Albeedh H, Sharma P, Johal A. Effectiveness of bonded and vacuum-formed retainers: a prospective randomized controlled clinical trial. *Am J Orthod Dentofacial Orthop*. 2016;150:406–415.
97. Saleh M, Hajeer MY, Muessig D. Acceptability comparison between Hawley retainers and vacuum-formed retainers in orthodontic adult patients: a single-centre, randomized controlled trial. *Eur J Orthod*. 2017;39:453–461.
98. Sun J, Yu YC, Liu MY, Chen L, Li HW, Zhang L, Zhou Y, Ao D, Tao R, Lai WL. Survival time comparison between Hawley and clear overlay retainers: a randomized trial. *J Dent Res*. 2011;90:1197–1201.
99. Zachrisson BU. The bonded lingual retainer and multiple spacing of anterior teeth. *Swed Dent J Suppl*. 1982;15:247–255.
100. Di Venere D, Pettini F, Nardi GM, Laforgia A, Stefanachi G, Notaro V, Rapone B, Grassi FR, Corsalini M. Correlation between parodontal indexes and orthodontic retainers: prospective study in a group of 16 patients. *Oral Implantol (Rome)*. 2017;10:78–86.
101. Salehi P, Zarif Najafi H, Roeinpekar SM. Comparison of survival time between two types of orthodontic fixed retainer: a prospective randomized clinical trial. *Prog Orthod*. 2013;14:25.
102. Steinnes J, Johnsen G, Kerosuo H. Stability of orthodontic treatment outcome in relation to retention status: an 8-year follow-up. *Am J Orthod Dentofacial Orthop*. 2017;151:1027–1033.
103. Wolf M, Schumacher P, Jäger F, Wego J, Fritz U, Korbmacher–Steiner H, Jäger A, Schauseil M. Novel lingual retainer created using CAD/CAM technology: evaluation of its positioning accuracy. *J Orofac Orthop*. 2015;76:164–174.
104. Dyer KC, Vaden JL, Harris EF. Relapse revisited—again. *Am J Orthod Dentofacial Orthop*. 2012;142:221–227.
105. Baysal A, Uysal T, Gul N, Alan MB, Ramoglu SI. Comparison of three different orthodontic wires for bonded lingual retainer fabrication. *Kor J Orthod*. 2012;42:39–46.
106. Shawesh M, Bhatti B, Usmani T, Mandall N. Hawley retainers full—or part—time? A randomized clinical trial. *Eur J Orthod*. 2010;32:165–170.
107. Vandevska–Radunovic V, Espeland L, Stenvik A. Retention: type, duration and need for common guidelines. A survey of Norwegian orthodontists. *Orthodontics (Chic.)*. 2013;14:110–117.
108. Eliades T, Voutsas D, Sifakakis I, Makou M, Katsaros C. Release of bisphenol–A from a light-cured adhesive bonded to lingual fixed retainers. *Am J Orthod Dentofacial Orthop*. 2011;139:192–195.
109. Türköz C, Canigür Bavbek N, Kale Varlik S, Akça G. Influence of thermoplastic retainers on *Streptococcus mutans* and *Lactobacillus* adhesion. *Am J Orthod Dentofacial Orthop*. 2012;141:598–603.
110. Zachrisson BJ. Third-generation mandibular bonded lingual 3–3 retainer. *J Clin Orthod*. 1995;29:39–48.
111. Edman Tynelius G, Bondemark L, Lilja–Karlander E. Evaluation of orthodontic treatment after 1 year of retention—a randomized controlled trial. *Eur J Orthod*. 2010;32:542–547.
112. Bruni A, Serra FG, Gallo V, Deregius A, Castrolforio T. The 50 most-cited articles on clear aligner treatment: a bibliometric and visualized analysis. *Am J Orthod Dentofacial Orthop*. 2021;159:e343.
113. Gong B, Liu Z, Yang L, Sun X, Lu J, Teng L, Bai Y, Xie X. Twenty years of clear aligner therapy: a bibliometric analysis (2002–2022). *Aust Orthod J*. 2023;39:15–31.
114. He X, Huang Z, Yang Y, Yuan X, Wen S, Li Y, Hu G, Lai W, Long H. A bibliometric analysis of clear aligner treatment (CAT) from 2003 to 2023. *Cureus*. 2024;16:6.
115. Sari ÖF, Albayrak E, Büyükcavuş MH. Evaluation of the most cited articles about clear aligners in the last 10 years: a bibliometric analysis (Methodological studies). *Türkiye Klinikleri J Dent Sci*. 2025;31:1.
116. Lam XY, Ren J, Yeung AW, Lin Y. The 100 most-cited randomised controlled trials in orthodontics: a bibliometric study. *Int Dent J*. 2024;74:868–875.
117. Fernandes EC, Júnior MB, Tórres AC, de Oliveira Nóbrega FJ, Santos PB. The 100 most-cited articles in orthodontic journals in the last 20 years. *Am J Orthod Dentofacial Orthop*. 2022;161:e260.
118. Pandis N. Randomized clinical trials (RCTs) and systematic reviews (SRs) in the context of evidence-based orthodontics (EBO). *Sem Orthod*. 2013;19:142–157.
119. Alsulaiman AA, Alsulaiman OA. Accelerated orthodontics: a descriptive bibliometric analysis of the top 50 cited articles from 2012 to 2023. *Clin Pract*. 2024;14:1716–1736.
120. Meade MJ, Lin TH. Retainer preferences and retention protocols of orthodontists: a scoping review. *Semin Orthod*. 2026. <https://doi.org/10.1053/j.sodo.2026.06.008>. Article in press.
121. Cornelis MA, Cattaneo PM. Retention in Orthodontics: an evidence-based overview. *Sem Orthod*. 2025. <https://doi.org/10.1053/j.sodo.2025.11.002>.
122. Wong KF, Lam XY, Jiang Y, Yeung AW, Lin Y. Artificial intelligence in orthodontics and orthognathic surgery: a bibliometric analysis of the 100 most-cited articles. *Head Face Med*. 2023;19:38.
123. Selvaraj M, Nivethitha B, Varshitha P, Sangeetha U, Madhan B. A bibliometric analysis of the 100 top-cited systematic review and meta-analysis in Orthodontics. *Dent Press J Orthod*. 2024;29:e242401.
124. Meade MJ, Ju X, Jamieson LM. Conflict of interest and funding reporting by articles published in orthodontic journals: a cross-sectional investigation. *J Dent*. 2026;166:106312.
125. Jakab M, Kittl E, Kiesslich T. How many authors are (too) many? A retrospective, descriptive analysis of authorship in biomedical publications. *Scientometrics*. 2024;129(3):1299–1328.
126. Hui J, Han Z, Geng G, Yan W, Shao P. The 100 top-cited articles in orthodontics from 1975 to 2011. *Angle Orthod*. 2013;83:491–499.
127. Polizzi A, Boato M, Serra S, D'Antò V, Leonardi R. Applications of artificial intelligence in orthodontics: a bibliometric and visual analysis. *Clin Oral Investig*. 2025;29:1–4.