

Review Article

Most Cited Publications on Root Resorption of Permanent Teeth

Shaul Lin^{1,2,3}, Dekel Wisblech¹, Khalid Al Hezaimi⁴, Ilan Rotstein^{4*}

¹Department of Endodontics, Rambam Health Care Campus, Haifa, Israel

²The Ruth and Bruce Rappaport Faculty of Medicine, Technion - Israel Institute of Technology, Haifa, Israel

³The Israeli National Center for Trauma & Emergency Medicine Research, Gertner Institute, Tel Hashomer, Israel

⁴Herman Ostrow School of Dentistry, University of Southern California, Los Angeles, California, USA

*Correspondence author: Ilan Rotstein, Herman Ostrow School of Dentistry, University of Southern California, Los Angeles, California, USA;
E-mail: ilan@usc.edu

Citation: Lin S, et al. Most Cited Publications on Root Resorption of Permanent Teeth. J Dental Health Oral Res. 2024;5(3):1-20.

<https://doi.org/10.46889/JDHOR.2024.5313>

Received Date: 03-12-2024

Accepted Date: 23-12-2024

Published Date: 30-12-2024



Copyright: © 2024 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CCBY) license (<https://creativecommons.org/licenses/by/4.0/>).

Abstract

Introduction: Root resorption of permanent teeth is a complex phenomenon, often presenting clinical challenges. The aim was to identify and analyze the most cited publications related to root resorption of permanent teeth.

Method: A bibliographic search of all citations related to root resorption of permanent teeth published in scientific journals. Only publications with 100 citations or more were included, divided into four categories: experimental and review studies related to external or internal root resorption. A descriptive statistical analysis was conducted, including standard deviation and margin of error.

Results: Sixty-nine (0.49%) publications, 48 experimental, and 21 review studies met the inclusion criteria. Of the 48 most cited experimental research publications, 48 (100%) pertained to external root resorption. Of the 21 most cited review publications, 19 (90.48%) pertained to external root resorption, and 2 (9.52%) to internal root resorption.

Keywords: Root Resorption; Teeth; Scientific Publications

Introduction

Root resorption of permanent teeth can challenge clinicians regarding diagnosis, case selection, treatment, and prognosis [1-5]. It is distinguished by its duration, i.e., transient or progressive, its location, namely external or internal and the presence of contamination, specifically infected or non-infected root resorption [4-9]. Several etiological factors can contribute to the development of root resorption, such as microbial, mechanical, chemical, and thermal [6,8,10-14]. Microbial factors may include microbial infection from a necrotic pulp (i.e., external inflammatory root resorption) or the periodontal ligament (i.e., external cervical root resorption). Mechanical factors may include traumatic injuries to the dental apparatus (i.e., radicular cracks or fractures, avulsions, and root luxations) resulting in resorption of the root. Tumors, cysts, impacted teeth, intra-coronal bleaching of nonvital teeth using high concentrations of oxidizing agents, and excessive orthodontic forces can also be the culprit [1,4,6,8,10-16].

Quantitative bibliometric analysis is often used to assess the impact of scientific publications [17]. It is a method that involves the systematic collection and analysis of bibliographic data to study and evaluate peer-reviewed articles. One of the primary applications of bibliometric analysis is assessing scientific publications' impact. Citation analysis provides a fast and efficient way to identify the most significant publications or "classics" in a field, and there is considerable overlap between the publications identified through citation analysis and those included in current reading curriculums [18]. Furthermore, a publication with 100 or more citations is considered 'classic' based on the specific field of scientific and clinical research [19,20]. The number of citations represents the number of times that peers have cited a specific publication over time. It is frequently used in bibliographic studies and is one of the metrics that assess a journal's impact factor [21]. Clinicians can use it as a quick reference to publications that received greater attention from their peers [22].

Another assessment method used in bibliometric analysis is citation density, calculated by dividing the total number of citations by the number of years after the publication first appeared [17]. This analysis mainly emphasizes more recent publications that have received many citations.

Several bibliographic studies have been published ranking dental publications based on their number of citations [22-29]. These publications include the outcome of endodontic treatment, dental traumatology, and regenerative endodontics. Bibliometric-based studies have several implications on clinical practice, including identifying influential research, supporting evidence-based practice, and identifying research gaps. Additionally, bibliometric analysis can highlight areas of research that require further investigation.

To date, a study focusing on the most cited publications related to root resorption has not been included. Therefore, the present study aimed to identify and analyze the most cited publications related to root resorption of permanent teeth.

Materials and Methods

Data Extraction and Bibliometric Analysis

The retrospective study was conducted according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (www.strobe-statement.org) [30,31]. Publications appearing between 1950 and 2022 were included. An electronic and manual search of all citations related to root resorption was carried out utilizing the Web of Science platform (<http://www.webofknowledge.com>; Clarivate Analytics, Philadelphia, PA, USA), including all its databases.

The search included keywords covering all relevant categories based on MeSH terms. Keywords included root resorption, surface resorption, replacement resorption, ankylosis, and cervical resorption. Only publications in the English language were included. Exclusion criteria were letters to the editor, lectures, conference proceedings, and abstracts. Publications related to orthodontic-induced root resorption were also excluded from this study.

The publications were analyzed and sorted in descending order according to the number of citations that each received. Publications with 100 citations or more were determined to be the most cited. Citation density was also assessed. The following objective parameters were applied: the title of the publication, authors, the journal in which the publication appeared, the year of publication, the number of citations, and citation density.

Methodological Design

The most cited publications were divided into experimental and review [22,32]. Experimental publications included all prospective and retrospective studies and randomized clinical trials. These publications were then subdivided into publications related to either external root resorption or internal root resorption. The review publications included all systematic reviews and literature meta-analyses. These publications were also subdivided into publications related to either external root resorption or internal root resorption. The data collected was analyzed, and a descriptive statistical analysis was conducted.

Country of Origin and Associated Institutions

The country of origin of the most cited publications and the institutions associated with the corresponding authors were categorized.

Results

Citation Number and Citation Density

Of a total of 31,228 publications identified, 13,887 publications were related to root resorption. Of the 13,887 publications related to root resorption, 143 (1.02%) had 100 citations or more. Sixty-nine publications (0.49%) met the inclusion criteria. Forty-eight (69.57%) experimental publications had 100 citations or more (Fig. 1). The top-cited publication had 413 citations with a citation density score of 15.3 (Table 1). This top publication also had the most citations of the 69 total publications, with 100 citations or more (Table 1,2). The average citation number among all top-cited experimental publications was 161.23 (SD±70.12; ME±10.12), and the average citation density was 6.21 (SD±3.91; ME±0.56). Of the 69 publications that met the inclusion criteria, 21 (30.43%) review publications had 100 citations or more (Table 2).

The top-cited publication comprised 334 citations with a citation density score of 9.82. The average citation number among all

top-cited review publications was 168.81 (SD±64.43; ME±14.05), and the average citation density was 9.19 (SD±3.97; ME±0.86). Of the 48 most cited experimental publications, 48 (100%) pertained to external root resorption (Table 3). Of the 21 most cited review publications, 19 (90.48%) pertained to external root resorption, and 2 (9.52%) to internal root resorption.

Several publications included both types of root resorption. No systematic reviews or meta-analyses were found among the publications with 100 citations or more.

Rank	Title	Authors	Journal	Year	No. of Citations	Citation Density
1	Replantation of 400 avulsed permanent incisors. 4. Factors related to periodontal-ligament healing.	Andreasen JO, Borum MK, Jacobsen HL, Andreasen FM.	Endodontics & Dental Traumatology	1995	413	15.3
2	Prognosis of luxated nonvital maxillary incisors treated with calcium hydroxide and filled with gutta-percha - a retrospective clinical study.	Cvek M.	Endodontics & Dental Traumatology	1992	400	13.3
3	Effect of extra-alveolar period and storage media upon periodontal and pulpal healing after replantation of mature permanent incisors in monkeys.	Andreasen JO.	International Journal of Oral Surgery	1981	277	6.76
4	Replantation of teeth. I. Radiographic and clinical study of 110 human teeth replanted after accidental loss.	Andreasen JO, Hjorting-Hansen E.	Acta Odontologica Scandinavica	1966	276	4.93
5	Healing following implantation of periodontitis affected roots into bone tissue.	Karring T, Nyman S, Lindhe J.	Journal of Clinical Periodontology	1980	275	6.55
6	Central giant-cell lesions of the jaws - a clinicopathological study.	Chuong R, Kaban LB, Kozakewich H, Perezatayde A.	Journal of Oral and Maxillofacial Surgery	1986	255	7.08
7	Periodontal repair in dogs - recombinant human bone morphogenetic protein-2 significantly enhances periodontal regeneration.	Sigurdsson TJ, Lee MB, Kubota K, Turek TJ, Wozney JM, et al.	Journal of Periodontology	1995	236	8.74
8	A long-term study of 370 autotransplanted premolars. 3. Periodontal healing subsequent to transplantation.	Andreasen JO, Paulsen HU, Yu Z, Schwartz O.	European Journal of Orthodontics	1990	217	6.78
9	The effect of limited drying or removal of the periodontal-ligament - periodontal healing after replantation of mature permanent incisors in monkeys.	Andreasen JO, Kristerson L.	Acta Odontologica Scandinavica	1981	211	5.15
10	Histochemical analysis of dental hard tissues following bleaching.	Rotstein I, Dankner E, Goldman A, Heling I, Stabholz A, Zalkind M.	Journal of Endodontics	1996	191	7.35

11	Replantation of 400 avulsed permanent incisors. 1. Diagnosis of healing complications.	Andreasen JO, Borum MK, Jacobsen HL, Andreasen FM.	Endodontics & Dental Traumatology	1995	187	6.93
12	Responses of immature permanent teeth with infected necrotic pulp tissue and apical periodontitis/abscess to revascularization procedures.	Chen MYH, Chen KL, Chen CA, Tayebaty F, Rosenberg PA, Chen MYH, Chen KL, Chen CA, Tayebaty F, Rosenberg PA. Lin LM.	International Endodontic Journal	2012	176	17.6
13	Effect of splinting upon periodontal healing after replantation of permanent incisors in monkeys.	Andreasen JO.	Acta Odontologica Scandinavica	1975	169	3.6
14	Rate and predictability of pulp revascularization in therapeutically reimplanted permanent incisors.	Kling M, Cvek M, Mejare I.	Endodontics & Dental Traumatology	1986	167	4.64
15	Invasive cervical resorption: An analysis of potential predisposing factors.	Heithersay GS.	Quintessence International	1999	163	7.09
16	Periodontal healing after replantation and auto-transplantation of incisors in monkeys.	Andreasen JO.	International Journal of Oral Surgery	1981	163	3.98
17	Replantation of teeth. II. histological study of 22 replanted anterior teeth in humans.	Andreasen JO, Hjorting-Hansen E.	Acta Odontologica Scandinavica	1966	161	2.88
18	Luxation of permanent teeth due to trauma. A clinical and radiographic follow-up study of 189 injured teeth.	Andreasen JO.	Scandinavian Journal of Dental Research	1970	158	3.04
19	The detection and management of root resorption lesions using intraoral radiography and cone beam computed tomography - an <i>in vivo</i> investigation.	Patel S, Dawood A, Wilson R, Horner K, Mannocci F.	International Endodontic Journal	2009	156	12
20	Central giant-cell lesions of the jaws - A clinical, radiologic, and histopathologic study.	Whitaker SB, Waldron CA.	Oral Surgery Oral Medicine Oral Pathology Oral Radiology and Endodontology	1993	152	5.24
21	Auto-transplantation of human premolars - a clinical and radiographic study of 100 teeth.	Kristerson L.	International Journal of Oral Surgery	1985	148	4

22	Periodontal repair in dogs: effect of rhbmp-2 concentration on regeneration of alveolar bone and periodontal attachment.	Wikesjo UME, Guglielmoni P, Promsudthi A, Cho KS, Trombelli L, et al.	Journal of Clinical Periodontology	1999	139	6.04
23	A time-related study of periodontal healing and root resorption activity after replantation of mature permanent incisors in monkeys.	Andreasen JO.	Swedish Dental Journal	1980	139	3.31
24	Localization of impacted maxillary canines and observation of adjacent incisor resorption with cone-beam computed tomography.	Liu DG, Zhang WL, Zhang ZY, Wu YT, Ma XC.	Oral Surgery Oral Medicine Oral Pathology Oral Radiology and Endodontology	2008	138	9.86
25	The pattern of resorption and repair of human cementum.	Henry JL, Weinmann JP.	Journal of the American Dental Association (1939)	1951	136	1.92
26	Influence of voxel size in the diagnostic ability of cone beam tomography to evaluate simulated external root resorption.	Liedke GS, Silveira HED, Silveira HLD, Dutra V, De Figueiredo JAP.	Journal of Endodontics	2009	131	10.1
27	Progression of root resorption following replantation of human-teeth after extended extraoral storage.	Andersson L, Bodin I, Sörensen S.	Endodontics & Dental Traumatology	1989	129	3.91
28	A specific ifih1 gain-of-function mutation causes singleton-merten syndrome.	Rutsch F, MacDougall M, Lu C, Buers I, Mamaeva O, et al.	American Journal of Human Genetics	2015	124	17.7
29	The effect of mineral trioxide aggregate on the apexification and periapical healing of teeth with incomplete root formation.	Felippe WT, Felipe MC, Rocha MJ.	International Endodontic Journal	2006	122	7.63
30	Tooth ankylosis - clinical, radiographic and histological assessments.	Andersson L, Blomlöf L, Lindskog S, Feiglin B, Hammarström L.	International Journal of Oral Surgery	1984	122	3.21
31	Diagnostic accuracy of small volume cone beam computed tomography and intraoral periapical radiography for the detection of simulated external inflammatory root resorption.	Durack C, Patel S, Davies J, Wilson R, Mannocci F.	International Endodontic Journal	2011	122	11.1
32	Effect of recombinant human bone morphogenetic protein-2/absorbable collagen sponge (rhbmp-2/acs) on healing in 3-wall intrabony defects in dogs.	Choi SH, Kim CK, Cho KS, Huh JS, Sorensen RG, et al.	Journal of Periodontology	2002	121	6.05

33	Adenomatoid odontogenic-tumor - biologic profile based on 499 cases.	Philipsen HP, Reichart PA, Zhang KH, Nikai H, Yu QX.	Journal of Oral Pathology & Medicine	1991	119	3.84
34	Relationship between surface and inflammatory resorption and changes in the pulp after replantation of permanent incisors in monkeys.	Andreasen JO.	Journal of Endodontics	1981	119	2.9
35	Pulpal healing after luxation injuries and root fracture in the permanent dentition.	Andreasen FM.	Endodontics & Dental Traumatology	1989	118	3.58
36	Incidence of external root resorption and esthetic results in 58 bleached pulpless teeth.	Friedman S, Rotstein I, Libfeld H, Stabholz A, Heling I.	Endodontics & Dental Traumatology	1988	117	3.44
37	Relationship between cell-damage in the periodontal-ligament after replantation and subsequent development of root resorption - a time-related study in monkeys.	Andreasen JO.	Acta Odontologica Scandinavica	1981	116	2.83
38	A retrospective study of 889 injured permanent teeth.	Hecova H, Tziggounakis V, Merglova V, Netolicky J.	Dental Traumatology	2010	114	9.5
39	Potentials for root resorption during periodontal wound healing.	Karring T, Nyman S, Lindhe J, Sirirat M.	Journal of Clinical Periodontology	1984	113	2.97
40	Revascularization and periapical repair after endodontic treatment using apical negative pressure irrigation versus conventional irrigation plus triantibiotic intracanal dressing in dogs' teeth with apical periodontitis.	da Silva LA, Nelson-Filho P, da Silva RA, Flores DS, Heilborn C, et al.	Oral Surgery Oral Medicine Oral Pathology Oral Radiology and Endodontology	2010	111	9.25
41	Dynamics of dentoalveolar ankylosis and associated root resorption.	Hammarström L, Blomlöf L, Lindskog S.	Endodontics & Dental Traumatology	1989	110	3.33
42	Periodontal effects of root perforations before and during endodontic procedures.	Seltzer S, Sinai I, August D.	Journal of Dental Research	1970	108	2.08
43	Clinical and histological evaluation of autogenous iliac bone grafts in humans. 2. External root resorption.	Dragoo MR, Sullivan HC.	Journal of Periodontology	1973	107	2.18
44	A clinical follow-up study of 278 autotransplanted teeth.	Lundberg T, Isaksson S.	British Journal of Oral & Maxillofacial Surgery	1996	106	4.08

45	Central giant cell granuloma of the jaws: a clinical, radiologic, and histopathologic study of 26 cases.	Kruse-Lösler B, Diallo R, Gaertner C, Mischke KL, Joos U, et al.	Oral Surgery Oral Medicine Oral Pathology Oral Radiology and Endodontology	2006	104	6.5
46	Effect of root surface alterations on periodontal healing. 2. Citric acid treatment of the denuded root.	Polson AM, Proye MP.	Journal of Clinical Periodontology	1982	101	2.53
47	Relationship between periodontal injury, selective cell repopulation and ankylosis.	Line SE, Polson AM, Zander HA.	Journal of Periodontology	1974	101	2.1
48	Replantation of teeth and antibiotic treatment.	Hammarstrom L, Blomlof L, Feiglin B, Andersson L, Lindskog S.	Endodontics & Dental Traumatology	1986	100	2.78

Table 1: Most cited (n ≥100) experimental studies on root resorption of permanent teeth.

Rank	Title	Authors	Journal	Year	No. of Citations	Citation Density
1	Root resorption - Etiology, terminology and clinical manifestations.	Tronstad L.	Endodontics & Dental Traumatology	1988	334	9.82
2	Tooth bleaching - A critical review of the biological aspects.	Dahl JE, Pallesen U.	Critical Reviews in Oral Biology & Medicine	2003	311	16.4
3	Properties and applications of calcium hydroxide in endodontics and dental traumatology.	Mohammadi Z, Dummer PMH.	International Endodontic Journal	2011	256	23.3
4	Root resorption - diagnosis, classification and treatment choices based on stimulation factors.	Fuss Z, Tsesis I, Lin S.	Dental Traumatology	2003	230	12.1
5	Dental cementum: The dynamic tissue covering of the root.	Bosshardt DD, Selvig KA.	Periodontology 2000	1997	211	8.44
6	New dimensions in endodontic imaging: Part 2. Cone beam computed tomography.	Patel S.	International Endodontic Journal	2009	202	15.5
7	Hydrogen peroxide tooth-whitening (bleaching) products: Review of adverse effects and safety issues.	Tredwin CJ, Naik S, Lewis NJ, Scully C.	British Dental Journal	2006	165	10.3
8	Undesirable and adverse effects of tooth whitening products: A review.	Goldberg M, Grootveld M, Lynch E.	Clinical Oral Investigations	2010	164	13.7
9	Clinical management of the avulsed tooth: Present strategies and future directions.	Trope, M	Dental Traumatology	2002	163	8.15

10	Nonvital tooth bleaching: A review of the literature and clinical procedures.	Plotino G, Buono L, Grande NM, Pameijer CH, et al.	Oral Surgery Oral Medicine Oral Pathology Oral Radiology and Endodontology	2008	155	11.1
11	Possible etiologic factors in external root resorption.	Newman WG.	American Journal of Orthodontics and Dentofacial Orthopedics	1975	152	3.23
12	Protective and destructive immune reactions in apical periodontitis.	Marton IJ, Kiss C.	Oral Microbiology and Immunology	2000	146	6.64
13	Tooth resorption.	Ne RF, Witherspoon DE, Gutmann JL.	Quintessence International	1999	133	5.78
14	Use of cone beam computed tomography in endodontics.	Scarfe WC, Levin MD, Gane D, Farman AG.	International Journal of Dentistry	2009	131	10.1
15	External cervical resorption: A review.	Patel S, Kanagasingam S, Ford TP.	Journal of Endodontics	2009	122	9.38
16	Review of the current status of tooth whitening with the walking bleach technique.	Attin T, Paque F, Ajam F, Lennon AM.	International Endodontic Journal	2003	122	6.42
17	Clinical, radiologic, and histopathologic features of invasive cervical resorption.	Heithersay GS.	Quintessence International	1999	115	5
18	Avulsed permanent teeth: A review of the literature and treatment guidelines.	Barrett EJ, Kenny DJ.	Endodontics & Dental Traumatology	1997	111	4.44
19	External root resorption - its implication in dental traumatology, pedodontics, periodontics, orthodontics and endodontics.	Andreasen JO.	International Endodontic Journal	1985	109	2.95
20	Internal root resorption: A review.	Patel S, Ricucci D, Durak C, Tay F.	Journal of Endodontics	2010	108	9
21	An overview of tooth bleaching techniques: Chemistry, safety and efficacy.	Suliman MAM.	Periodontology 2000	2008	106	7.57

Table 2: Most cited (n ≥100) review studies on root resorption of permanent teeth.

Publication Type	Resorption Type	Number (%)
Experimentation	External resorption	48 (100%)
	Internal resorption	0
Review	External resorption	19 (90.48%)
	Internal resorption	2 (9.52%)

Table 3: Most cited (n ≥100) publications on external root resorption of permanent teeth vs. internal root resorption.

Country of Origin

Of the 69 publications with 100 citations and more, Denmark was ranked first place with 18 (26.1%) publications, followed by the United States with 13 (18.8%) publications, and Sweden with 8 (11.6%) publications (Fig. 2). Denmark also topped the list regarding experimental publications with 17 (35.4%) publications, followed by the United States with 9 (18.7%) publications, and Sweden with 8 (16.6%) publications. Regarding publication of reviews, the United Kingdom topped the list with 5 (23.8%) publications, followed by the United States with 4 (19%) publications, and Canada and Italy each with 2 (9.5%) publications.

Institutions

This criterion was based on the institutional address of the corresponding author. The university hospital (Rigshospitalet), Copenhagen, Denmark, accounted for the 14 (20.2%) top publications, followed by King's College, London Dental Institute, London, UK, with 4 (5.8%) publications, and the Royal Dental College, Copenhagen, Denmark, with 3 (4.3%) publications. One of the corresponding authors was affiliated with a private dental clinic (Table 4,5).

Year of Publication

Between 1950 and 2022, most of the top publications appeared in 1981 and 2009, with 5 (7.4%) publications appearing each year, followed by 1999 and 2010 with 4 (5.8%) publications each year and 1986, 1989, 2003, and 2008 with 3 (4.3%) publications each year (Fig. 3).

Authors

Regarding experimental studies, Dr. Jans Andreasen topped the list with 12 (25%) publications as corresponding authors. In review studies, Dr. Shanon Patel topped the list with 2 (9.5%) publications as corresponding authors and 3 other publications (4.3%) of the 69 publications. One of the top publications authored by Polson & Proye (1982) did not mention a corresponding author (Table 6,7).

Journals Where Most Cited Publications Were Published

The journal with the most cited publications was Dental Traumatology (which includes publications published under its previous name-Endodontics & Dental Traumatology), comprising 15 (21.74%) publications. The International Endodontic Journal followed with 8 (11.6%) publications, and the Journal of Endodontics with 5 (7.2%) publications (Table 4).

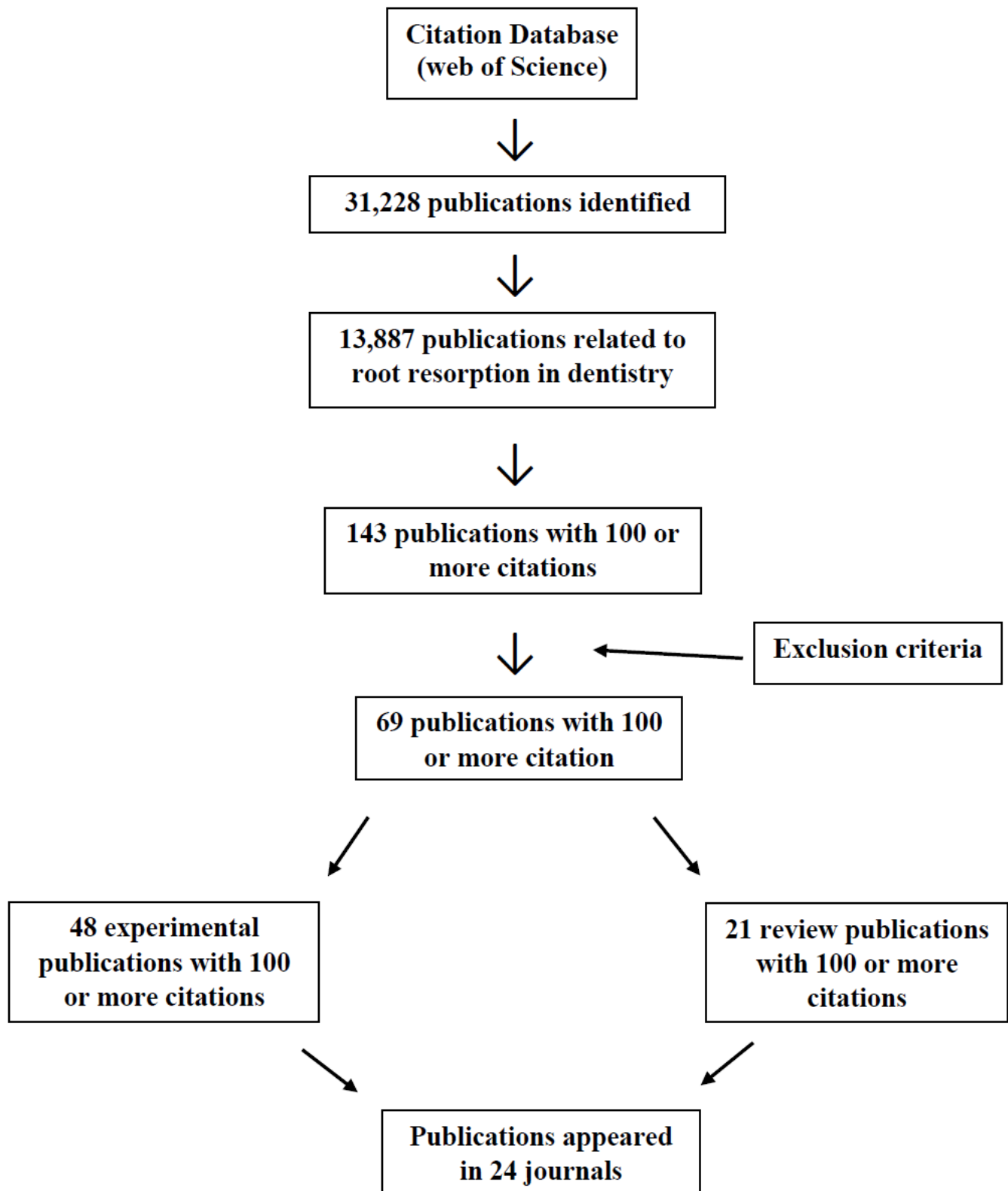


Figure 1: Flow chart of the bibliometric analysis.

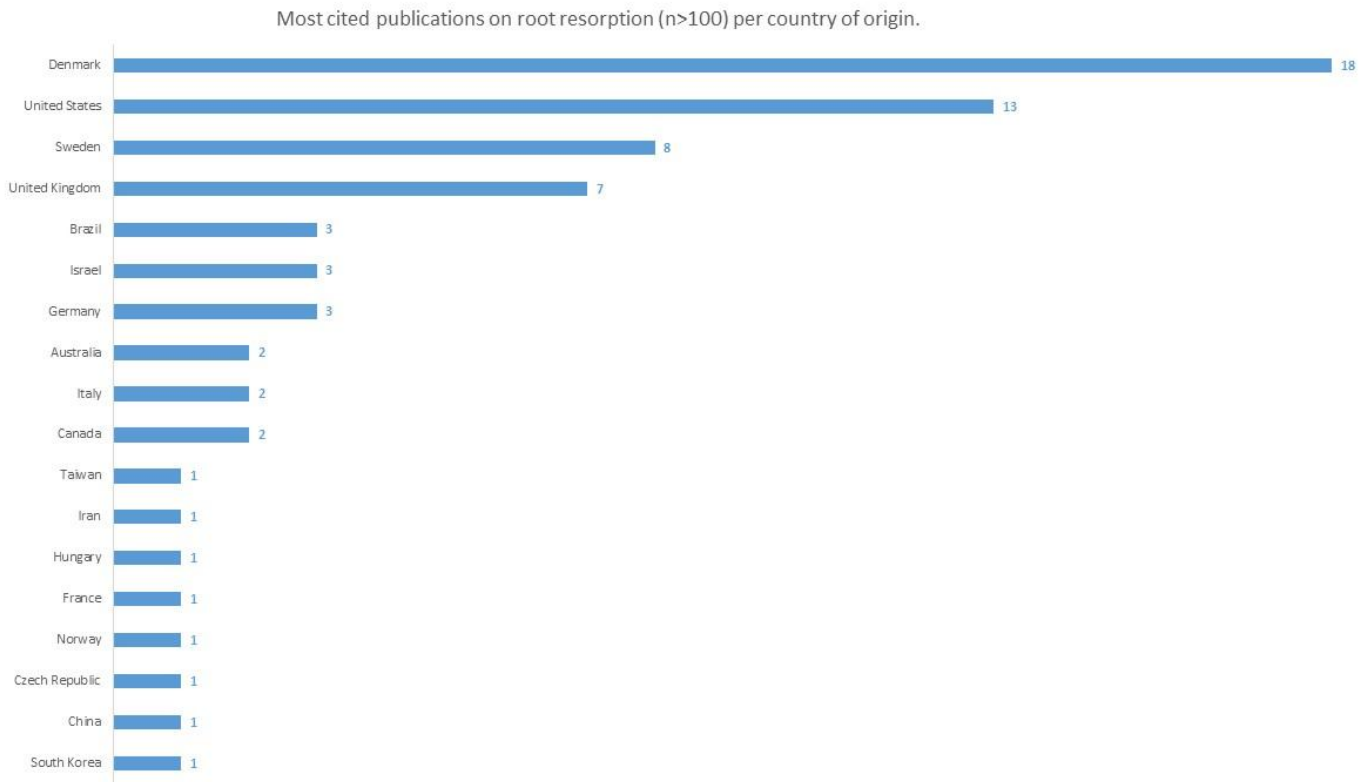


Figure 2: Most cited publications on root resorption (n>100) per country of origin.

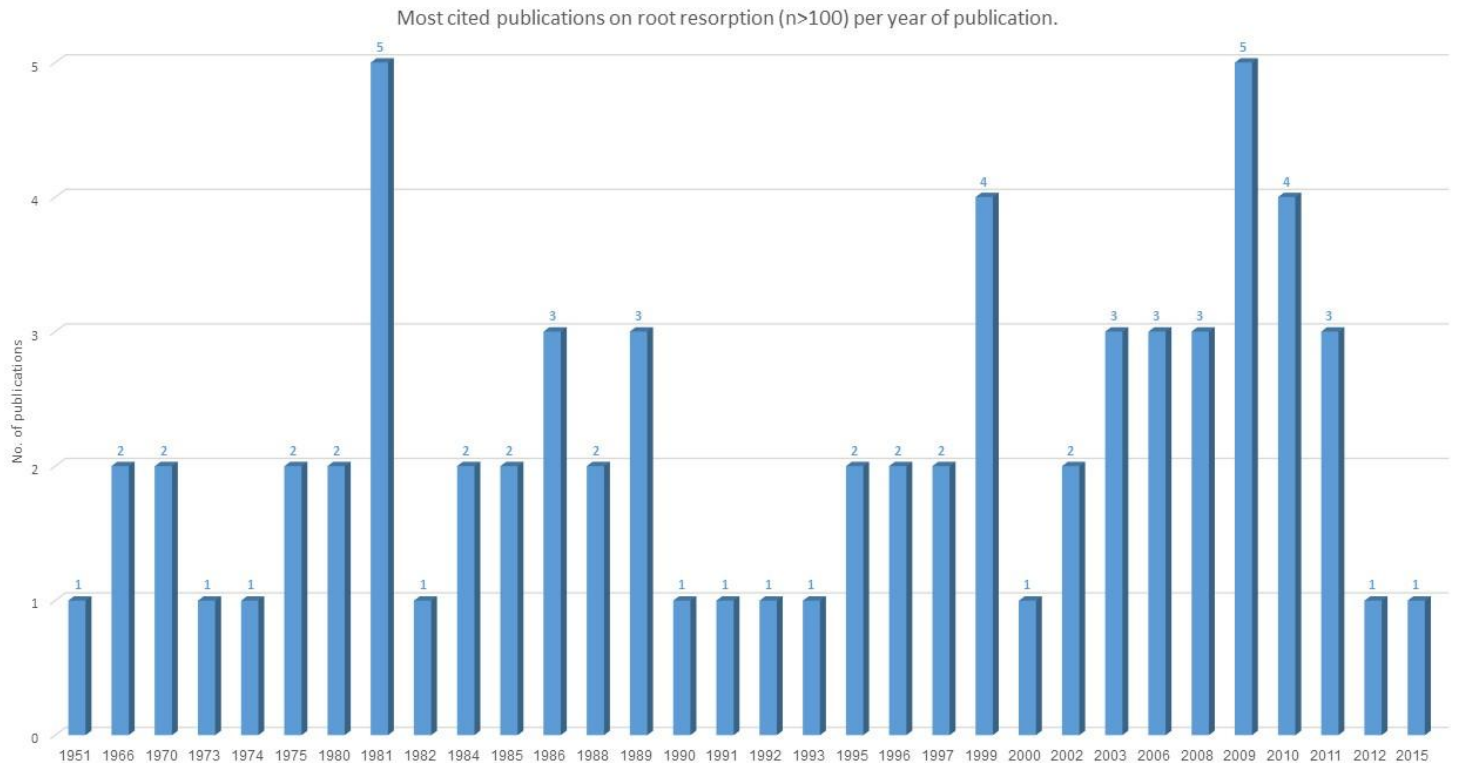


Figure 3: Most cited publications on root resorption (n>100) per year of publication.

	Name of Journal	Root resorption (Ex)	Root resorption (Rv)	Total
1	Dental Traumatology (Endodontics & Dental Traumatology*)	10	5	15
2	International Endodontic Journal	5	3	8
3	Journal of Endodontics	3	2	5
4	Oral Surgery Oral Medicine Oral Pathology Oral Radiology and Endodontology	4	1	5
5	Acta Odontologica Scandinavica	5		5
6	International Journal of Oral Surgery	4		4
7	Journal of Clinical Periodontology	4		4
8	Journal of Periodontology	4		4
9	Quintessence International	1	2	3
10	Periodontology 2000		2	2
11	Critical Reviews in Oral Biology & Medicine		1	1
12	Journal of Oral and Maxillofacial Surgery	1		1
13	European Journal of Orthodontics	1		1
14	Scandinavian Journal of Dental Research	1		1
15	Swedish Dental Journal	1		1
16	Journal of the American Dental Association (1939)	1		1
17	American Journal of Human Genetics	1		1
18	Journal of Dental Research	1		1
19	British Journal of Oral & Maxillofacial Surgery	1		1
20	Clinical Oral Investigations		1	1
21	British Dental Journal		1	1
22	American Journal of Orthodontics and Dentofacial Orthopedics		1	1
23	Oral Microbiology and Immunology		1	1
24	International Journal of Dentistry		1	1
*Endodontics & Dental Traumatology was the official name of the journal until 2001, at which time it changed to Dental Traumatology				

Table 4: Journals with most cited (n ≥ 100) Experimental (Ex) and Review (Rv) publications on root resorption of permanent teeth.

Ranking	Institution	Country	No. of Publications
1	University Hospital (Rigshospitalet), Copenhagen	Denmark	13
2	Faculty of Dentistry, Oral & Craniofacial Sciences, King's College London, London	UK	4
3	Royal Dental College, Copenhagen	Denmark	3
4	Central Hospital, Västerås	Sweden	2
4	School of Dentistry, Karolinska Inststutet, Stockholm	Sweden	2
4	Bone Biology and Applications, Genetics Institute, Andover, Massachusetts	USA	2
4	University of Adelaide, Adelaide	Australia	2
4	Muenster University, Muenster	Germany	2
4	School of Dental Medicine, University of Pennsylvania, Philadelphia, Pennsylvania	USA	2
4	Hebrew University-Hadassah Faculty of Dental Medicine, Jerusalem	Israel	2
5	Faculty of Odontology, University of Lund, Lund	Sweden	1

5	Eastman Institute, Stockholm	Sweden	1
5	Eastman Dental Center, Rochester, New York	USA	1
5	College of Dentistry, Yonsei University, Seoul	South Korea	1
5	Chi Mei Medical Center, Yong Kang and Liouying, Tainan	Taiwan	1
5	Institute of Florida, St. Petersburg, Florida	USA	1
5	Dental School of Ribeirão Preto, University of São Paulo, São Paulo	Brazil	1
5	University of Washington, Seattle, Washington	USA	1
5	School of Dentistry, Federal University of Santa Catarina, Florianópolis, Santa Caterina	Brazil	1
5	Karolinska Institutet, Stockholm,	Sweden	1
5	College of Dentistry, University of Illinois, Chicago, Illinois	USA	1
5	Dentistry Department, Faculty of Medicine and Faculty Hospital in Pilsen, Charles University, Prague	Czech Republic	1
5	University of Adelaide, Adelaide	Australia	1
5	University School and Hospital of Stomatology, Beijing	China	1
5	Private dental clinic, Roma	Italy	1
5	School of Dentistry, Federal University of Rio Grande do Sul, Rio Grande	Brazil	1
5	School of Dentistry, Medical College of Georgia, Augusta, Georgia	USA	1
5	Länssjukhuset University, Halmstad	Sweden	1
5	School of Dentistry, Temple University, Philadelphia, Pennsylvania	USA	1
5	Loma Linda University, Loma Linda. California	USA	1
5	West Virginia University School of Dentistry, Morgantown, West Virginia	USA	1
5	Georg-August Universität, Göttingen	Germany	1
5	Hospital for Sick Children, University of Toronto, Toronto	Canada	1
5	Faculty of Dentistry, University of Montreal, Montreal	Canada.	1
5	Scandinavian Institute of Dental Materials, Kirkeveien, Haslum	Norway	1
5	Maurice and Gabriela Goldschleger School of Dental Medicine, Tel Aviv University, Tel Aviv	Israel	1
5	Faculty of Dentistry, University Paris Descartes, Montrouge, Paris	France	1
5	University Medical School of Debrecen, Debrecen	Hungary	1
5	Hamedan University of Medical Sciences, Hamedan	Iran	1
5	University of Manchester, Manchester	UK	1
5	Texas A & M University System, Baylor College of Dentistry, Dallas, Texas	USA	1
5	Catholic University of Sacred Heart, Rome	Italy	1
5	Hospital Dentistry, The University of Louisville, Kentucky	USA.	1
5	University of Bristol Dental School, Wimbledon, Bristol	UK	1
5	Eastman Dental Institute, University College London, London	UK	1

Table 5: Most cited publications on root resorption of permanent teeth (n>100) per institution and country.

Country	Institution	As corresponding author	As co-author	As first author	Author	Ranking
Denmark	University Hospital (Rigshospitalet), Copenhagen	12		12	Andreasen JO	1

Sweden	Västerås Central Hospital, Västerås	2	1	2	Andersson L	3
Sweden	School of Dentistry, Karolinska Institutet, Stockholm	2	1	2	Hammarström L	3
Denmark	Royal Dental College, Copenhagen	2		2	Karring T	3
Denmark	University Hospital (Rigshospitalet), Copenhagen	2		1	Andreasen FM	4
Sweden	Faculty of Odontology, University of Lund, Lund	1	1	1	Kristerson L	5
Sweden	Eastman Institute, Stockholm	1	1	1	Cvek M	5
Israel	Hebrew University-Hadassah Faculty of Dental Medicine, Jerusalem	1	1	1	Rotstein I	5
USA	Eastman Dental Center, Rochester, New York	1	1	1	Polson AM	5
UK	King's College London Dental Institute, London	1	1	1	Patel S	6
South Korea	College of Dentistry, Yonsei University, Seoul	1		1	Choi SH	6
Taiwan	Chi Mei Medical Center, Yong Kang and Liouying, Tainan	1		1	Chen MYH	6
USA	Institute of Florida, St. Petersburg	1		1	Chuong R	6
UK	Dental Institute, King's College London, London	1		1	Durack C	6
Brazil	Dental School of Ribeirão Preto, University of São Paulo, São Paulo	1		1	da Silva LA	6
USA	University of Washington, Seattle	1		1	Dragoo MR	6
Brazil	School of Dentistry, Federal University of Santa Catarina, Florianópolis, Santa Catarina	1		1	Felippe WT	6
Israel	Hebrew University-Hadassah Faculty of	1		1	Friedman S	6

	Medicine, Jerusalem					
Sweden	Eastman institutet, Stockholm	1		1	Kling M	6
USA	College of Dentistry, University of Illinois, Chicago, Illinois	1		1	Henry JL	6
Czech Republic.	Faculty of Medicine and Faculty Hospital in Pilsen, Charles University in Prague	1		1	Hecova H	6
Australia	University of Adelaide, Adelaide	1		1	Heithersay GS	6
Germany	University of Münster, Münster	1		1	Kruse-Lösler B	6
China	Peking University School and Hospital of Stomatology, Beijing	1		1	Liu DG	6
Brazil	Dentistry, Federal University of Rio Grande do Sul	1		1	Liedke GS	6
USA	School of Dentistry, Medical College of Georgia, Augusta	1		1	Line SE	6
Sweden	Länssjukhuset, Halmstad	1		1	Lundberg T	6
Denmark	Royal Dental College, Aarhus	1		1	Philipsen HP	6
Germany	Muenster University Children's Hospital, Muenster	1		1	Rutsch F	6
USA	School of Dentistry, Tample University, Philadelphia, Pennsylvania	1		1	Seltzer S	6
USA	Loma Linda University, Loma Linda, California	1		1	Sigurdsson TJ	6
USA	West Virginia University School of Dentistry, Morgantown, West Virginia	1		1	Whitaker SB	6
USA	Genetics Institute, Andover, Massachusetts	1		1	Wikesjo UME	6

Table 6: Most cited experimental studies on root resorption of permanent teeth (n>100) by corresponding author.

Ranking	Author	As first author	As co-author	As corresponding author	Institution	Country
1	Patel S	3		2	King's College London Dental Institute, London	UK
2	Attin T	1		1	Georg-August Universität Göttingen, Göttingen	Germany
2	Barrett EJ	1		1	Hospital for Sick Children, University of Toronto, Toronto	Canada
2	Bosshardt DD	1		1	Faculty of Dentistry, University of Montreal, Montreal	Canada.
2	Dahl JE	1		1	Scandinavian Institute of Dental Materials, Kirkeveien, Haslum	Norway
2	Heithersay GS	1		1	University of Adelaide, Adelaide	Australia
2	Fuss Z	1		1	Maurice and Gabriela Goldschleger School of Dental Medicine, Tel Aviv University, Tel Aviv	Israel
2	Goldberg M	1		1	Faculty of Dentistry, University Paris Descartes, Montrouge, Paris	France
2	Marton IJ	1		1	University Medical School of Debrecen, Debrecen	Hungary
2	Mohammadi Z	1		1	Hamedan University of Medical Sciences, Hamedan	Iran
2	Newman WG	1		1	University of Manchester, Manchester Academic Health Science Centre, Manchester	UK
2	Witherspoon ED	1		1	Texas A & M University System, Baylor College of Dentistry, Dallas, Texas	USA
2	Ricucci M		1	1	Private dental clinic, Roma	Italy
2	Plotino G	1		1	Catholic University of Sacred Heart, Rome	Italy
2	Andreasen JO	1		1	University Hospital (Rigshospitalet), Copenhagen	Denmark
2	Scarfe WC	1		1	Hospital Dentistry, The University of Louisville, Kentucky	USA.
2	Sulieman MAM	1		1	University of Bristol Dental School, Wimbledon, Bristol	UK
2	Trope M	1		1	School of Dental Medicine, University of Pennsylvania, Philadelphia, Pennsylvania	USA
2	Tronstad L	1		1	School of Dental Medicine, University of Pennsylvania, Philadelphia, Pennsylvania	USA

2	Tredwin CJ	1		1	Eastman Dental Institute, University College London, London	UK
---	------------	---	--	---	---	----

Table 7: Most cited review studies on root resorption of permanent teeth (n>100) by corresponding author.

Discussion

This comprehensive literature analysis assessed the most cited publications on root resorption of permanent teeth for over 70 years. It is the first study to provide bibliometric information on publications focusing on this topic. It provides a list of publications receiving 100 citations or more, categorized according to experimental and review publications. Publications with 100 citations or more are considered "classic" [27,33,34]. Therefore, the present bibliometric study included only the publications that received at least 100 citations. As a result, our findings provide a ranking of classic publications on root resorption of permanent teeth that can be used as an assessment tool for clinicians, researchers, educators, and students. Overall, it is apparent that such classic publications are scarce, constituting only about 0.5% of all publications on root resorption.

Publications related to orthodontic-induced root resorption were excluded due to several previous publications in this field [35,36].

When comparing the number of experimental research publications to the number of review publications receiving 100 citations or more, experimental research publications were more than double the review publications: 48 vs 21, respectively. The division was made according to the publication type [22,32]. When comparing the citation density of these 2 groups, the average citation density of the review publications was 50% higher. This may indicate the tendency of authors to search for cumulative and more comprehensive information in one place, with access to an extensive list of references simultaneously.

Four publications exceeded 300 citations, of which 2 publications exceeded 400 citations (Table 1,2). The publications exceeding 400 citations were experimental research publications, and the publications exceeding 300 citations but with less than 400 citations were review publications. In the experimental research publications, the top 2 cited publications also received the highest citation density scores, except for one study (Table 1). In the review publications, the top cited ones received 300 citations or more, and 3 other publications received higher citation density scores (Table 2). This may reflect a high level of peer consideration for such publications. It should be noted that the citation number score is dynamic and can change as time passes. Thus, publications with high citation density will receive additional citations in the following years.

Publications not written in English were excluded from this study since a negative effect can occur, skewing the search results against certain countries in which publications appear in other languages [37]. Furthermore, it has been proposed that non-English publications be excluded when executing a comparative analysis of size-independent indicators [38]. Moreover, on average, non-English publications appear to receive fewer citations, thereby suggesting that many researchers may not read publications that are not in English [37,38].

The topics more frequently studied were related to traumatic dental injury, with 29 (60.42%) of the total publications among the experimental studies (48 publications). Some duplications were found in the review studies (21 publications) depending on the subject of the publication. For example, root resorption can be related to traumatic dental injury, root infection, or an impacted tooth.

Although the citation number is an important factor used to assess the professional attention to a certain publication, it does not ascertain the quality of the publication or the validity of the results [17]. Also, the year of publication may affect the number of citations. However, when reviewing the results of the present study, it is clear that a publication that receives a higher number of citations can receive a lower citation density. Therefore, when evaluating the significance and quality of a publication, factors other than just the number of citations should also be considered [38].

The bibliographic citation search in this study was performed using the Web of Science (Clarivate Analytics, Philadelphia, PA, USA). This website provides a subscription-based platform for multiple databases with comprehensive citation data for various academic disciplines [39]. The same platform has been used in other bibliometric studies in endodontics [24,27]. Even so, <https://doi.org/10.46889/JDHOR.2024.5313> <https://athenaeumpub.com/journal-of-dental-health-and-oral-research/>

searching for the same information on other search engine platforms such as PubMed, Scopus, or Google Scholar may yield a different exact number of citations. This phenomenon was reported in other studies [23,27]. Therefore, certain publications may have received 100 citations or more in a bibliometric analysis using other platforms.

When analyzing the year of publication between 1951 and 2005, a substantial increment was found in the number of most cited publications between 1951 and 1963 and between 2003 and 2015, from 1 (1.4%) publication to 23 (33.3%), respectively (Fig. 4). This increment may indicate more authors' reliance on publications that used more advanced technology.

Assessing authors' contribution to the field of root resorption, Jans Andreasen topped the list with 13 (19%) publications as the corresponding author, followed by Shanon Patel with 3 (4.3%) top-cited publications. Jans Andreasen's contributions also affected other analysis components, such as country of origin and the corresponding institute. This finding aligns with the study of Ahmad, et al., who reported that 12 (24%) of Jans Andreasen's publications were among the top 50 most cited publications [37].

Five publications reported root resorption associated with systemic diseases such as tumors or central giant cell granuloma [40-44]. This type of resorption is known as impacted tooth or tumor pressure root resorption [2]. The American Association of Endodontists considers it an external surface root resorption [8].

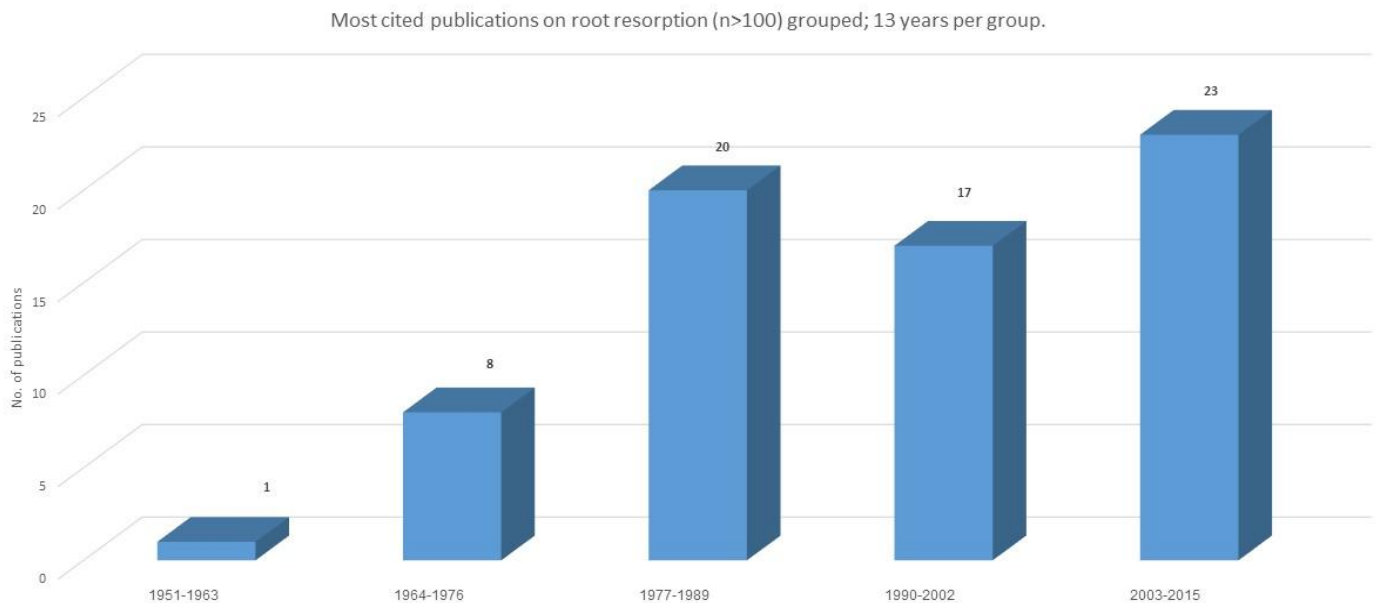


Figure 4: Most cited publications on root resorption (n>100) grouped; 13 years per group.

Conclusion

This bibliometric analysis can be a beneficial tool for assessing the impact of publications related to root resorption of permanent teeth.

Conflict of Interest

There are no potential conflicts of interest to declare in this systematic review.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors.

Author Contributions

All authors contributed equally for this paper.

References

- Andreasen JO, Borum MK, Jacobsen HL, Andreasen FM. Replantation of 400 avulsed permanent incisors. Factors related to periodontal ligament healing. *Endod Dent Traumatol*. 1995;11:76-89.
- Fuss Z, Tsesis I, Lin S. Root resorption- diagnosis, classification and treatment choices based on stimulation factors. *Dent Traumatol*. 2003;19:175-82.
- Abbott PV, Lin S. Tooth resorption- Part 2: A clinical classification. *Dent Traumatol*. 2022;38:267-85.
- Heboyen A, Avetisyan A, Karobari MI, Marya A, Khurshid Z, Rokaya D, et al. Tooth root resorption: A review. *Sci Prog* 2022; 105: 368504221109217.
- Patel S, Saberi N, Pimental T, Teng P-H. Present status and future directions: Root resorption. *Int Endod J*. 2022;55:892-921.
- Tronstad L. Root resorption- etiology, terminology and clinical manifestations. *Dent Traumatol*. 1988;4:241-52.
- Patel S, Mavridou AM, Lambrechts P, Saberi N. External cervical resorption- part 1: histopathology, distribution and presentation. *Int Endod J*. 2018;51:1205-23.
- American Association of Endodontists. Glossary of endodontic terms: American Association of Endodontists. 2020.
- Patel K, Mannocci F, Patel S. The assessment and management of external cervical resorption with periapical radiographs and cone-beam computed tomography: A clinical study. *J Endod*. 2016;42:1435-40.
- Brezniak N, Wasserstein A. Orthodontically induced inflammatory root resorption. Part I: The basic science aspects. *Angle Orthodontist*. 2002;72:175-9.
- Friedman S, Rotstein I, Libfeld H, Stabholz A, Heling I. Incidence of external root resorption and esthetic results in 58 bleached pulpless teeth. *Dent Traumatol*. 1988;4:23-6.
- Rotstein I, Friedman S, Mor C, Katznelson J, Sommer M, Bab I. Histological characterization of bleaching-induced external root resorption in dogs. *J Endod*. 1991;17:436-41.
- Mavridou AM, Bergmans L, Barendregt D, Lambrechts P. Descriptive analysis of factors associated with external cervical resorption. *J Endod*. 2017;43:1602-10.
- Årtun J, Van Hullenaar R, Doppel D, Kuijpers-Jagtman AM. Identification of orthodontic patients at risk of severe apical root resorption. *Am J Orthod Dentofacial Orthop*. 2009;135:448-55.
- Heithersay GS. Invasive cervical resorption: an analysis of potential predisposing factors. *Quintessence Int*. 1999;30:83-95.
- Jeng PY, Lin LD, Chang SH, Lee YL, Wang CY, Jeng JH, et al. Invasive cervical resorption-distribution, potential predisposing factors, and clinical characteristics. *J Endod*. 2020;46:475-82.
- Jones R, Hughes T, Lawson K, DeSilva G. Citation analysis of the 100 most common articles regarding distal radius fractures. *J Clin Orthop Trauma*. 2017;8:73-5.
- Ahmad SS, Evangelopoulos DS, Abbasian M, Röder C, Kohl S. The hundred most-cited publications in orthopaedic knee research. *J Bone Joint Surg Am*. 2014;96:e190.
- Gondivkar SM, Sarode SC, Gadbail AR, Gondivkar RS, Chole R, Sarode GS. Bibliometric analysis of 100 most cited articles on oral submucous fibrosis. *J Oral Pathol Med*. 2018;47:781-7.
- Feijoo JF, Limeres J, Fernández-Varela M, Ramos I, Diz P. The 100 most cited articles in dentistry. *Clin Oral Investig*. 2014;18:699-706.
- Garfield E. Citation analysis as a tool in journal evaluation. *Science*. 1972;178:471-9.
- Dadresanfar B, Rotstein I. Outcome of endodontic treatment: The most cited publications. *J Endod*. 2021;47:1865-74.
- Ullah R, Adnan S, Afzal AS. Top-cited articles from dental education journals, 2009 to 2018: A bibliometric analysis. *J Dent Educ*. 2019;83:1382-91.
- Ahmad P, Elgamal HAM. Citation classics in the journal of endodontics and a comparative bibliometric analysis with the most downloaded articles in 2017 and 2018. *J Endod*. 2020;46:1042-51.
- Ahmad P, Vincent Abbott P, Khurshed Alam M, Ahmed Asif J. A bibliometric analysis of the top 50 most cited articles published in the Dental Traumatology. *Dent Traumatol*. 2020;36:89-99.
- Yılmaz B, Dinçol ME, Yalçın TY. A bibliometric analysis of the 103 top-cited articles in endodontics. *Acta Odontol Scand*. 2019;77:574-83.
- Ahmad P, Dummer PMH, Noorani TY, Asif JA. The top 50 most-cited articles published in the international endodontic journal. *Int Endod J*. 2019;52:803-18.
- Adnan S, Ullah R. Top-cited articles in regenerative endodontics: A bibliometric analysis. *J Endod*. 2018;44:1650-64.
- Nagendrababu V, Jacimovic J, Jakovljevic A, Rossi-Fedele G, Dummer PMH. A bibliometric analysis of the top 100 most-cited case reports and case series in endodontic journals. *Int Endod J*. 2022;55:185-218.

30. Cuschieri S. The STROBE guidelines. *Saudi J Anaesth*. 2019;13:S31-4.
31. STROBE. Strengthening the reporting of observational studies in epidemiology. *Strobe*. 2023.
32. Ahmad P, Dummer PMH, Chaudhry A, Rashid U, Saif S, Asif JA. A bibliometric study of the top 100 most-cited randomized controlled trials, systematic reviews and meta-analyses published in endodontic journals. *Int Endod J*. 2019;52:1297-316.
33. Fardi A, Kodonas K, Gogos C, Economides N. Top-cited articles in endodontic journals. *J Endod*. 2011;37:1183-90.
34. Kolahi J, Khazaei S, Iranmanesh P, Khademi A, Nekoofar MH, Dummer PMH. Altmetric analysis of the contemporary scientific literature in Endodontology. *Int Endod J*. 2020;53:308-16.
35. Fernandes EC, Nascimento Junior MB, Paiva Torres ACS, Nobrega FJO, Santos PB. The 100 most-cited articles in orthodontic journals in the last 20 years. *Am J Orthod Dentofacial Orthop*. 2022;161:e260-76.
36. Hui J, Han Z, Geng G, Yan W, Shao P. The 100 top-cited articles in orthodontics from 1975 to 2011. *Angle Orthod*. 2013;83:491-9.
37. van Raan AFJ, van Leeuwen TN, Visser MS. Severe language effect in university rankings: particularly Germany and France are wronged in citation-based rankings. *Scientometrics*. 2011;88:495-8.
38. Aksnes DW, Langfeldt L, Wouters P. Citations, citation indicators, and research quality: An overview of basic concepts and theories. *SAGE Open*. 2019;9:2158244019829575.
39. Pulgar R, Jiménez-Fernández I, Jiménez-Contreras E, Torres-Salinas D, Lucena-Martín C. Trends in world dental research: An overview of the last three decades using the Web of Science. *Clin Oral Investig*. 2013;17:1773-83.
40. Chuong R, Kaban LB, Kozakewich H, Perez-Atayde A. Central giant cell lesions of the jaws: A clinicopathologic study. *J Oral Maxillofac Surg*. 1986;44:708-13.
41. Whitaker SB, Waldron CA. Central giant cell lesions of the jaws: A clinical, radiologic, and histopathologic study. *Oral Surg Oral Med Oral Pathol*. 1993;75:199-208.
42. Rutsch F, MacDougall M, Lu C, Buers I, Mamaeva O, Nitschke Y, et al. A specific IFIH1 gain-of-function mutation causes singleton-merten syndrome. *Am J Human Genet*. 2015;96:275-82.
43. Philipsen HP, Reichart PA, Zhang KH, Nikai H, Yu QX. Adenomatoid odontogenic tumor: biologic profile based on 499 cases. *J Oral Pathol Med*. 1991;20:149-58.
44. Kruse-Lösler B, Diallo R, Gaertner C, Mischke KL, Joos U, Kleinheinz J. Central giant cell granuloma of the jaws: a clinical, radiologic, and histopathologic study of 26 cases. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2006;101:346-54.

Journal of Dental Health and Oral Research



Publish your work in this journal

Journal of Dental Health and Oral Research is an international, peer-reviewed, open access journal publishing original research, reports, editorials, reviews and commentaries. All aspects of dental health maintenance, preventative measures and disease treatment interventions are addressed within the journal. Dental experts and other related researchers are invited to submit their work in the journal. The manuscript submission system is online and journal follows a fair peer-review practices.

Submit your manuscript here: <https://athenaeumpub.com/submit-manuscript/>