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REVIEW ARTICLE **OPEN ACCESS**

Top 100 Most-cited Scientific Articles in Guided Endodontic 2018–2024: A Bibliometric Analysis

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Abstract:

Introduction: Bibliometric analysis serves as a valuable method to evaluate the scientific impact of published literature, highlight influential authors and institutions, and uncover gaps in knowledge within a specific field. This study aimed to update and assess the 100 most-cited articles on guided endodontics published between 2018 and 2024.

Methods: A thorough search was conducted in the Web of Science (WoS) database using keywords related to guided endodontics. Relevant articles were selected based on predefined inclusion criteria. Data were extracted on citation counts, publication year, journal, authorship, country of origin, study design, and research focus. The top 100 most-cited articles were analyzed using bibliometric methods to evaluate author productivity, geographic distribution, study designs, and citation impact.

Results: The 100 most-cited articles received between 1 and 100 citations in the (WoS) (All Databases). Most were published in first quartile (Q1) journals (n = 60), with 2021 being the most productive year (n = 27). Journal of Endodontics (JOE) had the highest number of publications (28%), followed by the International Endodontic Journal (8%), Australian Endodontic Journal (8%), and Clinical Oral Investigations (5%).

Discussion: Brazil led in the number of publications (n = 17), followed by Germany and the United States. The predominance of Q1 journal publications and the increase in recent years reflect growing interest in guided endodontics. The most active authors and countries represent research hubs in the field. However, the relatively modest citation numbers suggest that this area of study is still developing.

Conclusion: Thomas Connert emerged as the most prolific author, with ten publications that have played a significant role in advancing guided endodontics. This bibliometric analysis may serve as a foundation for setting future research priorities and fostering international collaborations in the field.

Keywords: Regenerative medicine, Dental education, Guided tissue regeneration, Endodontics, Tissue regeneration, Bibliometric.

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1. INTRODUCTION

Bibliometric analysis involves the quantitative evaluation of scientific literature, enabling the identification and assessment of research trends and patterns within a specific field in this case, dentistry. This type of analysis focuses on quantifying scientific output using parameters such as the total number of publications, citation counts, institutional contributions, and countries where the research was conducted [1].

Root canal obliteration can result from various factors, including luxation injuries following dental trauma, carious lesions, physiological aging of the tooth, extensive coronal restorations, orthodontic movements, vital pulp therapies, and the progressive deposition of secondary dentin over time [2]. This condition poses a significant challenge for dental practitioners, as it complicates the localization and cleaning of affected root canals. Accessing calcified root canals is particularly difficult, often leading to alterations in canal anatomy and substantial loss of dental hard tissue, which may weaken the tooth or even cause root perforations [3, 4].

The introduction of advanced technologies such as cone-beam computed tomography (CBCT) and endodontic navigation systems has significantly improved the accuracy of identifying and treating these canals. Recently, a novel technique called guided endodontics has been developed to manage calcified canals. This method represents a major advancement in the treatment of teeth affected by canal calcification. It allows for precise virtual planning and a guided approach, resulting in improved disinfection and obturation outcomes, reduced complications, and increased treatment success rates [5].

Guided endodontics uses specialized software to align a CBCT scan with an external surface scan of the tooth to be treated, enabling virtual planning of an ideal access cavity. Subsequently, a resin guide is 3D-printed based on this virtual plan, incorporating the dimensions and angulations of the planned access cavity, as well as the size and length of the bur to be used. This approach is known as static navigation or static guided endodontics [6].

Alternatively, calcified teeth can be treated using micro-guided endodontics through dynamic navigation systems, also referred to as dynamic guided endodontics. This technique allows for minimally invasive preparation of the access cavity and precise localization of root canals, particularly in mandibular incisors, by employing a computer-guided approach. It enhances the accuracy of endodontic instrument placement in real time by integrating radiographic images with endodontic instruments through an optical tracking device controlled *via* a computer interface.

This method is based on computer-assisted surgical navigation technology, which uses optical motion-tracking cameras and real-time visual feedback to guide the positioning of endodontic instruments during access preparation [7]. Thus, the information planned during the diagnostic phase is directly transferred to the clinical setting, enabling precise, real-time tracking of the handpiece's position. Several dynamic guidance systems originally developed for implant placement have been adapted for endodontic applications, including RoboDent, X-Guide, Image Guided Implantology, and Navident [8].

The period from 2018 to 2024 was selected because it reflects the recent emergence and consolidation of guided endodontics technology. During these years, there has been a notable increase in both scientific production and clinical application of these techniques. This timeframe captures the most relevant and up-to-date developments in the field, highlighting the evolution of tools and methodologies used in guided endodontics and reflecting the growing interest within the dental community, as well as the impact of technological innovations on the treatment of calcified canals.

In this context, a bibliometric review was conducted focusing on the 100 most cited and influential publications in the field. The analysis aimed to identify the most effective techniques and tools used to address the challenges associated with calcified canals, while emphasizing the importance of accurate treatment planning and a personalized approach tailored to each clinical case.

2. METHODS

2.1. Search Strategy

A bibliometric study was conducted to identify and analyze the 100 most-cited articles on guided endodontics. The search was carried out on October 8, 2024, and included articles published between January 2018 and September 2024. The databases used were Web of Science All Databases (WoS-AD) and Web of Science Core Collection (WoS-CC), under the category "Dentistry, Oral Surgery & Medicine".

A comprehensive search was conducted on the WoS platform using both the Core Collection (WoS-CC) and All Databases (WoS-AD) versions to ensure broad coverage of relevant publications. The following keywords were used: "guided endodontics", "guided endodontic treatment", "guided root canal treatment", "static guided endodontics", "dynamic guided endodontics", "dynamic navigation endodontics", "microguided endodontics", and "endodontic navigation system". The use of both WoS versions allowed for comparison of citation counts, recognizing that WoS-AD may include a wider range of sources, potentially resulting in higher citation numbers. In addition, citation counts from Scopus and Google Scholar were also retrieved for comparative analysis.

During the selection process, no language restrictions were applied, and a filter was used to include only articles published between 2018 and September 2024. Any discrepancies in data extraction were resolved through discussion and consensus among all researchers, including those who were not directly involved in the initial article selection.

Articles whose main focus was not on guided endodontics, as well as letters to the editor and conference abstracts, were excluded from the analysis. In contrast,

original research articles, case reports, review papers, and short communications within the fields of dentistry, oral surgery, and medicine published in dental or related scientific journals were included in the study.

A list of articles was compiled and ranked in descending order according to their citation counts in WoS-AD and WoS-CC. In cases where multiple articles had the same number of citations, the most recent publication was prioritized. Additionally, citation data for each article were also collected from Google Scholar and Scopus databases for comparative purposes.

A list of articles was organized in descending order based on the number of citations recorded in WoS-AD and WoS-CC. In cases where multiple articles had the same citation count, the most recent publication was prioritized. Citation counts for each article were also retrieved from Google Scholar and Scopus for comparative analysis.

No cross-database normalization was performed, as citation metrics were reported independently for each source. This approach enabled a direct comparison of the articles' impact across different indexing platforms. Furthermore, self-citations were not excluded from the analysis, as most databases do not support their automated removal. This limitation is acknowledged and discussed in the corresponding section of the manuscript.

2.2. Data Extraction

The evaluation was concluded upon identifying the 100 most-cited articles. The following information was extracted from each article: title, year of publication, authorship, total number of citations, citation average (calculated as the ratio of citation count to the time period from the year of publication to September 2024), research center or institute/university, country and continent based on the affiliation of the corresponding author, study design, journal name, journal quartile category, keywords, and research topic. All data were recorded in a purpose-designed spreadsheet. Study designs were categorized as follows: case report, laboratory study (including *in vitro*, *in vivo*, *in situ*, and *ex vivo* studies), observational study (including case reports/series, cross-sectional studies, case-control studies, cohort studies, and retrospective/longitudinal studies), randomized clinical trial (RCT), non-randomized clinical study, systematic review/meta-analysis, and narrative review.

3. RESULTS

The search strategy retrieved a total of 374 articles from WoS All Databases (Fig. **1** shows the flow diagram of the selection process). After sorting these articles in descending order by citation count, 56 articles were excluded due to a lack of direct focus on guided endodontics. The remaining 100 most-cited articles published between 2018 and 2024, along with their respective citation counts, are presented in Table **1** [9-108].

The top 100 articles accumulated a total of 1,864 citations in WoS-AD (ranging from 1 to 100), 1,609 citations in WoS-CC (1 to 87), 2,011 citations in Scopus (1 to 115), and 3,875 citations in Google Scholar (1 to 247). The most frequently cited article received 100 citations in WoS-AD, averaging 16.6 citations per year, and was also the most cited in WoS-CC, with 87 citations. All included articles were published in English.

Table 1. Bibliometric characteristics of the 100 most-cited articles in guided endodontics (2018–2024).

Total of Citations (meana)										
Rank	**Title**	**Year of Publication**	**First Author**	**Other Authors**	**Wos-AD**	**WoS-CC**	**Scopus**	**Google Scholar**	**Journal Citation Indicator 2023**	**Category Quartile**
1	Microguided Endodontics: a method to achieve minimally invasive access cavity preparation and root canal location in mandibular incisors using a novel computer-guided technique [9]	2018	Connert, T.	M S Zehnder, M Amato, R Weiger, S Kühl, G Krastl	100 (16,6)	87 (14,5)	114	230	International Endodontic Journal (1,9)	Q1
2	Endodontic applications of 3D printing [10]	2018	Anderson, J.	J Wealleans, J Ray	97 (16,16)	83 (13,8)	115	247	International Endodontic Journal (1,9)	Q1
3	Guided Endodontics *versus* Conventional Access Cavity Preparation: A Comparative Study on Substance Loss Using 3-dimensional-printed Teeth [11]	2019	Connert, T.	Ralf Krug, Florin Eggmann, Isabel Emsermann, Ashraf ElAyouti, Roland Weiger, Sebastian Kühl, Gabriel Krastl	96 (19,2)	77 (15,4)	102	215	Journal of Endodontics (1,86)	Q1
4	Clinical applications, accuracy and limitations of guided endodontics: a systematic review [12]	2020	Moreno-Rabié, C	A Torres, P Lambrechts, Reinhilde Jacobs	73 (18,25)	64 (16)	86	145	International Endodontic Journal (1,9)	Q1

(Table 1) contd.....

Total of Citations (meana)										
Rank	**Title**	**Year of Publication**	**First Author**	**Other Authors**	**Wos-AD**	**WoS-CC**	**Scopus**	**Google Scholar**	**Journal Citation Indicator 2023**	**Category Quartile**
5	3D imaging, 3D printing and 3D virtual planning in endodontics [13]	2018	Pratik Shah	B S Chong	66 (11)	53 (8,8)	73	157	Clinical Oral Investigations (1.33)	Q1
6	3-Dimensional Accuracy of Dynamic Navigation Technology in Locating Calcified Canals [14]	2020	Sameer D Jain	Caroline K Carrico, Ido Bermanis	56 (14)	50 (12,5)	49	93	Journal of Endodontics (1,86)	Q1
7	Computer-aided dynamic navigation: a novel method for guided endodontics [15]	2019	Bun San Chong	Manpreet Dhesi, Jimmy Makdissi	53 (10,6)	43 (8,6)	54	109	Quintessence International (0,73)	Q3
8	Guided Endodontic Access of Calcified Anterior Teeth [16]	2018	Warley Luciano Fonseca Tavare	Ana Cecília Diniz Viana, Vinícius de Carvalho Machado, Luiz Carlos Feitosa Henriques, Antônio Paulino Ribeiro Sobrinho	53 (8,8)	47 (7,8)	69	151	Journal of Endodontics (1,86)	Q1
9	Accuracy of Computer-Aided Dynamic Navigation Compared to Computer-Aided Static Procedure for Endodontic Access Cavities: An *In Vitro* Study [17]	2020	Álvaro Zubizarreta-Macho	Ana de Pedro Muñoz, Elena Riad Deglow, Rubén Agustín-Panadero, Jesús Mena Álvarez	52 (13)	47 (11,75)	49	103	Journal of Clinical Medicine (0,92)	Q1
10	Guided root canal preparation using cone beam computed tomography and optical surface scans - an observational study of pulp space obliteration and drill path depth in 50 patients [18]	2019	J Buchgreitz	Buchgreitz M, Bjørndal L	52 (10,4)	47 (9,4)	55	103	International Endodontic Journal (1,9)	Q1
11	Microguided Endodontics: a case report of a maxillary lateral incisor with pulp canal obliteration and apical periodontitis [19]	2019	Torres A	Shaheen E, Lambrechts P, Politis C, Reinhilde Jacobs.	52 (10,4)	42 (8,4)	56	112	International Endodontic Journal (1,9)	Q1
12	Accuracy and Efficiency of a Dynamic Navigation System for Locating Calcified Canals [20]	2020	Omid Dianat	Ali Nosrat, Patricia A Tordik, Sara A Aldahmash, Elain Romberg, Jeffery B Price, Behzad Mostoufi	50 (12,5)	46 (11,5)	50	89	Journal of Endodontics (1,86)	Q1
13	Guided Endodontic Access in Maxillary Molars Using Cone-beam Computed Tomography and Computer-aided Design/Computer-aided Manufacturing System: A Case Report [21]	2018	Sônia T de O Lara-Mendes	Camila de Freitas M Barbosa, Caroline C Santa-Rosa, Vinícius C Machado	49 (8,16)	43 (7,16)	64	121	Journal of Endodontics (1,86)	Q1
14	Present status and future directions - Guided endodontics [22]	2022	Connert, T.	Roland Weiger, Gabriel Krastl	39 (19,5)	37 (18,5)	41	72	International Endodontic Journal (1,9)	Q1
15	A New Approach for Minimally Invasive Access to Severely Calcified Anterior Teeth Using the Guided Endodontics Technique [23]	2018	Sônia T O Lara-Mendes	Camila de Freitas M Barbosa, Vinícius C Machado, Caroline C Santa-Rosa	42 (7)	37 (6,16)	60	114	Journal of Endodontics (1,86)	Q1

(Table 1) contd.....

Total of Citations (meana)										
Rank	**Title**	**Year of Publication**	**First Author**	**Other Authors**	**Wos-AD**	**WoS-CC**	**Scopus**	**Google Scholar**	**Journal Citation Indicator 2023**	**Category Quartile**
16	Case Reports in Maxillary Posterior Teeth by Guided Endodontic Access [24]	2019	Lucas Moreira Maia	Vinicius de Carvalho Machado, Nelson Renato França Alves da Silva, Manoel Brito Júnior, Rodrigo Richard da Silveira, Gil Moreira Júnior, Antônio Paulino Ribeiro Sobrinho	36 (7,2)	32 (6,4)	47	86	Journal of Endodontics (1,86)	Q1
17	Dynamic navigation: a laboratory study on the accuracy and potential use of guided root canal treatment [25]	2021	Andres Torres	Gerd-Jan Boelen, Paul Lambrechts, Mariano Simon Pedano, Reinhilde Jacobs	35 (11,66)	30 (10)	32	50	International Endodontic Journal (1,9)	Q1
18	Guided Endodontic Access in a Maxillary Molar Using a Dynamic Navigation System [26]	2021	Omid Dianat	Swati Gupta, Jeffery B Price, Behzad Mostoufi	35 (11,66)	29 (9,6)	33	59	Journal of Endodontics (1,86)	Q1
19	Accuracy and Efficiency of 3-dimensional Dynamic Navigation System for Removal of Fiber Post from Root Canal-Treated Teeth [27]	2021	Anmar Janabi	Patricia A Tordik, Ina L Griffin, Behzad Mostoufi, Jeffey B Price, Priya Chand, Frederico C Martinho	32 (10,6)	29 (9,6)	29	46	Journal of Endodontics (1,86)	Q1
20	Dynamically Navigated *versus* Freehand Access Cavity Preparation: A Comparative Study on Substance Loss Using Simulated Calcified Canals [28]	2020	Sameer D Jain	Madison W Saunders, Caroline K Carrico, Aniket Jadhav, Janina Golob Deeb, Garry L Myers	32 (8)	29 (7,25)	32	64	Journal of Endodontics (1,86)	Q1
21	Precision of Dynamic Navigation to Perform Endodontic Ultraconservative Access Cavities: A Preliminary *In Vitro* Analysis [29]	2020	Gianluca Gambarini	Massimo Galli, Antonio Morese, Luigi Vito Stefanelli, Fouad Abduljabbar, Massimo Giovarruscio, Dario Di Nardo, Marco Seracchiani, Luca Testarelli	32 (8)	29 (7,25)	30	70	Journal of Endodontics (1,86)	Q1
22	Optimisation of a guided endodontics protocol for removal of fibre-reinforced posts [30]	2020	Cyril Perez	Gary Finelle, Cauris Couvrechel	32 (8)	24 (6)	38	59	Australian Endodontic Journal (0,62)	Q3
23	Guided Endodontics: Use of a Sleeveless Guide System on an Upper Premolar with Pulp Canal Obliteration and Apical Periodontitis [31]	2021	Andres Torres	Kathleen Lerut, Paul Lambrechts, Reinhilde Jacobs	31 (10,33)	27 (9)	37	59	Journal of Endodontics (1,86)	Q1
24	Guided Endodontics Modified for Treating Molars by Using an Intracoronal Guide Technique [32]	2019	Jørgen Buchgreitz	Mikkel Buchgreitz, Lars Bjørndal	28(5,6)	20 (4)	34	73	Journal of Endodontics (1,86)	Q1

(Table 1) contd.....

Total of Citations (meana)										
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25	Three-dimensional (3D) printing in dental practice: Applications, areas of interest, and level of evidence [33]	2023	Abdulrahman A Balhaddad	Isadora Martini Garcia, Lamia Mokeem, Rashed Alsahafi, Ahmad Majeed-Saidan, Hathal H Albagami, Abdul Samad Khan, Shakil Ahmad, Fabricio Mezzomo Collares, Alvaro Della Bona, Mary Anne S Melo	24 (24)	24 (24)	N/A	30	Clinical Oral Investigations (1.33)	Q1
26	Real-Time Guided Endodontics with a Miniaturized Dynamic Navigation System *Versus* Conventional Freehand Endodontic Access Cavity Preparation: Substance Loss and Procedure Time [34]	2021	Thomas Connert	Wadim Leontiev, Dorothea Dagassan-Berndt, Sebastian Kühl, Ashraf ElAyouti, Ralf Krug, Gabriel Krastl, Roland Weiger	24 (8)	22 (7,3)	23	51	Journal of Endodontics (1,86)	Q1
27	Micro-Computed Tomography-Guided Artificial Intelligence for Pulp Cavity and Tooth Segmentation on Cone-beam Computed Tomography [35]	2021	Xiang Lin	Genqiang Ren, Xiaoyu Yang, Wei Duan, Yufei Chen, Qi Zhang	23 (7,6)	19 (6,3)	26	32	Journal of Endodontics (1,86)	Q1
28	Guided Endodontics for Managing Severely Calcified Canals [36]	2021	Marc Llaquet Pujol	Carlos Vidal, Montse Mercadé, Miguel Muñoz, Sebastian Ortolani-Seltenerich	23 (7,6)	23 (7,6)	32	64	Journal of Endodontics (1,86)	Q1
29	Three-dimensional-guided removal and preparation of dental root posts-concept and feasibility [37]	2019	Franz Sebastian Schwindling	Akinori Tasaka, Tim Hilgenfeld, Peter Rammelsberg, Andreas Zenthöfer	22 (4,4)	17 (3,4)	28	50	Journal of prosthodontic research (1,63)	Q1
30	Endodontic Retreatment Using Dynamic Navigation: A Case Report [38]	2021	Jonathan Bardales-Alcocer	Marco Ramírez-Salomón, Elma Vega-Lizama, María López-Villanueva, Gabriel Alvarado-Cárdenas, Kenneth S Serota, Jorgeraul Ramírez-Wong	21 (7)	18 (6)	22	27	Journal of Endodontics (1,86)	Q1
31	Effect of Computer-Aided Navigation Techniques on the Accuracy of Endodontic Access Cavities: A Systematic Review and Meta-Analysis [39]	2021	Álvaro Zubizarreta-Macho	Sara Valle Castaño, José María Montiel-Company, Jesús Mena-Álvarez	21 (7)	20 (6,6)	24	4	Biology-Basel (0,94)	Q1
32	Computer-aided design-based guided endodontic: A novel approach for root canal access cavity preparation [40]	2018	Ankit Nayak	Prashant K Jain, P K Kankar, Niharika Jain	21 (3,5)	17 (2,83)	32	62	Proceedings of the Institution of Mechanical Engineers, Part H: Journal of Engineering in Medicine (0,34)	Q3

(Table 1) contd.....

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33	Suitability of Magnetic Resonance Imaging for Guided Endodontics: Proof of Principle [41]	2021	Wadim Leontiev	Oliver Bieri, Philipp Madörin, Dorothea Dagassan-Berndt, Sebastian Kühl, Gabriel Krastl, Ralf Krug, Roland Weiger, Thomas Connert	20 (6,6)	19 (6,3)	20	31	Journal of Endodontics (1,86)	Q1
34	Limitations and Management of Static-guided Endodontics Failure [42]	2022	Warley Luciano Fonseca Tavares	Natália de Oliveira Murta Pedrosa, Raphael Alves Moreira, Tiago Braga, Vinícius de Carvalho Machado, Antônio Paulino Ribeiro Sobrinho, Rodrigo Rodrigues Amaral	19 (9,5)	18 (9)	21	44	Journal of Endodontics (1,86)	Q1
35	Guided Endodontics: Volume of Dental Tissue Removed by Guided Access Cavity Preparation-An *Ex Vivo* Study [43]	2020	Marco Antônio Z Loureiro	Marcela R A Elias, Lucas R Capeletti, Julio A Silva, Patrícia C Siqueira, Gustavo S Chaves, Daniel A Decurcio	19 (6,3)	14 (3,5)	20	43	Journal of Endodontics (1,86)	Q1
36	Guided endodontic treatment of multiple teeth with dentin dysplasia: a case report [44]	2020	Ralf Krug	Julian Volland, Sebastian Reich, Sebastian Soliman, Thomas Connert, Gabriel Krastl	19 (6,3)	13 (3,25)	19	28	Head & Face Medicine (1,15)	Q2
37	Microguided endodontics: Accuracy evaluation for access through intraroot fibre-post [45]	2021	Cyril Perez	Amira Sayeh, Olivier Etienne, Catherine Isabelle Gros, Ashley Mark, Cauris Couvrechel, Florent Meyer	18 (6)	14 (4,6)	17	24	Australian Endodontic Journal (0,62)	Q3
38	Guided endodontics: a comparative *in vitro* study on the accuracy and effort of two different planning workflows [46]	2020	Ralf Krug	Sebastian Reich, Thomas Connert, Stefan Kess, Sebastian Soliman, Marcel Reymus, Gabriel Krastl	16 (4)	16 (4)	17	23	International Journal of Computerized Dentistry (0,8)	Q2
39	Minimization of Tooth Substance Removal in Normally Calcified Teeth Using Guided Endodontics: An *In Vitro* Pilot Study [47]	2021	Jana Kostunov	Peter Rammelsberg, Anna-Luisa Klotz, Andreas Zenthöfer, Franz Sebastian Schwindling	15 (5)	13 (3,25)	18	34	Journal of Endodontics (1,86)	Q1
40	Guided endodontics: accuracy of access cavity preparation and discrimination of angular and linear deviation on canal accessing ability-an *ex vivo* study [48]	2021	Yinghui Su	Chenghui Chen, Chiahua Lin, Huina Lee, Kerkong Chen, Yenkun Lin, Fuhsiung Chuang	15 (5)	14 (4,6)	16	26	Bmc Oral Health (1,26)	Q1
41	Management of Pulp Canal Obliteration-Systematic Review of Case Reports [49]	2021	Alexandra Vinagre	Catarina Castanheira, Ana Messias, Paulo J Palma, João C Ramos	15 (5)	15 (5)	14	28	Medicina-Lithuania (0,67)	Q1
42	Digital Planning on Guided Endodontics Technology [50]	2021	Daniel A Decurcio	Mike R Bueno, Julio A Silva, Marco A Zaiden Loureiro, Manoel Damião Sousa-Neto, Carlos Estrela	14 (4,6)	N/A	12	35	Brazilian Dental Journal JCI N/A	Q2

(Table 1) contd.....

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43	Template-guided endodontic access [51]	2021	Randolph Todd	Scott Resnick, Thomas Zicarelli, Courtney Linenberg, Jennifer Donelson, Christina Boyd	12 (4)	10 (3,3)	13	22	Journal of the American Dental Association (1,49)	Q1
44	Effectiveness of the static-guided endodontic technique for accessing the root canal through MTA and its effect on fracture strength [52]	2021	ALI, Afzal	Hakan Arslan	11 (3,6)	8 (2,6)	9	21	Clinical Oral Investigations (1.33)	Q1
45	Guided endodontic treatment in a region of limited mouth opening: a case report of mandibular molar mesial root canals with dystrophic calcification [53]	2022	Marcos Coelho Santiago	Michel Mattar Altoe, Caroline Piske de Azevedo Mohamed, Laudimar Alves de Oliveira, Loise Pedrosa Salles	10 (5)	10 (5)	11	18	Bmc Oral Health (1,26)	Q1
46	Guided Endodontics: A Literature Review [54]	2022	Kateryna Kulinkovych-Levchuk	María Pilar Pecci-Lloret, Pablo Castelo-Baz, Miguel Ramón Pecci-Lloret, Ricardo E Oñate-Sánchez	10 (5)	10 (5)	11	28	International Journal of Environmental Research and Public Health N/A	Q2
47	Guided endodontics: The impact of new technologies on complex case solution [55]	2021	Marco Antônio Z Loureiro	Julio A Silva, Gustavo S Chaves, Lucas R Capeletti, Carlos Estrela, Daniel A Decurcio	10 (3,3)	9 (3)	14	28	Australian Endodontic Journal (0,62)	Q3
48	Antimicrobial photodynamic therapy and guided endodontics: A case report [56]	2020	Warley Luciano Fonseca Tavares	Marcus Vinícius Lucas Ferreira, Vinícius de Carvalho Machado, Tiago Braga, Rodrigo Rodrigues Amaral, Stephen Cohen	10 (2,5)	10 (2,5)	13	18	Photodiagnosis and Photodynamic Therapy (0,7)	Q2
49	Access to original canal trajectory after deviation and perforation with guided endodontic assistance [57]	2020	Bruna de Athayde Casadei	Sônia T de O Lara-Mendes, Camila de Freitas M Barbosa, Christiane Valente Araújo, Cristina Almeida de Freitas, Vinícius C Machado, Caroline C Santa-Rosa	10 (2,5)	10 (2,5)	15	45	Australian Endodontic Journal (0,62)	Q3
50	Treatment of Pulp Canal Obliteration Using a Dynamic Navigation System: Two Case Reports [58]	2023	Mengyan Wu	Mingwen Liu, Yue Cheng, Weilong Tang, Ping Yan, Han Jiang	9 (9)	8 (8)	8	10	Journal of Endodontics (1,86)	Q1
51	Novel method for augmented reality guided endodontics: An *in vitro* study [59]	2022	Marco Farronato	Andres Torres, Mariano S Pedano, Reinhilde Jacobs	9 (4,5)	8 (4)	11	13	Journal of Dentistry (1,98)	Q1
52	Guided Access Cavity Preparation Using Cost-Effective 3D Printers [60]	2022	George K Koch	Hisham Gharib, Peixi Liao, Hongsheng Liu	9 (4,5)	8 (4)	9	13	Journal of Endodontics (1,86)	Q1

(Table 1) contd.....

Total of Citations (meana)										
Rank	**Title**	**Year of Publication**	**First Author**	**Other Authors**	**Wos-AD**	**WoS-CC**	**Scopus**	**Google Scholar**	**Journal Citation Indicator 2023**	**Category Quartile**
53	Endodontic guide for the conservative removal of a fiber-reinforced composite resin post [61]	2022	Lucas Moreira Maia	Wilson Bambirra Júnior, Kênia Maria Toubes, Gil Moreira Júnior, Vinicius de Carvalho Machado, Bruno César Parpinelli, Antônio Paulino Ribeiro Sobrinho	9 (4,5)	8 (4)	10	17	Journal of Prosthodontic Research (1,63)	Q1
54	Dynamic Navigation in Guided Endodontics - A Systematic Review [62]	2018	Aishwarya Vasudevan	Sneha Susan Santosh, Rene Jochebed Selvakumar, Durga Tharini Sampath, Velmurugan Natanasabapathy	9 (1,5)	9 (1,5)	11	18	European Endodontic Journal (0,61)	Q3
55	Accuracy of Endodontic Access Cavities Performed Using an Augmented Reality Appliance: An *In Vitro* Study [63]	2022	Vicente Faus-Matoses	Tanaz Moradian, Elena Riad Deglow, Celia Ruiz-Sánchez, Nirmine Hamoud-Kharrat, Álvaro Zubizarreta-Macho, Ignacio Faus-Matoses	8 (4)	7 (3,5)	7	10	International Journal of Environmental Research and Public Health N/A	Q2
56	Fiber-reinforced composite post removal using guided endodontics: a case report [64]	2022	Changgi Cho	Hyo Jin Jo, Jung-Hong Ha	8 (4)	5 (2,5)	N/A	19	Restorative Dentistry and Endodontics N/A	N/A
57	Guided Endodontic Treatment of Calcified Lower Incisors: A Case Report [65]	2021	Georges Ishak	Marc Habib, Hani Tohme, Shanon Patel, Antonietta Bordone, Cyril Perez, Carla Zogheib	8 (2,6)	8 (2,6)	12	26	Dentistry Journal (1,04)	Q2
58	Accuracy of Dynamic Navigation for Non-Surgical Endodontic Treatment: A Systematic Review [66]	2022	Egle Marija Jonaityte	Goda Bilvinaite, Saulius Drukteinis, Andres Torres	7 (3,5)	7 (3,5)	8	17	Journal of Clinical Medicine (0,92)	Q1
59	Application of computer-assisted dynamic navigation in complex root canal treatments: Report of two cases of calcified canals [67]	2022	Paula Andrea Villa-Machado	Felipe Augusto Restrepo-Restrepo, Hugo Sousa-Dias, Sergio Iván Tobón-Arroyave	7 (3,5)	7 (3,5)	8	19	Australian Endodontic Journal (0,62)	Q3
60	Digital Design of Minimally Invasive Endodontic Access Cavity [68]	2022	Gambarini Gianluca	Galli Massimo, Morese Antonio, Abduljabbar Fouad, Seracchiani Marco, Stefanelli Luigi Vito, Giovarruscio Massimo, Di Nardo Dario, Testarelli Luca	7 (3,5)	7 (3,5)	8	19	Applied Sciences-Basel (0,56)	Q2
61	Guided endodontic access of a calcified mandibular central incisor using a software-based three-dimensional treatment plan A case report [69]	2020	Jörg Philipp Tchorz	Karl-Thomas Wrbas, Elmar Hellwig	7 (1,75)	7 (1,75)	10	19	International Journal of Computerized Dentistry (0,8)	Q2

(Table 1) contd.....

Total of Citations (meana)										
Rank	**Title**	**Year of Publication**	**First Author**	**Other Authors**	**Wos-AD**	**WoS-CC**	**Scopus**	**Google Scholar**	**Journal Citation Indicator 2023**	**Category Quartile**
62	Current Applications of Dynamic Navigation System in Endodontics: A Scoping Review [70]	2020	Frederico Canato Martinho	Ina Laurie Griffin, Bruna Jordão Motta Corazza	7 (1,75)	7 (1,75)	2	11	European Journal of Dentistry N/A	Q2
63	Guided Endodontics in Root Canals with Complex Access: Two Case Reports [71]	2023	Wesley Fernandes Gonçalves	Lucas da Fonseca Roberti Garcia, Daniela Peressoni Vieira-Schuldt, Eduardo Antunes Bortoluzzi, Luiz Carlos de Lima Dias-Júnior, Cleonice da Silveira Teixeira	6 (1)	N/A	6	15	Brazilian Dental Journal JCI N/A	Q2
64	Access opening guide produced using a 3D printer (AOG-3DP) as an effective tool in difficult cases for dental students [72]	2021	Yiseul Choi	Woo Seok Jeon, Jung Min Cho, Ho-Gul Jeong, Yooseok Shin, Wonse Park	6 (3)	5 (1,6)	N/A	7	Journal of Dental Education (0,74)	Q3
65	Effectiveness of guided endodontics in locating calcified root canals: a systematic review [73]	2019	F Peña-Bengoa	M Valenzuela, M J Flores, N Dufey, K P Pinto, E J N L Silva	6 (1,2)	5 (1)	4	11	Clinical Oral Investigations (1.33)	Q1
66	The Use of Dynamic Navigation Systems as a Component of Digital Dentistry [74]	2021	W L Tang	X Y Chao, Z Ye, M W Liu, H Jiang	5 (1,6)	5 (1,6)	4	5	Journal of Dental Research (2,86)	Q1
67	Computer-Controlled CO2 Laser Ablation System for Cone-beam Computed Tomography and Digital Image Guided Endodontic Access: A Pilot Study [75]	2021	Jacob C Simon	Jason W Kwok, Frank Vinculado, Daniel Fried	5 (1,6)	4 (1,3)	5	13	Journal of Endodontics (1,86)	Q1
68	Three-dimensional inlay-guided endodontics applied in variant root canals: A case report and review of literature [76]	2021	Yin-Qiu Yan	Hui-Li Wang, Yu Liu, Tai-Jing Zheng, Ya-Ping Tang, Rui Liu	5 (1,6)	4 (1,3)	6	8	World Journal of Clinical Cases (0,26)	Q3
69	*In vitro* study on the accuracy of sleeveless guided endodontics and treatment of a complex upper lateral incisor [77]	2024	A Torres	M Dierickx, W Coucke, M S Pedano, P Lambrechts, R Jacobs	4 (1)	4 (1)	4	4	Journal of Dentistry (1,98)	Q1
70	The accuracy of using guided endodontics in access cavity preparation and the temperature changes of root surface: An *in vitro* study [78]	2023	Cuifeng Zhang	Xiao Zhao, Cheng Chen, Jingyan Wang, Peiyu Gu, Junchi Ma, Daming Wu, Jin Li	4 (1)	3 (3)	4	7	Bmc Oral Health (1,26)	Q1
71	The effects of endodontic access cavity design on dentine removal and effectiveness of canal instrumentation in maxillary molars [79]	2022	Dan Wang	Wei Wang, Yu-Jiao Li, Yi-Rong Wang, Tao Hong, Shi-Zhu Bai, Yu Tian	4 (2)	4 (2)	4	11	International Endodontic Journal (1,9)	Q1
72	Guided Endodontics: Static *vs*. Dynamic Computer-Aided Techniques-A Literature Review [80]	2022	Diana Ribeiro	Eva Reis, Joana A Marques, Rui I Falacho, Paulo J Palma	4 (2)	4 (2)	6	20	Journal of Personalized Medicine (1,05)	Q2
73	Fiber Post Removal Using a Conservative Fully Guided Approach: A Dental Technique [81]	2022	Abdullah Alfadda	Abdulmohsen Alfadley, Ahmed Jamleh	4 (2)	4 (2)	5	11	Case Reports in Dentistry (0,31)	Q4

(Table 1) contd.....

Total of Citations (meana)										
Rank	**Title**	**Year of Publication**	**First Author**	**Other Authors**	**Wos-AD**	**WoS-CC**	**Scopus**	**Google Scholar**	**Journal Citation Indicator 2023**	**Category Quartile**
74	Use of dynamic navigation with an educational interest for finding of root canals [82]	2021	Carlo Prati	Spinelli A, Marchetti C, Gandolfi M. G, Zamparini F, Prati C, Pellegrino G	4 (1,3)	4 (1,3)	6	4	Giornale Italiano di Endodonzia (0,8)	Q4
75	Limitations and Management of Dynamic Navigation System for Locating Calcified Canals Failure [83]	2024	Xiaoxia Yang	Yinchun Zhang, Xuan Chen, Lei Huang, Xiaoling Qiu	3 (3)	3 (3)	4	5	Journal of Endodontics (1,86)	Q1
76	Expert consensus on digital guided therapy for endodontic diseases [84]	2023	Xi Wei	Yu Du, Xuedong Zhou, Lin Yue, Qing Yu, Benxiang Hou, Zhi Chen, Jingping Liang, Wenxia Chen, Lihong Qiu, Xiangya Huang, Liuyan Meng, Dingming Huang, Xiaoyan Wang, Yu Tian, Zisheng Tang, Qi Zhang, Leiying Miao, Jin Zhao, Deqin Yang, Jian Yang, Junqi Ling	3 (3)	3 (3)	4	5	International Journal of Oral Science (5,61)	Q1
77	Comparative Evaluation of a Dynamic Navigation System *versus* a Three-dimensional Microscope in Retrieving Separated Endodontic Files: An *In Vitro* Study [85]	2023	Mohammed H Karim	Bestoon M Faraj	3 (3)	3 (3)	2	2	Journal of Endodontics (1,86)	Q1
78	Guided Access through Ceramic Crowns with Fiberglass Post Removal in Lower Molars: An *In Vitro* Study [86]	2023	Gustavo Freitas Fachin	Thiago Revillion Dinato, Frederico Ballvé Prates, Thomas Connert, Rina Andrea Pelegrine, Carlos Eduardo da Silveira Bueno	3 (3)	3 (3)	3	4	Applied Sciences-Basel (0,56)	Q2
79	Guided Endodontics as a Personalized Tool for Complicated Clinical Cases [87]	2022	Wojciech Dąbrowski	Wiesława Puchalska, Adam Ziemlewski, Iwona Ordyniec-Kwaśnica	3 (1,5)	3 (1,5)	6	14	International Journal of Environmental Research and Public Health (0,93)	Q2
80	3D printing in endodontics: report of three clinical cases with innovative approaches [88]	2021	Kıvanç Kamburoğlu	Cemre Koç, Gül Sönmez, Abdullah Çapçı	3 (1)	3 (1)	3	4	International Journal of Computerized Dentistry (0,8)	Q2
81	Endodontic retreatment of a calcified anterior tooth using a 3D-printed endodontic guide [89]	2021	Bit-Na Kim	Sung-Ae Son, Jeong-Kil Park	3 (1)	3 (1)	3	5	International Journal of Computerized Dentistry (0,8)	Q2
82	A Global Overview of Guided Endodontics: A Bibliometric Analysis [90]	2020	Thaine Oliveira Lima	Aurélio de Oliveira Rocha, Lucas Menezes Dos Anjos, Nailson Silva Meneses Júnior, Marco Antonio Hungaro Duarte, Murilo Priori Alcalde, Mariane Cardoso, Rodrigo Ricci Vivan	3 (0,75)	3 (0,75)	3	5	Journal of Endodontics (1,86)	Q1

(Table 1) contd.....

Total of Citations (meana)										
Rank	**Title**	**Year of Publication**	**First Author**	**Other Authors**	**Wos-AD**	**WoS-CC**	**Scopus**	**Google Scholar**	**Journal Citation Indicator 2023**	**Category Quartile**
83	Adaptable fiberglass post after 3D guided endodontic treatment: Novel approaches in restorative dentistry [91]	2020	Amanda Stephanie Silva	Alice Cecília Carvalho Santos, Camila de Sousa Caneschi, Vinícius Carvalho Machado, Allyson Nogueira Moreira, Luís Fernando Dos Santos Alves Morgan, Warley Luciano Fonseca Tavares	3 (0,75)	3 (0,75)	4	10	Journal of Esthetic and Restorative Dentistry (1,28)	Q1
84	Treatment of obliterated root canals using various guided endodontic techniques [92]	2020	Antonietta Bordone	Cauris Cauvrechel	3 (0,75)	3 (0,75)	3	6	Giornale Italiano di Endodonzia (0,8)	Q4
85	Endodontic Management of Canal Calcification in Maxillary Central Incisor Using 3D Prototyping Technique: A Case Report [93]	2020	Suryasowjanya Doranala	Harikumar Vemisetty, Rajani Punna, Aditya Mohan Alwala	3 (0,75)	3 (0,75)	3	7	Journal of Advanced Oral Research (0,23)	Q4
86	Guided Access Cavity Preparation Using a New Simplified Digital Workflow [94]	2023	Gustavo S Chaves	Julio A Silva, Lucas R Capeletti, Emmanuel J N L Silva, Carlos Estrela, Daniel A Decurcio	2 (2)	2 (2)	2	3	Journal of Endodontics (1,86)	Q1
87	Guided endodontics *versus* conventional access cavity preparation: an *ex vivo* comparative study of substance loss [95]	2023	Hauke Hildebrand	Wadim Leontiev, Gabriel Krastl, Roland Weiger, Dorothea Dagassan-Berndt, Sebastian Bürklein, Thomas Connert	2 (2)	2 (2)	1	4	Bmc Oral Health (1,26)	Q1
88	Application of an Endodontic Static Guide in Fiber Post Removal from a Compromised Tooth [96]	2023	Mehran Farajollahi	Omid Dianat, Samaneh Gholami, Shima Saber Tahan	2 (2)	2 (2)	2	3	Case Reports in Dentistry (0,31)	Q4
89	Dynamic Navigation in Endodontics: Guided Access Cavity Preparation by Means of a Miniaturized Navigation System [97]	2022	Wadim Leontiev	Thomas Connert, Roland Weiger, Gabriel Krastl, Eva Magni	2 (1)	2 (1)	3	3	Jove-Journal of Visualized Experiments (0,27)	Q3
90	Endodontic guides and ultrasonic tips for management of calcifications [98]	2021	Amal Shabaan	Ehab Hassanien, Tarek Elsewify	2 (0,66)	2 (0,66)	3	3	Giornale Italiano di Endodonzia (0,8)	Q4
91	Comparing accuracy in guided endodontics: dynamic real-time navigation, static guides, and manual approaches for access cavity preparation - an *in vitro* study using 3D printed teeth [99]	2024	Karin Christine Huth	Lukas Borkowski, Anja Liebermann, Frank Berlinghoff, Reinhard Hickel	1 (1)	1 (1)	1	3	Clinical Oral Investigations (1.33)	Q1

(Table 1) contd.....

Total of Citations (meana)										
Rank	**Title**	**Year of Publication**	**First Author**	**Other Authors**	**Wos-AD**	**WoS-CC**	**Scopus**	**Google Scholar**	**Journal Citation Indicator 2023**	**Category Quartile**
92	Dynamic Navigation System vs. Free-Hand Approach in Microsurgical and Non-Surgical Endodontics: A Systematic Review and Meta-Analysis of Experimental Studies [100]	2023	Elina Mekhdieva	Massimo Del Fabbro, Mario Alovisi, Nicola Scotti, Allegra Comba, Elio Berutti, Damiano Pasqualini	1 (1)	1 (1)	1	2	Journal of Clinical Medicine (0,92)	Q1
93	Ex-vivo and in-vivo validation of a novel measuring protocol for guided endodontics [101]	2023	Andres Torres	Michael Dierickx, Wim Coucke, Mariano Simon Pedano, Paul Lambrechts, Reinhilde Jacobs	1 (1)	1 (1)	2	1	Journal of Dentistry (1,98)	Q1
94	Assessment of guide fitting using an intra-oral scanner: An *in vitro* study [102]	2023	Elias Bittar	Pauline Binvignat, Cyril Villat, Jean-Christophe Maurin, Maxime Ducret, Raphaël Richert	1 (1)	1 (1)	1	1	Journal of Dentistry (1,98)	Q1
95	Influence of Calcified Canals Localization on the Accuracy of Guided Endodontic Therapy: A Case Series Study [103]	2023	Emanuele Ambu	Benedetta Gori, Crystal Marruganti, Giulia Malvicini, Antonietta Bordone, Lorenzo Giberti, Simone Grandini, Carlo Gaeta	1 (1)	1 (1)	1	3	Dentistry Journal (1,04)	Q2
96	Three-dimensional accuracy of endodontic access preparations using novel nonrestrictive static guides: A laboratory study [104]	2023	Ahmed Elhakim	Junghwan Hwang, Sunil Kim, Euiseong Kim, Sumi Kang	1 (1)	1 (1)	0	1	Australian Endodontic Journal (0,62)	Q3
97	Guided endodontics of calcified canals: The drilling path of rotary systems and intracanal dentin wear [105]	2023	Cassiano Ricardo	Aline Evangelista Souza-Gabriel, Laís Lima Pelozo, Antônio Miranda Cruz-Filho, Manoel Damião Sousa-Neto, Ricardo Gariba Silva	1 (1)	1 (1)	0	4	Australian Endodontic Journal (0,62)	Q3
98	Ten-year follow up of previously traumatized immature permanent incisors sustaining second and third traumatic injuries after revascularization treatment: Case reports [106]	2022	Zafer C Cehreli	Gizem Erbas Unverdi, Pinar Serdar Eymirli	1 (0,5)	1 (0,5)	1	2	Dental Traumatology (1,01)	Q2
99	2D radiographs, cone-beam computed tomography and 3D CBCT-based planning software in access cavity preparation: A single blinded randomised controlled *in vitro* study [107]	2022	David W Christofzik	Patrick Glandorf, Jonas Conrad, Karim M Fawzy El-Sayed, Birte Größner-Schreiber, Christof E Dörfer	1 (0,5)	1 (0,5)	1	3	Australian Endodontic Journal (0,62)	Q3
100	Dynamic navigation for guided endodontics: a case report [108]	2020	Manpreet Dhesi	Bun San Chong	1 (0,25)	1 (0,25)	N/A	2	European Endodontic Journal (0,61)	Q3

Abbreviations: n/a., not applicable; WoS-AD, Web of Science–All Databases; WoS-CC, Web of Science–Core Collection.
a The mean based on the ratio of the numbers of citations and the period since the year of publication up to September 2024.

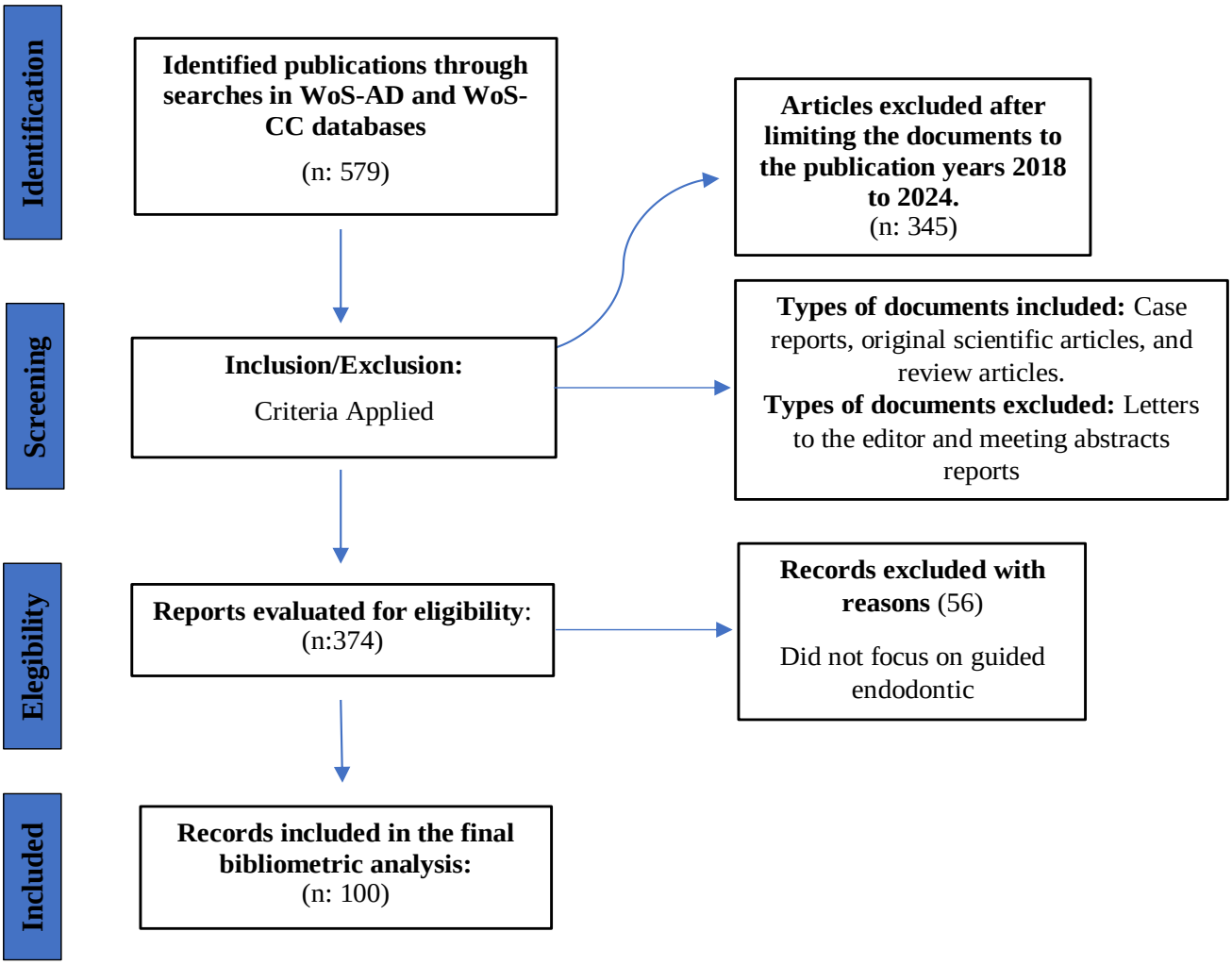


Fig. (1). Flow diagram illustrating the selection process of the top 100 most-cited articles in guided endodontics from 2018 to 2024.

3.1. Journals and Publication Dates of Top-cited Articles

Among the 100 most-cited articles on guided endodontics, 29% were published in the JOE. This was followed by 8% each in the International Endodontic Journal and the Australian Endodontic Journal, and 4% in each of the following journals: Clinical Oral Investigations, BMC Oral Health, Journal of Dentistry, and International Journal of Computerized Dentistry. Regarding publication years, the majority of the most-cited articles were published in 2020 (n = 48), followed by 2019 (n = 28), based on articles published between 2018 and 2023.

3.2. Authors, Institutions, and Countries of Origin

Table **2** details the leading authors and their citation counts, highlighting their significant contributions to the field and the influence of their work on advancing guided endodontics. Articles authored by four or more researchers tended to receive more citations compared to those with two or three authors. Among the analyzed authors, Thomas Connert from Switzerland stands out as the most frequently appearing author on the list. He contributed to 10 of the top 100 articles, accumulating a total of 321 citations, despite never being listed as the first author. Gabriel Krastl was the second most prolific author, with 9 articles and 318 citations, followed by Andrés Torres, who contributed 8 articles totaling 212 citations.

Data were extracted from 64 different institutions. The University of Basel was the most prolific institution, publishing six articles. KU Leuven University and the Federal University of Minas Gerais each contributed five articles, while the University of Maryland, Baltimore, published four. Two additional universities produced three articles each, and fourteen institutions contributed at least two articles. Notably, nearly 70% of the identified institutions contributed only one publication (see Table **3**).

Table 2. Most prominent authors and key citations from the bibliometric article, which serve as the basis for the analysis conducted.

Author	Number of Articles	Number of Citations
Thomas Connert	10	321
Gabriel Krastl	9	318
Andrés Torres	8	212
Roland Weiger	7	283
Reinhilde Jacobs	7	205
Lambrechts	6	196
Vinicius de Carvhalo	6	190
Ralf Krug	5	190
Kühl	4	237
Daniel A Decurcio	4	45

Table 3. List of institutions where two or more of the most cited works are found.

Institution (Country)	Number of Articles	Number of Citations WoS-AD
University of Basel (Switzerland)	6	281
Universidad KU Leuven (Belgium)	5	195
Universidade Federal de Minas Gerais (Brazil)	5	111
University of Maryland Baltimore (United States)	4	124
Queen Mary University of London (United States)	3	120
Universidade Federal de Goiás (Brazil)	3	44
Virginia Commonwealth University (United States)	2	88
Universidade de Itauna (Brazil)	2	87
University of Copenhagen (Denmark)	2	80
Universidad Alfonso X El Sabio (Spain)	2	73
University of Strasbourg (France)	2	50
Sapienza University of Rome (Italy)	2	39
Universidad de Heidelberg (Germany)	2	37
Griffith University (Australia)	2	35
University Hospital of Würzburg (Germany)	2	35
Universidad de Coimbra (Portugal)	2	19
Wuhan University (China)	2	14
Federal University of Santa Catarina (Brazil)	2	9
The Fourth Military Medical University (China)	2	8
Yonsei University (South Korea)	2	7

Based on the corresponding author's country, the 100 most cited articles originated from 26 countries. Brazil ranked first with 17 articles, followed by Germany with 14 and the United States with 10. A total of 47 articles came from 11 European countries (Germany, Switzerland, Belgium, Spain, Denmark, the United Kingdom, Italy, France, Portugal, Lithuania, and Poland). Ten Asian countries (China, India, Taiwan, South Korea, Lebanon, Saudi Arabia, Iraq, Iran, the United Arab Emirates, and Turkey) contributed 22 articles. The Americas accounted for 20 articles from five countries: Brazil, the United States, Mexico, Chile, and Colombia.

Fig. (**2**) illustrates the geographical distribution of the countries where the 100 most cited articles on guided endodontics. Countries are grouped by continent and represented with distinct colors on the world map. This visualization underscores the global scope of guided endodontics research, with a higher concentration of publications originating from Europe, Asia, and the Americas between 2016 and 2024.

3.3. Study Design

Among the 100 most cited articles, case reports were the most frequent study design (n = 43), followed by laboratory studies (n = 28), including both *in vitro* and *ex vivo* research. Literature reviews and systematic reviews (with or without meta-analysis) each accounted for six articles, while basic research studies comprised five. Table **4** provides a summary of the study design characteristics.

Table 4. Characteristics of 100 most cited papers in guided endodontics regarding study design.

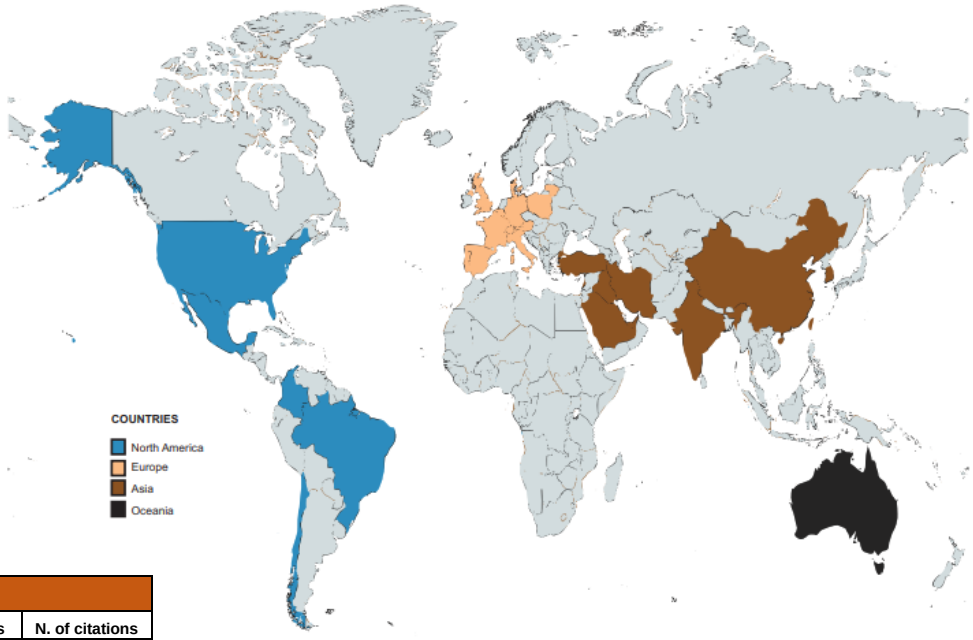
Study Design	Number of Papers	Number of Citations (WoS-AD)	Citation Ratio
Case Report	43	723	16,8
Laboratory Study	31	537	54,7
Literature Review	6	43	7,2
Basic research	5	112	22,4
Systematic Review / Meta-Analysis	6	22	3,7
Narrative review	3	207	69,0
Bibliometric Analysis	1	3	3,0
Case report and review of literature	1	5	5,0
Comparative Study	1	32	32,0
Pilot Study	1	5	5,0
Observational study	1	52	52,0
Scoping Review	1	7	7,0

Abbreviation: WoS-AD, Web of Science–All Databases.

[a] Number of citations/number of papers.

4. DISCUSSION

Resolving complications in endodontic treatments has traditionally required precise manual skills and substantial clinical experience. Guided endodontics enables endodontists to perform safer, more precise, and personalized procedures using three-dimensional imaging that reveals the exact location of root canals, potential anatomical challenges, and their relationship to vital structures such as nerves and blood vessels.



ASIA		
Country	**N. of articles**	**N. of citations**
China	8	61
South Korea	4	18
India	4	44
Saudi Arabia	2	28
Turkey	2	4
Taiwan	1	15
Lebanon	1	8
Iraq	1	3
Iran	1	2

OCEANIA		
Country	**N. of articles**	**N. of citations**
Australia	2	29

AMERICA		
Country	**N. of articles**	**N. of citations**
Brazil	16	272
USA	11	340
México	1	21
Colombia	1	7
Chile	1	6

EUROPE		
Country	**N. of articles**	**N. of citations**
Germany	7	76
Switzerland	6	281
Italy	6	54
Belgium	5	195
Spain	5	114
France	4	54
United Kingdom	3	133
Denmark	2	80
Portugal	2	19
Austria	1	7
Lithuania	1	7
Poland	1	3

Fig. (2). Global distribution of the 100 most cited articles in regenerative endodontics.

This technique represents a significant advancement in modern dentistry, enhancing clinical outcomes and patient satisfaction. However, its scientific evolution has been gradual, as most dental guide research has historically focused on maxillofacial surgery.

A review of the 100 most influential publications since 2018 revealed that the highest number of articles were published in 2021, predominantly in the JOE, followed by the International Endodontic Journal, Australian Endodontic Journal, and Clinical Oral Investigations.

This shift reflects a growing interest in the clinical applications of guided endodontics, particularly in complex scenarios such as root canal calcification and apical pathologies. It also underscores the impact of studies that integrate technological innovation with clinical relevance. The increasing citation counts of these works highlight the importance of guided techniques in contemporary endodontics and their potential to reshape diagnostic and therapeutic paradigms.

In earlier analyses, systematic reviews were underrepresented; however, recent years have shown a marked increase in their publication. In the current study, seven systematic reviews were identified. These studies represent the highest level of clinical evidence, offering structured syntheses of knowledge that support the development of clinical guidelines and help prioritize future research topics. In contrast, narrative (non-systematic) reviews, which lack methodological rigor in article selection and data extraction, ranked third, with 75 publications. Clinical case reports ranked second with 18 entries, reaffirming their relevance in documenting specific clinical scenarios. This trend may be partly attributed to the widespread presence of narrative reviews in non-clinical dental literature.

Nevertheless, systematic reviews demand a high level of methodological rigor, as well as substantial time and resource investment, which can limit their production, particularly in emerging fields or areas with limited primary research. Challenges such as the heterogeneity

and varying quality of available studies further complicate the generation of clear and reliable syntheses. In the health sciences, the lack of standardized data and well-designed clinical trials often restricts the feasibility of conducting systematic reviews. Moreover, limited training in review methodologies, along with insufficient technical and financial support, contributes to their lower frequency. Finally, certain dental subfields or newly developing specialties may still lack the necessary body of scientific literature to support comprehensive and robust systematic reviews.

This landscape is expected to evolve in the coming years as the number of high-quality systematic reviews in guided endodontics continues to grow. However, the strength of the evidence generated depends not only on the methodological rigor of these reviews but also on the quality and volume of the primary studies they include. These factors must be critically evaluated to assess the validity and applicability of the resulting knowledge.

Although Brazil leads in the number of publications on both static and dynamic guided endodontics (n = 17), these articles have not appeared in high-impact journals such as the JOE, the official publication of the American Association of Endodontists (AAE). This journal is predominantly occupied by studies from European and North American authors, whose articles tend to receive more citations. Consequently, research from these regions exerts greater influence within the field of guided endodontics.

The dominance of European and North American authors among highly cited articles is closely linked to factors such as robust research funding and preferential access to high-impact journals. Institutions like the University of Basel (Switzerland), KU Leuven (Belgium), and North American universities such as the University of Maryland, Baltimore, benefit from strong infrastructure and financial support, enabling sustained and rigorous research endeavors. This advantage facilitates publication in prestigious journals, thereby increasing visibility and citation rates.

Conversely, although countries like Brazil contribute valuable research, challenges, including limited funding, fewer international collaborations, and publications in lower-impact journals, may restrict the dissemination and citation of their work. This bibliometric pattern reflects structural inequalities in scientific production and highlights the need to enhance support for researchers in underrepresented regions to improve global visibility in guided endodontics.

Bibliometric indicators such as author productivity, citation trends, and geographic distribution can serve as valuable tools to guide research priorities and improve scientific impact. Early-career researchers and clinicians can leverage these insights to identify emerging topics, target high-impact journals, and establish potential collaborations. Understanding the current landscape enables them to strategically focus on underexplored areas or build upon influential studies, thereby increasing their chances of publishing impactful research and advancing their professional development.

A key finding of this bibliometric analysis is the identification of Thomas Connert as the most prolific author in the field of guided endodontics, with a total of 10 publications. This highlights his significant contribution to the development and consolidation of this innovative technique within modern endodontics. Notably, Connert was the most frequently appearing author in the article "*The 100 Most-Cited Articles on Guided Endodontics: 2018–2024*", underscoring his influence on the most impactful research during this period. His prominence not only demonstrates academic leadership but also reflects the broader scientific community's growing interest in adopting advanced techniques that enhance access and precision in complex endodontic procedures.

5. LIMITATIONS OF THE STUDY

This bibliometric study has several limitations that should be acknowledged. First, the analysis was restricted to the WoS database, potentially excluding relevant articles indexed in other platforms such as Scopus, PubMed, or Google Scholar. Second, by focusing exclusively on the 100 most-cited articles, the study introduces a citation-based bias that favors older publications, as more recent studies have not had sufficient time to accumulate citations. This may limit the comprehensiveness and temporal representativeness of the findings.

The study has several limitations that should be acknowledged. One notable limitation is the potential bias introduced by database selection, as different indexing platforms vary in coverage and source inclusion. For instance, Scopus and Google Scholar often encompass a broader range of publications, including non-traditional sources, which may lead to different citation counts compared in WoS. Furthermore, the literature search was limited to studies indexed up to September 2024, which may have led to the underrepresentation of recently published or cited articles. These factors could affect the completeness and temporal accuracy of the analysis.

CONCLUSION

This bibliometric analysis identified the most influential articles, authors, and institutions in guided endodontics published between 2018 and 2024. Although Brazil leads in overall research output, the majority of highly cited and impactful studies originate from Europe and North America. This trend suggests that publication in high impact journals such as the JOE plays a crucial role in enhancing article visibility and citation rates. Furthermore, Thomas Connert emerged as the most prolific author in this field, reinforcing his prominent role in advancing guided endodontics through high-quality research.

AUTHORS' CONTRIBUTION

The authors confirm their contribution to the paper as follows: G.A.M.V.: Writing the Paper; R.E.G.G.: Data analysis or interpretation; M.E.G.I.: Data collection; C.J.C.V.: Others; M.Y.B.B.: Writing of the paper.; A.A.C.C.: Data Analysis or Interpretation; SBTA.: Data Analysis or

Interpretation. All authors have reviewed the results and approved the final version of the manuscript.

LIST OF ABBREVIATIONS

WoS	=	Web of Science
WoS-AD	=	Web of Science All Databases
WoS-CC	=	Web of Science Core Collection
JOE	=	Journal of Endodontics
AAE	=	American Association of Endodontists

CONSENT FOR PUBLICATION

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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