



A Scientometric Evaluation of Türkiye's Research Productivity in High-Impact Endodontic Journals: A 41-Year Bibliometric Analysis

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Purpose: This study aims to examine scholarly communication patterns in high-impact endodontic journals through a bibliometric analysis of Türkiye-affiliated publications in the Journal of Endodontics, International Endodontic Journal, and Australian Endodontic Journal.

Methods: A total of 753 Web of Science-indexed articles published between 1983 and 2024 were analyzed using Bibliometrix in R with supplementary statistical analyses. Publications were evaluated in terms of document types, subject categories, citation performance, authorship and institutional productivity, multidisciplinary structures, and national and international collaboration patterns.

Results: Root canal preparation and irrigation-disinfection were the most frequently investigated topics, and laboratory-based studies predominated. The highest citation impact was observed in the Journal of Endodontics. Hacettepe University was the most productive institution, and Hakan Arslan the most prolific author. International collaborations were most frequently established with the United States.

Conclusion: This bibliometric analysis provides an overview of Türkiye-affiliated research productivity and trends in high-impact endodontic journals. Building on these findings, fostering interdisciplinary collaboration and expanding international partnerships may further strengthen scientific visibility and impact. Research performance should be evaluated not only by the number of publications but also by citation metrics and the h-index to provide a more accurate and balanced assessment of academic impact.

Keywords: Bibliometric analysis; citation analysis; collaboration networks; endodontics; research evaluation.

Introduction

Bibliometrics is an important method for the quantitative evaluation of scientific publications, serving as a key tool for the systematic examination of academic literature. Using statistical and mathematical techniques, this approach

helps identify research output, trends, and levels of impact across different scientific fields. Bibliometric studies allow researchers to explore trends, collaboration networks, and patterns of scientific productivity within their disciplines. This method also provides a comprehensive overview of

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the academic literature, making it possible to identify gaps in specific areas and suggest ways to address them (1,2).

There are many databases available for collecting data used in bibliometric analyses. The most used and internationally recognized databases include WoS, Scopus, and Google Scholar. For evaluating individual researchers, the most basic bibliometric indicators are the number of publications and citations. With the growth of digital resources, new indicators such as the h-index have been developed, forming the basis of more advanced bibliometric measures (3). To assess the academic influence of journals, the two-year impact factor is one of the most frequently used indicators (4). These parameters are increasingly important in evaluating academic productivity, faculty promotion processes, and research funding applications (5).

Citation analysis, one of the most common methods in bibliometric research, evaluates the scientific and clinical importance of a publication by examining how often it is cited by other researchers. Although citation count alone does not fully represent the scientific or clinical value of a study, it provides an objective reference point for researchers and clinicians to follow technological advances, assess current trends, and support evidence-based decision-making (1). Clarivate is a tool that systematically searches and indexes thousands of scientific journals to create a comprehensive database (6). The WoS search platform within Clarivate includes several citation indexes, such as the Science Citation Index (SCI), Social Sciences Citation Index (SSCI), and Arts & Humanities Citation Index (A&HCI) (7). The Science Citation Index Expanded (SCIE), previously known as the SCI, was developed under the leadership of Eugene Garfield. WoS covers more than 250 academic subjects and is well-known all over the world. Many top academic institutions support it (8).

Since the introduction of SCI in 1961, the journal impact factor has become an important criterion for evaluating academic journals (9). The impact factor is calculated by dividing the total number of citations received in a given year for articles published in the previous two years by the total number of articles published in the same period (10). It remains one of the most widely used indicators for assessing a journal's academic influence (4).

In the WoS database, the Journal of Endodontics (JOE), International Endodontic Journal (IEJ) and Australian Endodontic Journal (AEJ) are three highly regarded endodontic journals with strong impact factors. By publishing scientific work from different regions, these journals contribute to the global dissemination of knowledge produced in various countries (11).

JOE is the official journal of the American Association of Endodontists and has been published monthly since 1975.

According to the Journal Citation Reports (12), it ranks 22nd among 162 dentistry journals and is considered a leading publication for dental professionals. Its 2024 impact factor is 3.6. IEJ is a peer-reviewed journal in the field of endodontics and serves as the official publication of both the British Endodontic Society and the European Society of Endodontology. It was originally published between 1967 and 1980 under the title Journal of the British Endodontic Society and was relaunched as IEJ in 1980. In 2024, its impact factor was 7.1, ranking 3rd among all dentistry journals. AEJ is the official journal of the Australian Society of Endodontology and has been indexed in the SCI-Expanded since 1998. It is published three times per year. The journal's 2024 impact factor is 1.5, placing it 105th among dentistry journals.

The aim of this study was to examine scholarly communication patterns in high-impact endodontic journals by conducting a bibliometric analysis of Türkiye-affiliated publications in the Journal of Endodontics, International Endodontic Journal, and Australian Endodontic Journal. Accordingly, the null hypothesis assumes no statistically significant differences among these journals in terms of citation performance.

Materials and Methods

Data source and search strategy

All publications from the three journals were retrieved from the WoS database, specifically from sources indexed within the SCI-Expanded.

An electronic search was conducted in the WoS database in January 2024. The search strategy was defined using the criteria "Journal Name" and "Address," and publications affiliated with Türkiye were filtered accordingly. All articles published from the year of the first Türkiye-originated publication in each journal (JOE, 1983; IEJ, 1985; AEJ, 2008) up to 2024 were included. No time restrictions were applied.

Inclusion and exclusion criteria

Only original research articles, case series, case reports, and review articles published with a Turkish affiliation were included in the study. Editorial materials, letters to the editor, corrections, and proceeding papers were excluded (Fig. 1). Accordingly, a total of 753 articles were included in the analysis: 398 from JOE, 233 from IEJ, and 122 from AEJ.

Data extraction

The following information was obtained and evaluated from the included articles: Type of article, research topic,

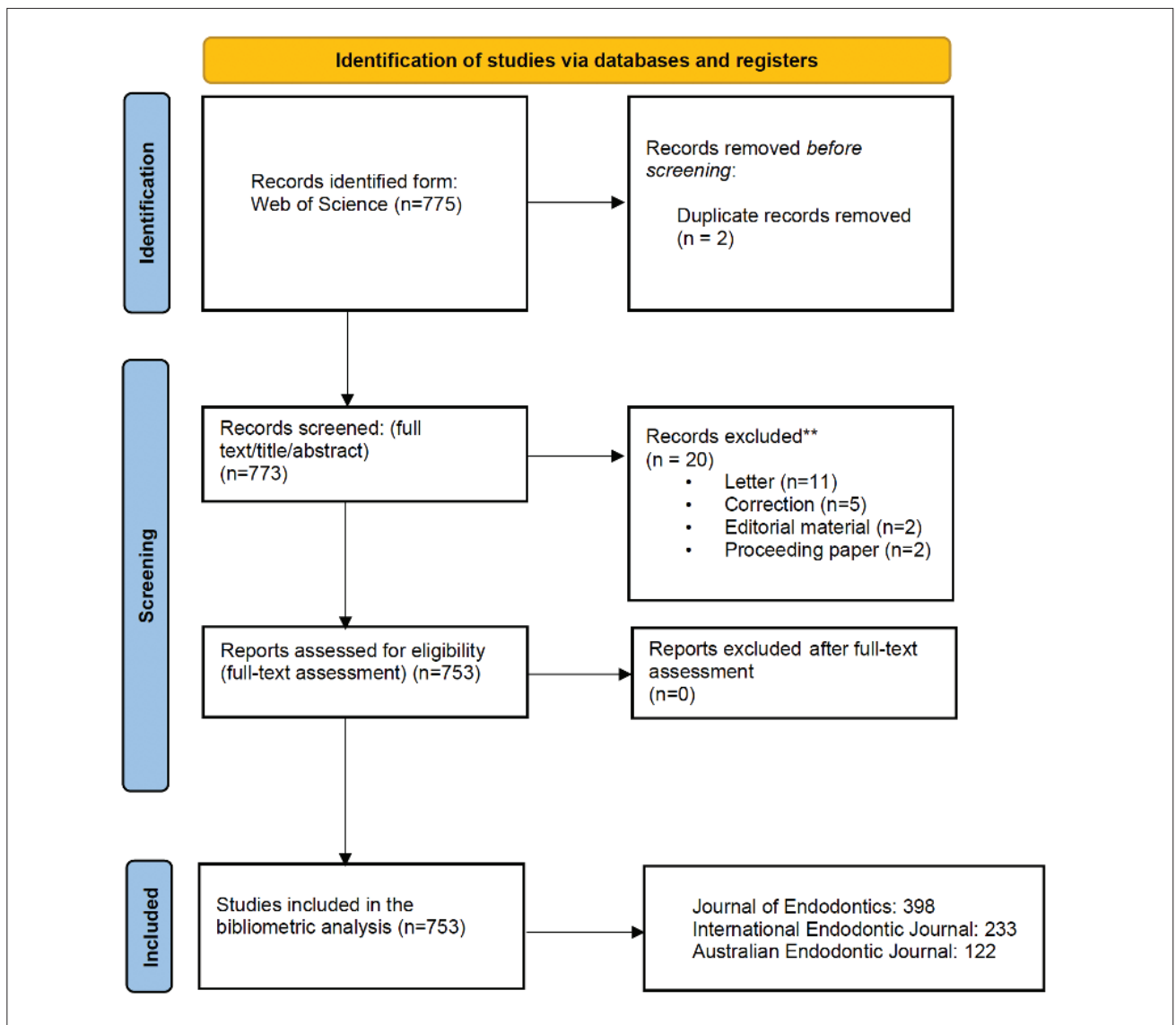


Fig. 1. Flow diagram of literature search and selection criteria (adapted from the PRISMA 2020 flowchart).

number of citations, number of authors, affiliated institution, presence of multidisciplinary collaboration, presence of national or international, cooperation, keywords.

The publications were classified into five main categories: Clinical studies, laboratory studies, animal studies, case reports/series, and review/systematic review–meta-analysis articles. The research topics were determined based on the abstracts and keywords of each study. Institutional and multidisciplinary characteristics were categorized according to the authors' affiliations and research fields. For the collaboration analysis, national and international cooperation was identified based on the institutional affiliations of all authors.

Data analysis

Publications retrieved from the WoS database were exported in BibTeX format and imported into the analysis system. Bibliometric analyses were conducted using the Bibliometrix package and the Biblioshiny interface, both compatible with the R programming language and known for their advanced visualization capabilities. All analyses were performed using RStudio Version 4.4.2.

In addition to the software-based analysis, all articles were manually reviewed to extract supplementary information not captured by the program. In addition to the bibliometric data obtained through the Bibliometrix software, all articles were manually reviewed to evaluate variables

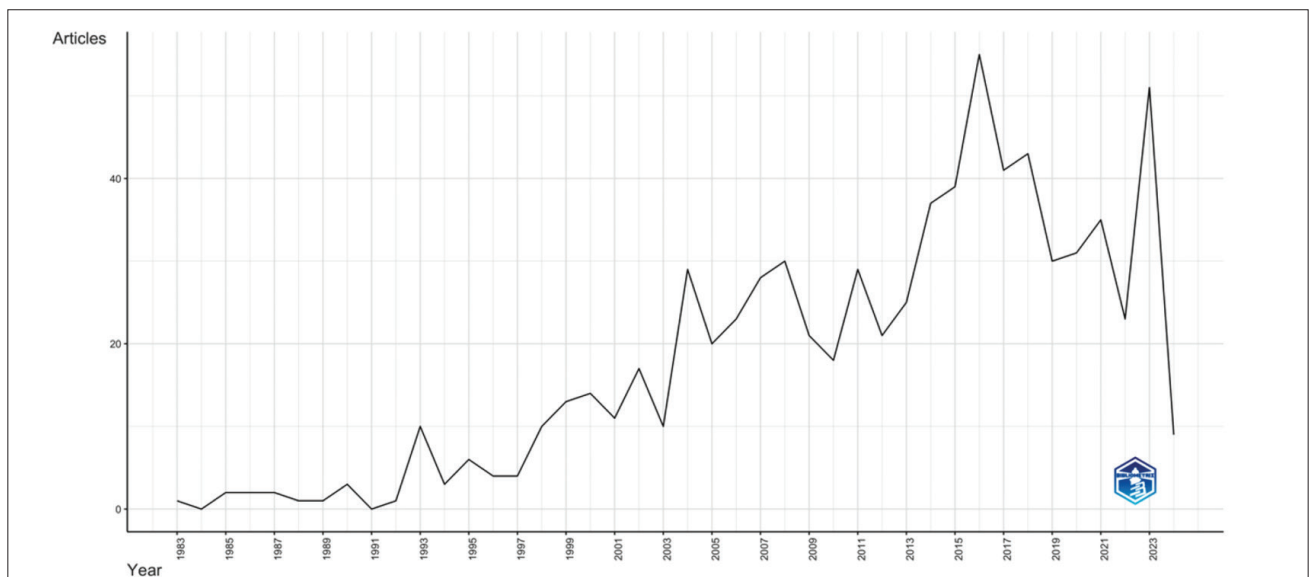


Fig. 2. Annual distribution of Türkiye-affiliated publications in JOE, IEJ and AEJ (JOE: Journal of Endodontics, IEJ: International Endodontic Journal, AEJ: Australian Endodontic Journal)

that could not be directly extracted by the program. In this context, the research topics of the articles, publication types (e.g., original research articles, reviews, etc.), study typologies (e.g., clinical studies, laboratory studies, animal studies, etc.), number of authors, and characteristics of multidisciplinary collaboration as well as national and international collaboration were determined manually. Research topics were classified based on the titles, abstracts, and keywords of the articles. Publication type and study typology were assessed according to their methodological content. Multidisciplinary collaboration was determined by examining the institutional affiliations and areas of expertise of the authors, whereas the presence of national or international collaboration was identified based on the countries of the authors' institutions. This manual evaluation process aimed to systematically obtain data that could not be automatically generated by the Bibliometrix software and thereby enhanced the comprehensiveness of the study.

Statistical analyses were carried out using SPSS Version 22 (IBM SPSS Statistics, Armonk, NY, USA). The normality of data distribution was tested using the Kolmogorov-Smirnov test. Descriptive statistics were expressed as median (minimum–maximum) values. The Kruskal–Wallis test, Mann–Whitney U test, and Bonferroni correction were applied for group comparisons. A p-value of <0.05 was considered statistically significant.

Results

The annual distribution of the included articles is presented in Figure 2. It was observed that the number of

publications has steadily increased since 2004, reaching its peak in 2016 with a total of 56 articles.

Among the 753 articles included in the study, the most frequently investigated topics were root canal preparation (n=134) and irrigation–disinfection (n=131). A total of 378 studies did not involve a multidisciplinary approach, while 375 studies incorporated a multidisciplinary design. Most studies (408) were conducted without institutional or country-level collaboration. These were followed by national collaborations (217 studies), international collaborations (98 studies), and combined national–international collaborations (30 studies).

Regarding authorship, the number of authors per article

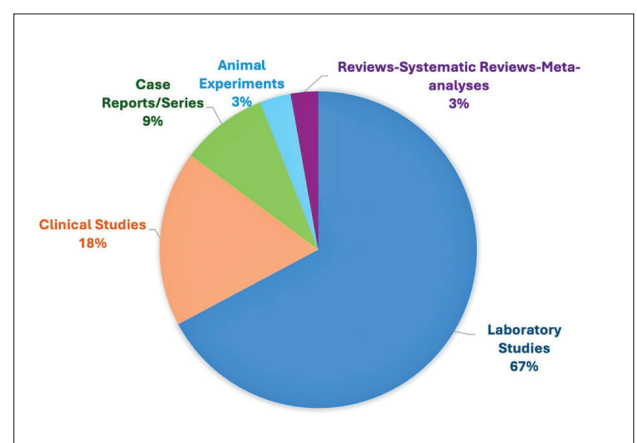


Fig. 3. Research typology of Türkiye-affiliated publications .

Table 1. Authors, publication year, citation counts, article titles, and journals of the 50 most cited articles

Authors	Years	Total Citations	Article Titles	Journal
Sert S & Bayırlı GS	2004	357	Evaluation of the root canal configurations of the mandibular and maxillary permanent teeth by gender in the Turkish population	JOE
Calt S & Serper A	2002	300	Time-dependent effects of EDTA on dentin structures	JOE
Caliskan MK et al.	1995	222	Root-canal morphology of human permanent teeth in a turkish population	JOE
Sen BH et al.	1995	185	The smear layer - a phenomenon in root-canal therapy	IEJ
Orhan K et al.	2020	179	Evaluation of artificial intelligence for detecting periapical pathosis on cone-beam computed tomography scans	IEJ
Eskitascioglu G et al.	2002	158	Evaluation of two post core systems using two different methods (frac-ture strength test and a finite elemental stress analysis)	JOE
Cehreli ZC et al.	2011	143	Regenerative endodontic treatment (revascularization) of immature necrotic molars medicated with calcium hydroxide: a case series	JOE
Capar ID et al.	2014	141	Comparative study of different novel nickel-titanium rotary systems for root canal preparation in severely curved root canals	JOE
Nagas E et al.	2012	139	Dentin moisture conditions affect the adhesion of root canal sealers	JOE
Tanalp J & Gungor T	2014	139	Apical extrusion of debris: a literature review of an inherent occurrence during root canal treatment	IEJ
Segura-Egea JJ et al.	2018	129	European Society of Endodontology position statement: the use of anti-biotics in endodontics	IEJ
Yoldas O et al.	2012	129	Dentinal microcrack formation during root canal preparations by different NiTi rotary instruments and the Self-Adjusting File	JOE
Bezgin T et al.	2015	127	Efficacy of platelet-rich plasma as a scaffold in regenerative endodontic treatment	JOE
Guneser MB et al.	2013	125	Effect of various endodontic irrigants on the push-out bond strength of bi dentine and conventional root perforation repair materials	JOE
Ercan ER et al.	2004	125	Antibacterial activity of 2% chlorhexidine gluconate and 5.25% sodium hypochlorite in infected root canal: In vivo study	JOE
Erdemir A et al.	2004	125	Effect of medications for root canal treatment on bonding to root canal dentin	JOE
Tinaz AC et al.	2005	121	The effect of disruption of apical constriction on periapical extrusion	JOE
Yaltirik M et al.	2004	119	Reactions of connective tissue to mineral trioxide aggregate and amalgam	JOE
Dogan H & Calt S	2001	119	Effects of chelating agents and sodium hypochlorite on mineral content of root dentin	JOE
Segura-Egea JJ et al.	2017	118	Antibiotics in Endodontics: a review	IEJ
Ari H et al.	2003	118	Effects of NaOCl on bond strengths of resin cements to root canal dentin	JOE
Ulusoy AT et al.	2019	115	Evaluation of blood clot, platelet-rich plasma, platelet-rich fibrin, and platelet pellet as scaffolds in regenerative endodontic treatment: a pro-spective randomized trial	JOE
Oncag O et al.	2003	114	Comparison of antibacterial and toxic effects of various root canal irri-gants	IEJ
Calt S & Serper A	1999	110	Dentinal tubule penetration of root canal sealers after root canal dressing with calcium hydroxide	JOE
Sert S et al.	2004	109	Investigation of the root canal configurations of mandibular permanent teeth in the Turkish population	IEJ
Eldeniz AU et al.	2007	107	Cytotoxicity of new resin-, calcium hydroxide- and silicone-based root canal sealers on fibroblasts derived from human gingiva and L929 cell lines	IEJ
Kocak S et al.	2013	104	Apical extrusion of debris using Self-Adjusting File, Reciprocating Single-file, and 2 rotary instrumentation systems	JOE
Ari H et al.	2004	104	Evaluation of the effect of endodontic irrigation solutions on the micro-hardness and the roughness of root canal dentin	JOE
Ozer SY	2011	99	Detection of vertical root fractures by using cone beam computed tomography with variable voxel sizes in an in vitro model	JOE
Azim AA et al.	2016	97	Efficacy of 4 irrigation protocols in killing bacteria colonized in dentinal tubules examined by a novel confocal laser scanning microscope analysis	JOE
Hakkı SS et al.	2009	97	Effects of Mineral Trioxide Aggregate on cell survival, gene expression	JOE

			associated with mineralized tissues, and biomineralization of cemento-blasts	
Sonmez D et al.	2008	97	A comparison of four pulpotomy techniques in primary molars: A long-term follow-up	JOE
Keskin C et al.	2017	96	Cyclic fatigue resistance of Reciproc Blue, Reciproc, and WaveOne Gold reciprocating instruments	JOE
Ungor M et al.	2006	92	Push-out bond strengths: the Epiphany-Resilon endodontic obturation system compared with different pairings of Epiphany, Resilon, AH Plus and gutta-percha	IEJ
Gorduysus M et al.	2001	92	Operating microscope improves negotiation of second mesiobuccal canals in maxillary molars	JOE
Tuna D & Olmez A	2008	90	Clinical long-term evaluation of MTA as a direct pulp capping material in primary teeth	IEJ
Keles A et al.	2014	88	Micro-CT evaluation of root filling quality in oval-shaped canals	IEJ
Kayahan MB et al.	2009	87	Effect of acid-etching procedure on selected physical properties of mineral trioxide aggregate	IEJ
Kayaoglu G et al.	2005	87	Short-term antibacterial activity of root canal sealers to-wards Enterococcus faecalis	IEJ
Oksan T et al.	1993	87	The penetration of root-canal sealers into dentinal tubules - a scanning electron-microscopic study	IEJ
Eldeniz AU et al.	2006	83	Antibacterial effect of selected root-end filling materials	JOE
Belli S et al.	2006	83	Reinforcement effect of polyethylene fibre in root-filled teeth: comparison of two restoration techniques	IEJ
Belli S et al.	2005	83	The effect of fibre insertion on fracture resistance of root filled molar teeth with MOD preparations restored with composite	IEJ
Kartal N et al.	1998	82	Root canal morphology of maxillary premolars	JOE
Gundogar M & Ozyurek T	2017	81	Cyclic fatigue resistance of OneShape, HyFlex EDM, WaveOne Gold, and Reciproc Blue nickel-titanium instruments	JOE
Sagsen B et al.	2011	81	Push-out bond strength of two new calcium silicate-based endodontic sealers to root canal dentine	IEJ
Ozer SY	2010	80	Detection of vertical root fractures of different thicknesses in endodontically enlarged teeth by cone beam computed tomography versus digital radiography	JOE
Tasdemir T et al.	2008	80	Efficacy of three rotary NiTi instruments in removing gutta-percha from root canals	IEJ
Calt S & Serper A	2000	79	Smear layer removal by EGTA	JOE
Ozyurek T et al.	2018	78	The effects of endodontic access cavity preparation design on the fracture strength of endodontically treated teeth: traditional versus conservative preparation	JOE

JOE: Journal of Endodontics, IEJ: International Endodontic Journal, AEJ: Australian Endodontic Journal.

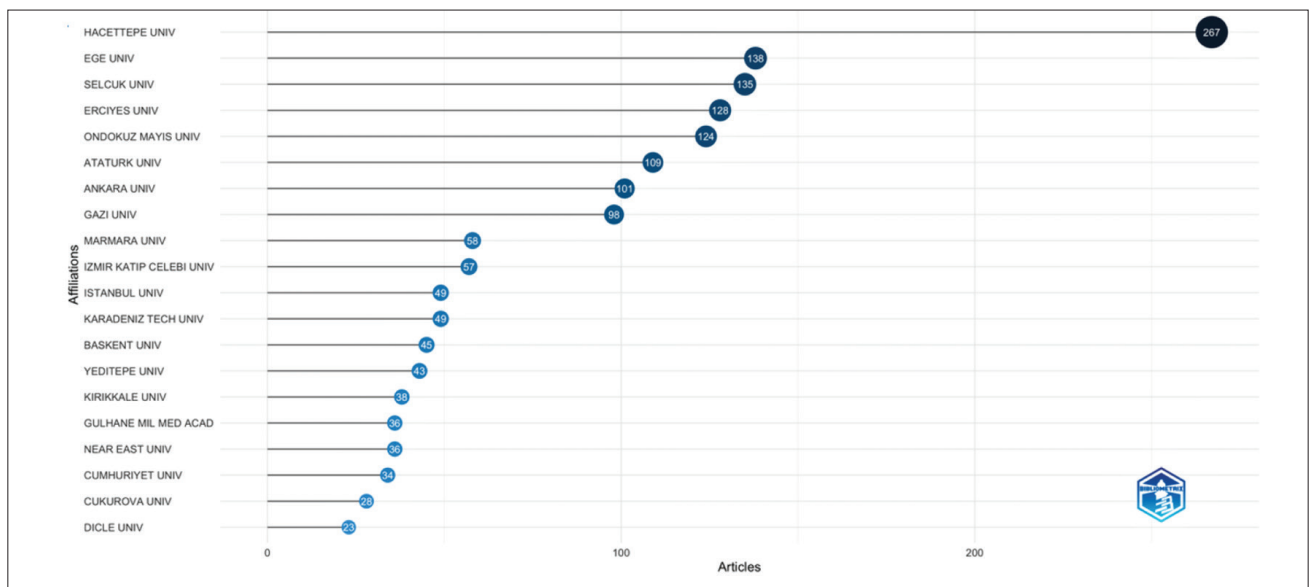


Fig. 4. Publication performance of the top 20 academic institutions producing the highest number of scientific articles.

ranged from 1 to 19, with a median of 4 authors. The majority of studies (506) were laboratory-based. In addition, 135 were clinical studies, 67 were case reports/series, 24 were animal studies, and 21 were systematic reviews or meta-analyses (Fig. 3).

The median number of citations for the 753 articles was 21, with a range of 0–357. Statistical analyses showed a significant difference in how often papers were cited between IEJ and AEJ ($P<0.001$) and between JOE and AEJ ($P<0.001$), but no statistically significant difference was seen between IEJ and JOE ($P>0.05$). Among the most cited publications, the study by Semih Sert and Gündüz S. Bayırlı, published in JOE in 2004, received the highest number of citations with 357 (13). This was followed by the research of Semra Calt and Ahmet Serper, published in the same journal in 2002, which received 300 citations (14). Additionally, the studies by Çalışkan et al. (15), published in JOE in 1995, and Sen et al. (16), published in IEJ in 1995, received 222 and 185 citations, respectively. The full citation details of the 50 most cited articles are presented in Table 1.

The distribution of the reviewed articles by institutions or universities is presented in Figure 4. In the graph, universities are shown on the vertical axis, while the num-

ber of published articles is displayed on the horizontal axis. According to these data, Hacettepe University ranks first with 267 articles, followed by Ege University (138), Selçuk University (135), Erciyes University (128), and Ondokuz Mayıs University (124).

The structural analysis and relationship patterns of inter-institutional academic collaborations are visualized in Figure 5. In the network map, the size of the nodes is proportional to the intensity of collaboration for each institution. The analysis revealed that Hacettepe University occupies a central position in the network with the highest number of collaborative connections. Additionally, a strong collaborative triangle was observed among İzmir Kâtip Çelebi University, Atatürk University, and Erciyes University.

The frequency of keyword usage and their interrelationships are shown in Figures 6 and 7. The most frequently used keyword was endodontics ($n=56$), followed by retreatment ($n=41$), calcium hydroxide ($n=38$), root canal ($n=31$), mineral trioxide aggregate ($n=27$), and fracture resistance ($n=25$).

As shown in Figure 8, core terms such as endodontics, retreatment, root canal, calcium hydroxide, and mineral trioxide aggregate have been used frequently and consistently over the years. The term smear layer has been used

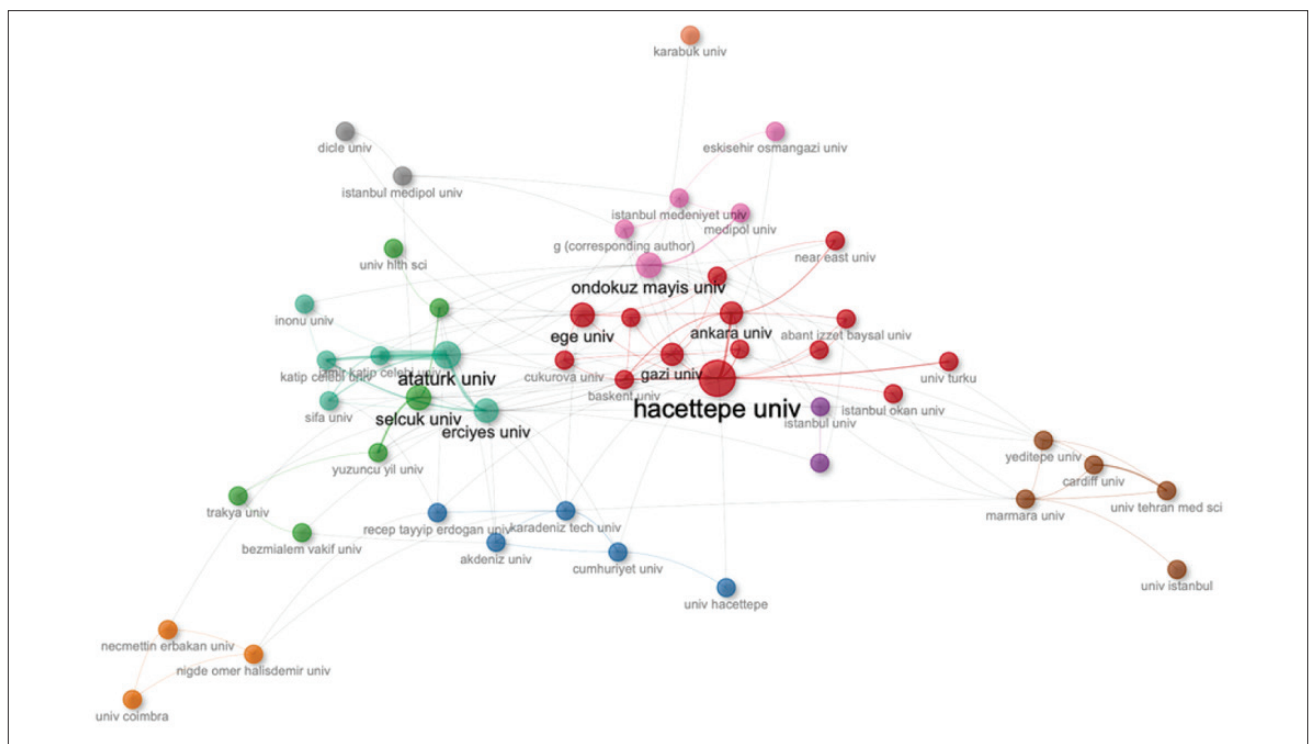


Fig. 5. Inter-institutional collaboration network among universities.

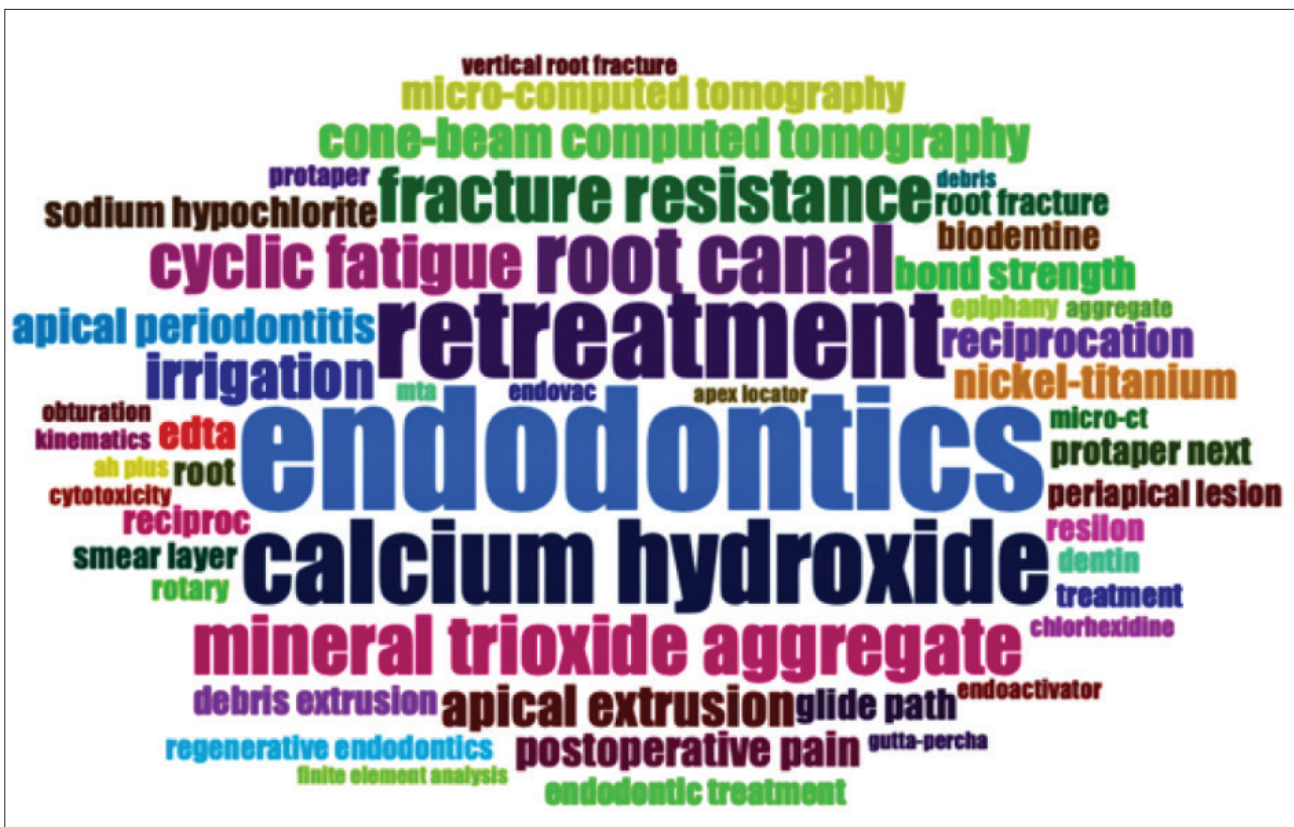


Fig. 6. Most frequently used keywords.

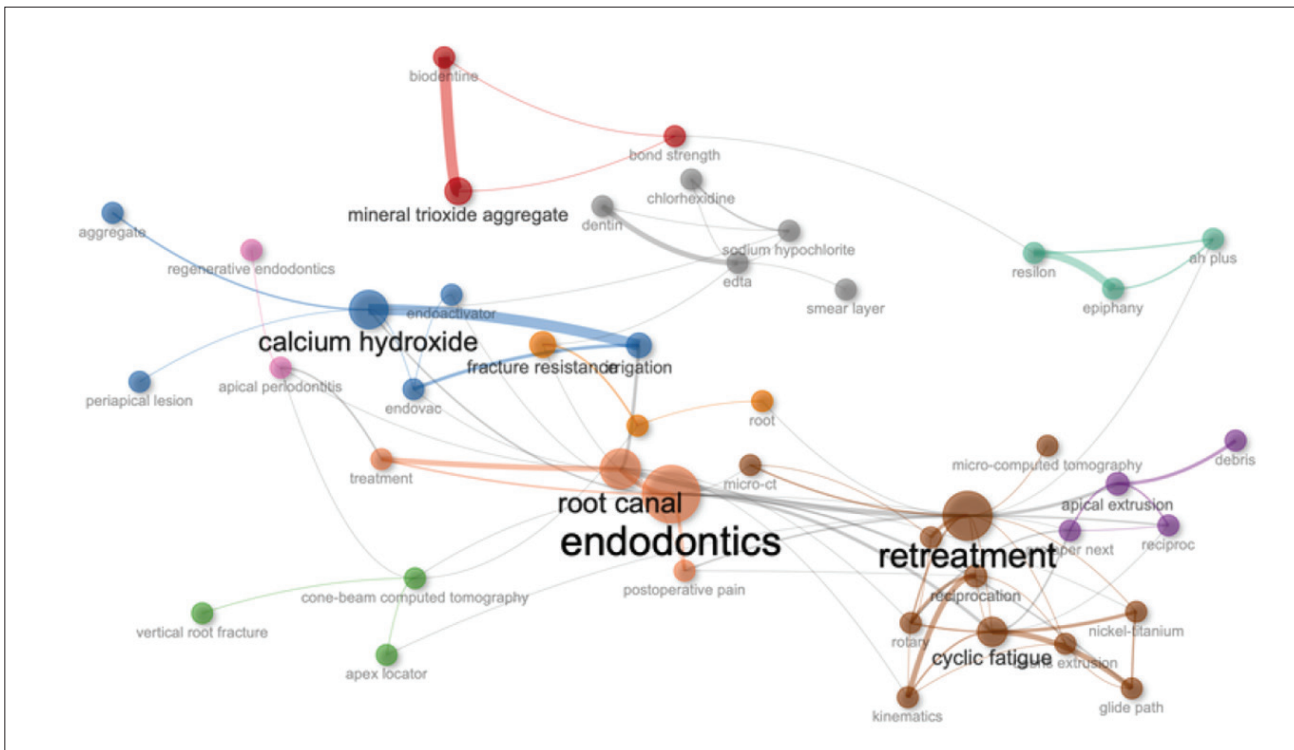


Fig. 7. Network map of the most frequently used keywords.

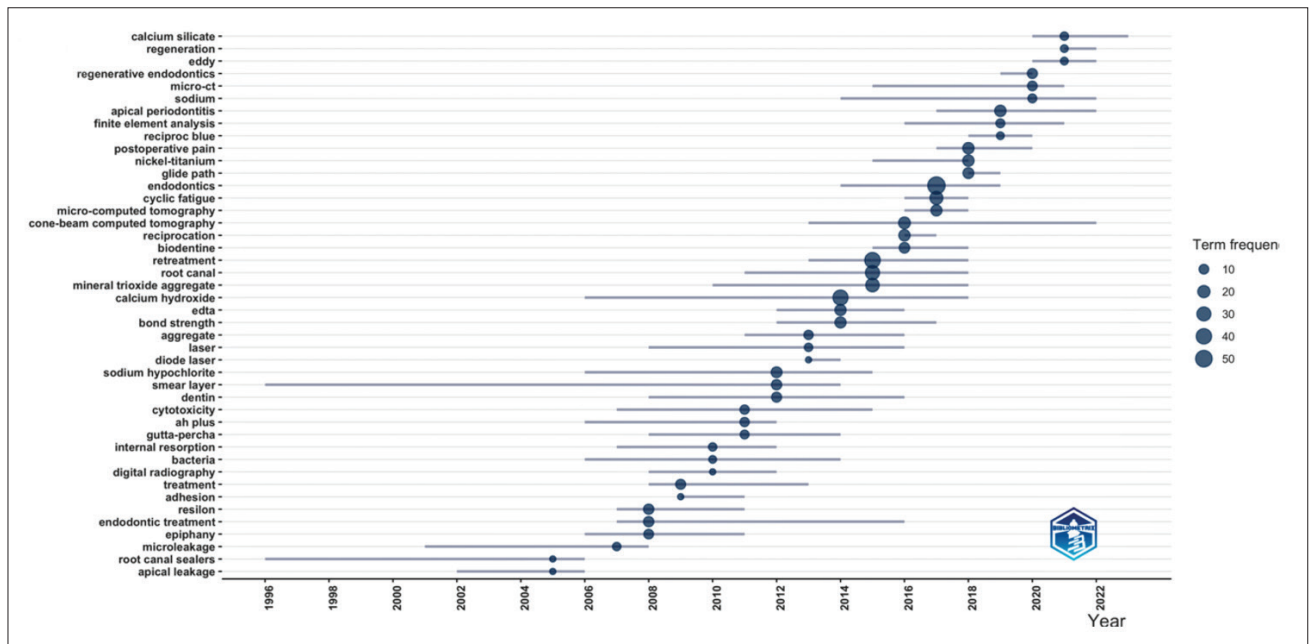


Fig. 8. Trend topics in publications, their annual distribution, and frequency of use.

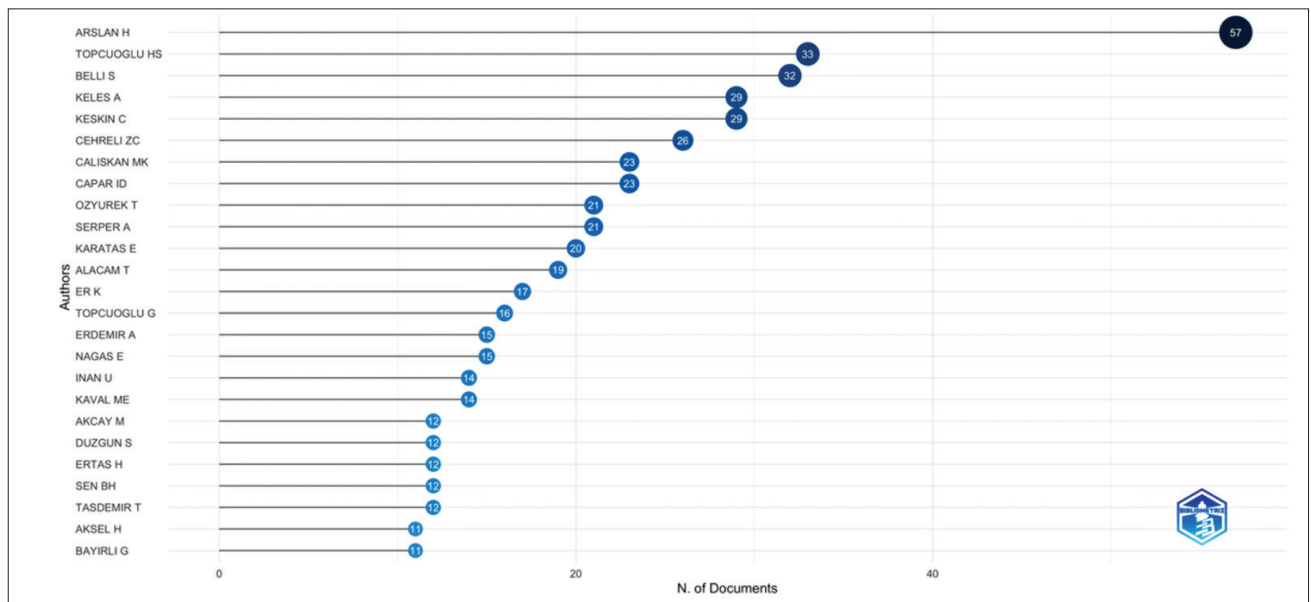


Fig. 9. Ranking of the 25 most productive authors.

in academic literature since the late 1990s, and it was used more in the 2000s. However, no significant increase was observed in recent years (2015 onward). Terms such as regeneration, calcium silicate, EDDY, micro-CT, and finite element analysis have been increasingly used, particularly after 2015.

Among the researchers included in this study, the most

prolific author was Hakan Arslan, with 57 publications. Other authors contributing a significant number of articles include Hüseyin Sinan Topcuoglu (33 articles), Sema Belli (32 articles), Ali Keles (29 articles) and Cangül Keskin (29 articles). Data on the total number of articles and h-index of the authors across the three journals are presented in Figures 9 and 10.

When examining the total citation counts of the authors, Hakan Arslan stands out as the most cited researcher with 1731 citations. He is followed by Sema Belli (1408), Ahmet Serper (1035), İsmail Davut Capar (959), and Taha Özyürek (835).

Figure 11 visualizes the scientific productivity and annual citation counts of authors over time. The size of the circles represents the number of articles published in a given year, while the color intensity indicates the number of citations

received that year. The graph covers a 41-year period from 1983 to 2024. The first Türkiye-affiliated publication was an in vitro study conducted by Tayfun Alacam and Tamer Yılmaz, published in 1983 in the JOE (17).^{*} As shown, overall academic output has generally increased since the early 2000s. Authors such as Hakan Arslan, Hüseyin Sinan Topcuoglu, Ali Keles, and İsmail Davut Capar demonstrated particularly high productivity in certain years. On the other hand, Tayfun Alacam and Mehmet Kemal

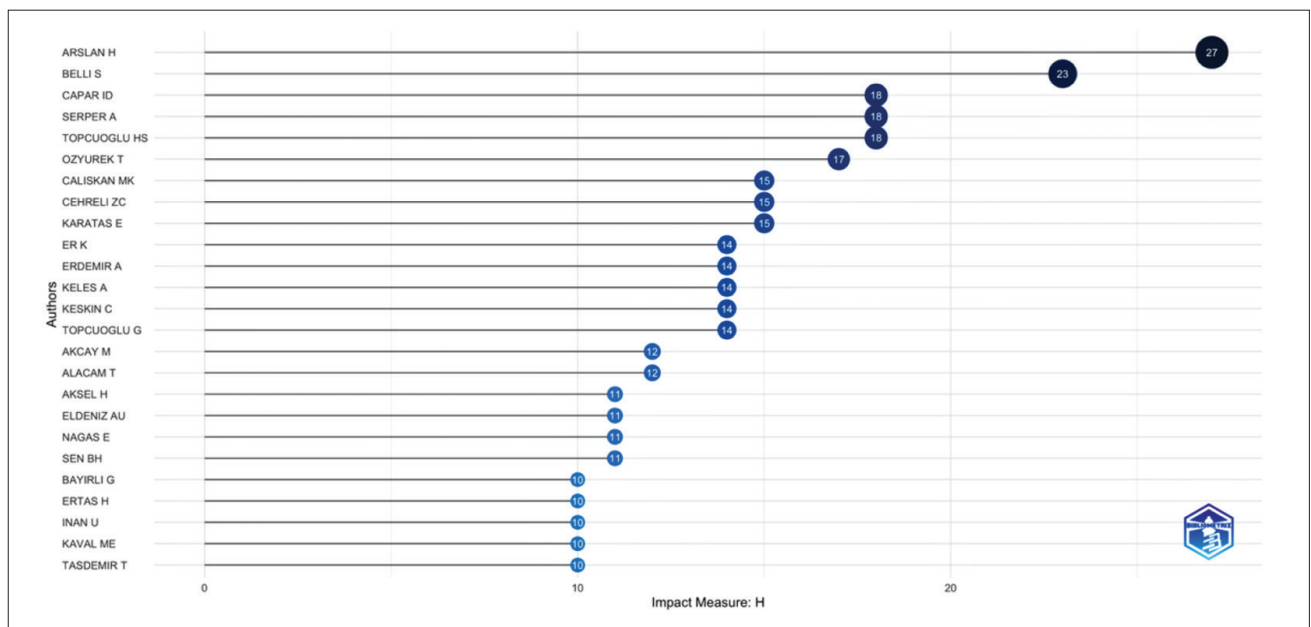


Fig. 10. Ranking of the top 25 authors based on h-index.

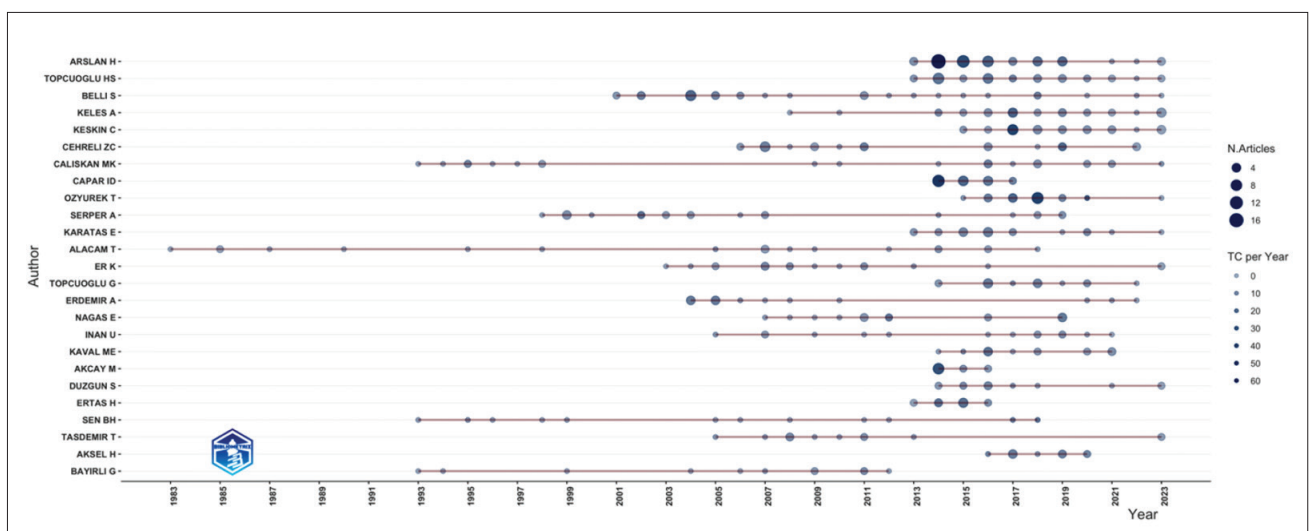


Fig. 11. Scientific productivity and citation counts of different authors over the years (N.: Number, TC: Total Citation).

Çalışkan maintained a more consistent publication output over a longer period. The 2015–2020 period appears as the most productive publishing phase for most authors.

The country most frequently collaborating on Türkiye-affiliated publications was the United States, with 57 articles. This was followed by the United Kingdom ($n=29$), Italy ($n=25$), and Iran ($n=18$). The collaboration network among countries is illustrated in Supplementary Figure S1.

Discussion

Bibliometrics is a valuable method that systematically analyzes scientific knowledge in a specific field, providing an overview of the topic, identifying knowledge gaps, and contributing to the development of new research ideas. It evaluates scientific impact by examining publication and citation data using statistical and mathematical methods (1). Commonly used metrics include citation analysis, h-index, impact factor, publication count, and co-authorship networks (1).

WoS database was selected for this study due to its widespread international recognition, comprehensive dataset, frequent use in academic promotions, and high compatibility with various bibliometric analysis software (6). In this context, Bibliometrix, which provides extensive analysis and visualization capabilities, was employed as the primary tool for data analysis (18).

JOE, IEJ, and AEJ are three highly regarded endodontic journals with strong impact factors. By publishing research from different regions, these journals contribute to a better understanding of the global profile of scientific production (11).

Among Türkiye-affiliated publications, JOE had the highest number of articles and h-index, while IEJ achieved the second-highest h-index. Since a high publication count alone is not sufficient to increase the h-index, additional bibliometric metrics such as average citation count should also be considered. Overall, JOE leads in terms of Türkiye-based publications, whereas IEJ provides broader international visibility and impact due to its higher global influence. The 2024 Journal Citation Reports (12) indicate that both IEJ and JOE are high-impact journals in dentistry, and research articles published in these journals hold significant scientific visibility and relevance (19).

The lower h-index of AEJ indicates that its publications receive fewer citations compared to the other journals. Although AEJ has shown growth, its scientific impact has not yet reached the desired level. Considering that AEJ has been indexed in WoS only since 2008 and is published three times per year, this outcome is expected. However, if the upward trend continues, the h-index of this journal

may increase in future years.

Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology is a multidisciplinary journal covering oral surgery, medicine, pathology, radiology, and endodontics. However, after endodontics editor Lars S. W. Spångberg stepped down, publication of endodontic articles ceased in December 2011. Additionally, the publication of articles from other dental disciplines may complicate the identification of endodontic studies and limit detailed analyses. Therefore, this study focused exclusively on Türkiye-affiliated articles published in SCIE-indexed journals directly related to endodontics (JOE, IEJ, and AEJ), while the multidisciplinary journal was excluded (20). This represents one of the methodological limitations of the study.

The number of citations an article receives is influenced by multiple factors, including the quality, methodology, and originality of the study, as well as the impact factor of the journal in which it is published. Additionally, the author's reputation and collaboration network contribute to citation levels. Studies with over 100 citations are generally considered “classic” in their respective fields (21). Among the 753 articles analyzed, only 28 received more than 100 citations, indicating a limited proportion of highly impactful publications and suggesting that academic influence in the field is concentrated around specific studies. This may reflect limitations in methodological rigor, originality, or international interest in some research, whereas highly cited papers represent reference-worthy studies that have shaped the development of the field (22).

Journal-based analysis showed that the majority of the most cited articles were published in JOE, followed by IEJ. Chronological analysis indicated that articles published after 2000 demonstrated higher annual citation metrics, whereas studies from the 1990s maintained high cumulative citation counts (23). These findings suggest that foundational research in endodontics continues to exert long-term influence and remains a reference in the current literature.

Examining the 41-year period from 1983 to 2024, a notable increase in Türkiye-affiliated publications has been observed, particularly from the early 2000s onward. This growth likely reflects increasing academic interest in endodontics and strengthened collaborations among researchers.

The fluctuations and partial decline observed in Türkiye-affiliated endodontic publications after 2016 may be explained by several factors. First, the substantial increase in the number of dental faculties established in Türkiye between 2010 and 2019 may have contributed to increased academic productivity through the recruitment of

an increasing number of academicians to newly founded institutions. In particular, the publication motivation of early-career academic staff driven by academic promotion requirements appears to have supported the increase in publication numbers during this period.

However, the decline in publication trends observed after 2019 is likely to have been significantly influenced by the COVID-19 pandemic. During the pandemic, the suspension of clinical studies, restrictions on patient admissions, disruptions in laboratory activities, and the increased educational and healthcare workload of academicians may have negatively affected scientific productivity. Particularly in clinically oriented research fields, interruptions in data collection processes may explain the temporary decrease in publication output.

In addition, the initially high academic productivity observed in newly established faculties may have reached a more stable level over time, potentially contributing to the slowdown in publication growth. Furthermore, changes in academic incentive systems, economic challenges, difficulties in accessing research funding, and increased administrative and clinical workloads may also be considered among the possible factors affecting publication performance.

Nevertheless, Figure 2 demonstrates a noticeable increase in publication numbers in 2023. This recovery may be associated with the reactivation of academic activities following the pandemic, the publication of previously delayed studies, and the restoration of research infrastructure. Moreover, the increase in international collaborations and the continuation of academic performance requirements may also have supported this upward trend.

Analysis of research topics showed that the most frequently studied areas were irrigation and disinfection, root canal preparation, root canal filling, and endodontic materials. This highlights the critical role of these processes in endodontic treatment and underscores areas that require continuous development. Overall, the proportion of multidisciplinary studies was balanced, indicating that endodontics interacts not only within their own discipline but also across other fields. Expanding multidisciplinary research in the future may support the development of novel treatment methods and materials (24).

Most Türkiye-affiliated studies published in JOE, IEJ, and AEJ involved approximately four authors, suggesting that academic productivity is typically driven by small to medium-sized teams. This may be due to the nature of the field, which often requires specialized expertise for experimental or clinical studies (25).

While most studies were conducted at individual or insti-

tutional levels, international collaborations were relatively limited. Increasing international collaboration could enhance the broader academic impact of research, leading to higher citation counts and greater scientific influence (26).

The choice of research methodology directly affects the reliability of scientific findings and the strength of evidence. In evidence-based medicine, different research designs have varying levels of evidential value, with methodologically robust approaches such as systematic reviews, cohort studies, and randomized clinical trials being recommended (27). In this analysis, most publications were original research articles, likely because these articles have a higher probability of being accepted by academic journals (28).

Institutional contributions to academic productivity showed that Hacettepe, Ege, Selçuk, Erciyes, and Ondokuz Mayıs Universities ranked highest. This indicates that certain universities possess greater research capacity in endodontics and their faculty are more productive. However, to achieve a more balanced distribution of scientific output, contributions from a wider range of institutions should be encouraged.

The diversity and number of keywords can increase a manuscript's visibility by reaching a broader academic audience, potentially enhancing its citation count (29). This indicates that researchers tend to focus on specific keywords, which helps shape the overall framework of the field and reflect current research trends. Indeed, the most frequently used keyword in Türkiye-affiliated publications was endodontics ($n=56$), reflecting its direct relevance to the general definition of the field (30,31). Other prominent keywords, such as retreatment ($n=41$) and calcium hydroxide ($n=38$), indicate a strong research focus on retreatment procedures in cases of endodontic failure and the biomedical agents used during these processes (32–34). Subtopics including root canal disinfection, regenerative endodontics, canal filling materials, and instrument systems also emerged, demonstrating that research in endodontics concentrates on specific, clinically relevant areas.

Bibliometric analysis identified Hakan Arslan as the most prolific researcher ($n=57$). Considering publication count as an important indicator of academic productivity, this finding highlights Hakan Arslan's significant contribution to the field. Other highly productive authors included Hüseyin Sinan Topcuoğlu ($n=33$), Sema Belli ($n=32$), Ali Keles ($n=29$) and Cangül Keskin ($n=29$), indicating that these researchers are among the most productive in endodontics. However, academic productivity should not be assessed solely by publication count; other bibliometric metrics such as citation numbers and h-index must also be considered (3). Hakan Arslan, with 1731 total citations

and an h-index of 27, stands out both in productivity and impact. These data suggest that academic productivity and influence in endodontics are concentrated around a select group of researchers.

Analyses revealed that Hakan Arslan has a strong collaboration network and occupies a central position within it. According to the literature, such academic collaborations play a critical role in improving acceptance rates, citation counts, and overall scientific impact (35–38). Hakan Arslan's central role also suggests influence in guiding research directions and setting thematic priorities. Researchers who occupy these coordinating positions typically contribute to scientific progress both through their own work and by leading collaborative groups (39). Meanwhile, researchers such as Gamze Topcuoglu, Ertugrul Karatas, and İsmail Davut Capar showed intensive collaboration within specific groups, indicating that certain author teams focus on specialized research topics and organize work to maximize productivity (36). This structure can promote specialization and enable in-depth studies in particular subfields. Analyzing collaborations also provides insights into how academic productivity is influenced, as connections among researchers facilitate information flow, foster new research ideas, and support the dissemination of scientific knowledge (37). Researchers with extensive networks may also be more open to interdisciplinary work and take leading roles in developing new technologies, methods, or materials (40,41).

In terms of international collaborations, the United States was the most frequent partner for Türkiye-affiliated publications. This likely reflects the fact that many Turkish researchers conduct academic work in the U.S., demonstrating a tendency to collaborate with internationally recognized and respected institutions. Collaboration with European countries and Iran was also notable, suggesting that Türkiye tends to collaborate more frequently with geographically and culturally proximate countries.

Limitations of the study

One of the limitations of the present study is that only Türkiye-affiliated articles published in SCIE-indexed journals directly related to endodontics (JOE, IEJ, and AEJ) were included, while multidisciplinary journals were excluded. Although this approach enabled the creation of a more homogeneous dataset and allowed for a focused evaluation of endodontic research productivity, collaboration patterns, and publication trends, it may also have resulted in the exclusion of potentially relevant endodontic studies published in multidisciplinary dental or medical journals. Because multidisciplinary journals contain publications from a broad range of specialties, accurately

identifying and classifying endodontic studies within such journals may be challenging and could reduce the specificity and reliability of field-focused bibliometric analyses. Therefore, the findings of the present study should be interpreted within the context of this methodological limitation.

Conclusion

The bibliometric analysis of Türkiye-affiliated publications in the three highest-impact endodontic journals provides a comprehensive overview of academic productivity and current research trends in Türkiye. These findings serve as a valuable reference for guiding future research efforts. Future studies should place greater emphasis on increasing randomized controlled clinical trials, systematic reviews, and meta-analyses to strengthen evidence-based endodontic practice. In addition, strengthening inter-university research networks and promoting multicenter collaborations are essential for enhancing scientific cooperation, while structured mentoring programs may support the development of early-career researchers. Expanding international collaborations, particularly while maintaining and developing partnerships with leading countries in the field, is also recommended. Emerging research areas such as digital endodontics, regenerative therapies, and biomaterials should be further prioritized to support technological advancement in the discipline. Furthermore, promoting open-access publishing and the dissemination of research findings through digital and social media platforms may enhance scientific visibility and impact. Finally, the establishment of targeted national funding programs dedicated to evidence-based clinical research in endodontics is encouraged to support high-quality scientific production.

* This study was derived from a postgraduate thesis. The thesis has not been previously published in any journal or other scientific publication.

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kiye. When copies of that issue reached the university libraries, Prof. Dr. Gündüz Bayırlı sent me a letter expressing how proud and happy they were. That was an incredibly exciting and motivating moment for me.” On this meaningful occasion, we would like to express our sincere gratitude to all endodontists who have contributed to the Turkish endodontic community’s esteemed position on the international stage. While commemorating with respect and gratitude the academics who are no longer with us, especially Prof. Dr. Gündüz Bayırlı, we also wish all Turkish endodontists many more years of success, scientific productivity, and continued contribution to the advancement of knowledge.

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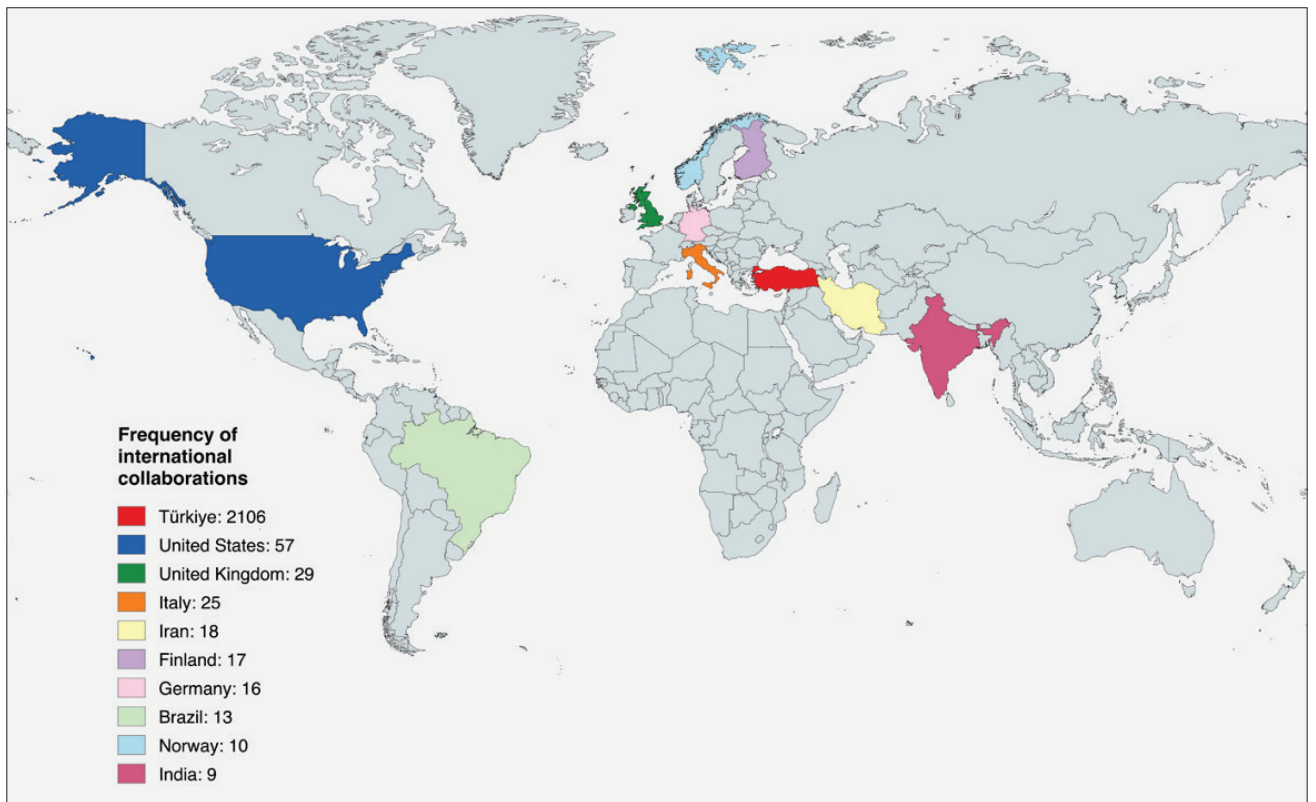
Ethical Approval: Not applicable – This study used publicly available bibliometric data only.

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Supplementary Fig. S1. Geographic distribution of the top 10 countries collaborating on publications.