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Bibliometric Analysis of Cone-Beam Computed Tomography Research in Endodontics: A Comparative Evaluation of Web of Science and TR Dizin

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Purpose: Bibliometric analyses are useful for evaluating scientific productivity. However, no study has been reported comparing international and national databases on cone-beam computed tomography (CBCT) in endodontics.

Methods: This study quantitatively analyzed CBCT related endodontic publications indexed in the Web of Science (WoS) and TR Dizin. Data covering 1999–2024 were collected in March 2025 using the keywords "root canal anatomy," "root canal form," "CBCT in endodontics," and "cone-beam computed tomography." Letters to the editor, case reports, and non-endodontic studies were excluded. The WoS dataset was examined for document type, indexing, journal productivity, annual trends, country rankings, and keyword networks, while TR Dizin was evaluated for subject classifications, publication trends, and institutional and city-level research distribution.

Results: A total of 710 CBCT-related publications were found in WoS and 61 in TR Dizin. In WoS, 648 were original articles and 421 were SCI-E indexed. Annual output rose steadily, reaching 45 publications in 2024; Türkiye contributed 9.7% of SCI-E papers. In TR Dizin, 44 publications were research articles, with peaks in 2021 and 2024. Ankara and İstanbul were the leading centers.

Conclusion: Findings show parallel research themes across databases, with Türkiye demonstrating strong and increasing contributions to global CBCT endodontic literature.

Keywords: Bibliometrics; cone-beam computed tomography; databases; bibliographic; endodontics.

Introduction

The morphology of roots and their canals is highly complex, making a thorough understanding of this anatomy essential for successful surgical and endodontic treatments (1).

Root canals rarely consist of a single canal and apical foramen; they often exhibit anatomical variations such as lateral canals, accessory canals, isthmuses, and apical deltas, which can complicate endodontic procedures (2). Studies have shown that root and canal morphology varies significantly across different populations, within the same population, and even among individuals (3).

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Conventional radiographic methods are often limited by image distortion and superimposition, leading to incomplete visualization of root canal systems. The introduction of cone beam computed tomography (CBCT) in dentistry in the early 2000s revolutionized diagnostic imaging by enabling volumetric assessment with minimal radiation exposure (4).

CBCT is an advanced imaging technique that provides highly detailed, three-dimensional visualization of root canal morphology. Unlike traditional two-dimensional radiographs, CBCT offers more accurate imaging across multiple planes, aiding in the planning and execution of endodontic treatments (5). CBCT has been widely applied across various dental fields, including endodontics, restorative dentistry, oral and maxillofacial surgery, periodontology, orthodontics, prosthodontics, and forensic dentistry (6). The evolution of three-dimensional (3D) imaging techniques has significantly improved decision-making in endodontic treatment planning.

Bibliometric evaluations not only reveal publication productivity and collaboration patterns but also identify research hotspots, influential authors, and thematic evolution over time. Such analyses help guide funding priorities and future investigations within a discipline (7,8).

Comparing national and international publication trends offers a broader understanding of how local research priorities align with global scientific progress. This perspective is particularly important for countries like Türkiye, where endodontic research has expanded notably in recent years. However, limited information exists regarding how Türkiye's CBCT related output compares with global patterns. Therefore, this study aims to provide a comprehensive bibliometric evaluation of CBCT research in endodontics by examining temporal trends, contributing countries, subject distributions, and keyword networks across both international and national databases.

Existing bibliometric studies have generally shown a growing global interest in CBCT, reflecting its expanding use in endodontics, oral surgery, and maxillofacial imaging. However, most of these analyses have relied primarily on international databases and have not specifically examined Türkiye's contribution within the scope of endodontic CBCT research. A recent Scopus-based global analysis reported that scientific output in this field is largely concentrated in countries such as Saudi Arabia, India, China, Brazil, Iran, and the United States, while Türkiye also appears among the contributing nations, with 13 publications and 333 citations, reflecting a visible yet comparatively modest presence in the global CBCT literature (3). Taken together, these findings highlight the value of evaluating national research patterns alongside global trends. By integrating data from both Web of Science (WoS) and TR Dizin, the present study addresses this need and provides a combined international and national perspective on CBCT related endodontic research

To our knowledge, this is the first study to conduct a comparative bibliometric assessment of CBCT related endodontic research using TR Dizin.

The hypothesis of this study was that Türkiye's publication trends would parallel global increases in CBCT related endodontic research, and that TR Dizin data would complement WoS findings by providing additional insight into national research productivity.

Materials and Methods

This bibliometric study included publications related to CBCT in endodontics retrieved from the WoS and TR Dizin databases. Searches were conducted in both Turkish and English without time restrictions using the following keywords: ("root canal anatomy" OR "root canal form") AND ("CBCT in endodontics" OR "cone-beam computed tomography"). All records up to 2024 were included, and data were collected in March 2025 and exported as CSV files. Data were collected in March 2025 from publications between 1999 and 2024. Broader search terms were applied to ensure comprehensive coverage. In the analyses conducted on the WoS database, the article language was selected as English.

WoS was selected because it is the most widely used and standardized international database for bibliometric analyses, while TR Dizin was included to represent national scientific output. General keywords were deliberately chosen to maintain consistency between the two databases, as highly specific clinical terms are not indexed uniformly across platforms and may introduce methodological inconsistencies or unintended expansion of the search scope.

Duplicates were identified and removed through DOI and title matching using Microsoft Excel filtering. Letters to the editor, case reports, review articles, and studies unrelated to endodontics were excluded.

Bibliometric network mapping was performed using VOSviewer version 1.6.20 (Center for Science and Technology Studies, Leiden University, The Netherlands; https://www.vosviewer.com/download). The co-occurrence of keywords was analyzed, and their interrelationships over time were visualized through word networks.

The datasets were examined to determine publication types, annual distributions, indexing categories, most productive journals, and contributing countries. For TR Dizin, subject classifications and journal distributions were also analyzed. Additionally, institutional affiliations, city-based productiv-

ity, contributing authors, and international collaborations were examined to provide a more comprehensive overview of national research output. Tables and figures were generated in Microsoft Excel 2021.

This study addressed the following research questions:

1) What is the distribution of CBCT related studies in endodontics?

2) How have CBCT studies in endodontics evolved over the years?

3) What is the country-wise distribution of studies indexed in SCI-E?

4) What is Türkiye's position in global CBCT research in endodontics?

5) What is the annual distribution of CBCT related publications?

6) What are the main subject areas covered in CBCT related endodontic research?

Each research question was linked to specific descriptive analyses and corresponding data presentations in the Results section. Research Questions 1, 2, and 5, which focus on the overall and annual distribution of CBCT related endodontic publications, are primarily addressed through frequency analyses presented in Tables 1–3 and Tables 4–5, as well as Figure 1. Research Questions 3 and 4, which relate to the country-wise distribution of SCI-E indexed studies and Türkiye's position in global CBCT research, are examined in Table 6 and Figure 2. Additional details for Türkiye are illustrated in Figures 3 and 4. Research Question 6, which concerns the main subject areas covered in CBCT related endodontic research, is evaluated using subject classifications and keyword mapping summarized in Table 7 and visualized in Figures 3–5. This structure clarifies how each research question is operationalized and reported in the manuscript.

Results

A total of 710 studies were identified in the WoS database. Among them: 648 Were original research articles, 56 were review articles, 6 were studies in progress, 1 were early access publications, 1 was a book chapter, 1 was a letter to the editor, 1 was a lead article (Table 1).

Of the 648 original research articles, 421 were indexed in WoS SCI-E. The index distribution of these studies is shown in Table 2, while their annual distribution according to WoS Index criteria is provided in Table 3. The top 10 journals publishing the highest number of studies are represented in a treemap chart (Fig. 1).

Distribution of Studies By Country

As shown in Table 6, the top five countries in CBCT related endodontic research collectively produced 240 publications.

The articles' use of "Turkey" and "Türkiye" was consolidated by combining them during the country selection process.

Table 1. Work distributions

Document Types	Count
Article	648
Review	56
Proceedings Paper	6
Early Access	1
Book Chapter	1
Editorial Material	1
Letter	1

Table 2. WoS index distributions

Web of Science Index	Count
WoS. SCI	421
WoS. ESCI	225
WoS. SSCI	8
WoS. ISTP	2
WoS. AHCI	1
WoS. BSCI	1

Table 3. Distribution of publications with SCI-E Criteria by years

Publication Years	Count
2024	45
2023	44
2022	43
2021	44
2020	40
2019	30
2018	20
2017	34
2016	22
2015	23
2014	16
2013	22
2012	9
2011	10
2010	10
2009	5
2008	1
2007	1
1999	1



Fig. 1. Treemap showing the top 10 journals publishing CBCTendodontic studies in the Web of Science database.

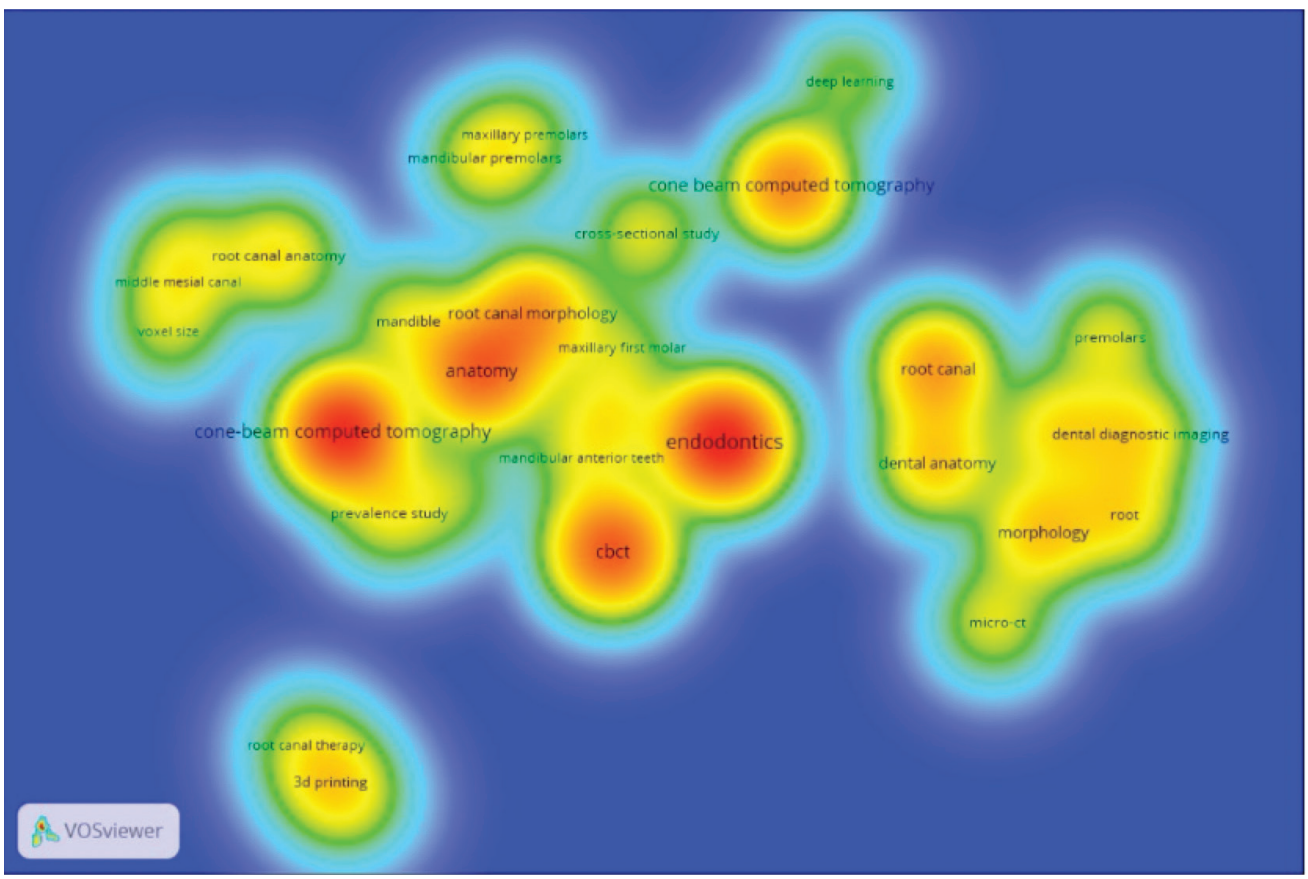


Fig. 2. Term map illustrating the keyword density of the five countries with the highest research output.

Table 4. Distribution of studies in TR DİZİN by years

Years	Count
2024	10
2023	5
2022	4
2021	10
2020	9
2019	4
2018	1
2017	1

Table 5. Distribution of studies published in TR DİZİN by journals

Journal Title	Count
European Endodontic Journal	17
Turkish Endodontic Journal	5
Current Research in Dental Science	3
Clinical and Experimental Health Science	3
Turkiye Klinikleri Journal of Dental Science	3
Clinical Dentistry and Research	2
Cumhuriyet Dental Journal	2
ADO Journal of Clinical Science	1
Bezmialem Science	1
Eastern Journal of Medicine	1
Journal of Health Science and Medicine	1
Online Turkish Journal of Health Sciences	1
Sabiad	1
Selçuk Dental Journal	1
Suleyman Demirel University Journal of Health Sciences	1

Table 6. Number of publications by countries

Country	Count
China	71
Brazil	70
United States of America	53
Türkiye	41
India	36

Table 7. Subject area distribution in TR Dizin

Subject Area	Count
Science > Dentistry > Dentistry	25
Science > Basic Sciences > Microscopy	11
Science > Engineering > Imaging Science & Photography	9
Science > Medicine > Anatomy & Morphology	5
Science > Basic Sciences > Optics	4

Among the 421 SCI-E indexed studies analyzed, the most cited article was the work by Patel et al. (9), which received 352 citations and emphasized the potential applications of cone-beam computed tomography in managing endodontic problems.

Among the top five most productive countries, the most cited publication was by Neelakantan et al. (10), which received 182 citations and compared root canal morphology using CBCT and various radiographic methods.

Keyword Analysis

Keyword co-occurrence analysis was performed for 240 studies from the five most productive countries using VOSviewer version 1.6.20 (Leiden University, The Netherlands). During the generation of the density map, the minimum occurrence threshold was set to two, meaning that only keywords appearing at least twice were included in the visualization. Among the 155 identified keywords, 31 met this criterion and were displayed in the network and density maps. This threshold ensured a balanced representation of frequently co-occurring terms while minimizing visual noise from single-instance keywords.

Türkiye's Contribution to CBCT Research

The overlay visualization of keywords in WoS-indexed CBCT endodontic publications originating from Türkiye illustrates a chronological shift in research focus (Fig. 3). Earlier studies (2013–2018, shown in blue tones) mainly concentrated on anatomical and morphological terms such as "root canal morphology", "canal configuration", and "CBCT accuracy".

In contrast, more recent publications (2020 onwards, indicated in yellow tones) emphasize clinically oriented and technological topics, including "guided endodontics", "three-dimensional imaging", and "root fracture detection".

The subject distribution of CBCT endodontic studies originating from Türkiye within the WoS database is presented in Figure 4.

TR Dizin Database Analysis

Filtering by publication year in the TR Dizin database is available only from 2017 onwards. A search conducted using the same English and Turkish keywords retrieved 61 studies, comprising 44 research articles, 9 case reports, and 8 review articles. The annual distribution of these studies is presented in Table 4, while their distribution across journals is provided in Table 5.

A comparison between WoS and TR Dizin demonstrated that CBCT related endodontic research in both data-

Table 8. Institutional Distribution in TR Dizin

Institution	Count
Foreign Institutions	18
Ankara University	4
Marmara University	3
Republic of Türkiye Ministry of Health	3
İstanbul Medipol University	3

Table 9. City distribution in TR Dizin

City	Count
Ankara	9
İstanbul	9
Aydın	2
Diyarbakır	2
Hatay	2

Table 10. Country Distribution (Collaboration)

Country	Count
Türkiye	17
Germany	1
USA	1
Austria	1
Others	1

Table 11. Author productivity in TR Dizin

Author	Count
Kaan Orhan	5
Ahmed A. Madfa	2
Elham Senan	2
Hatem Alhadainy	2
Gediz Geduk	2

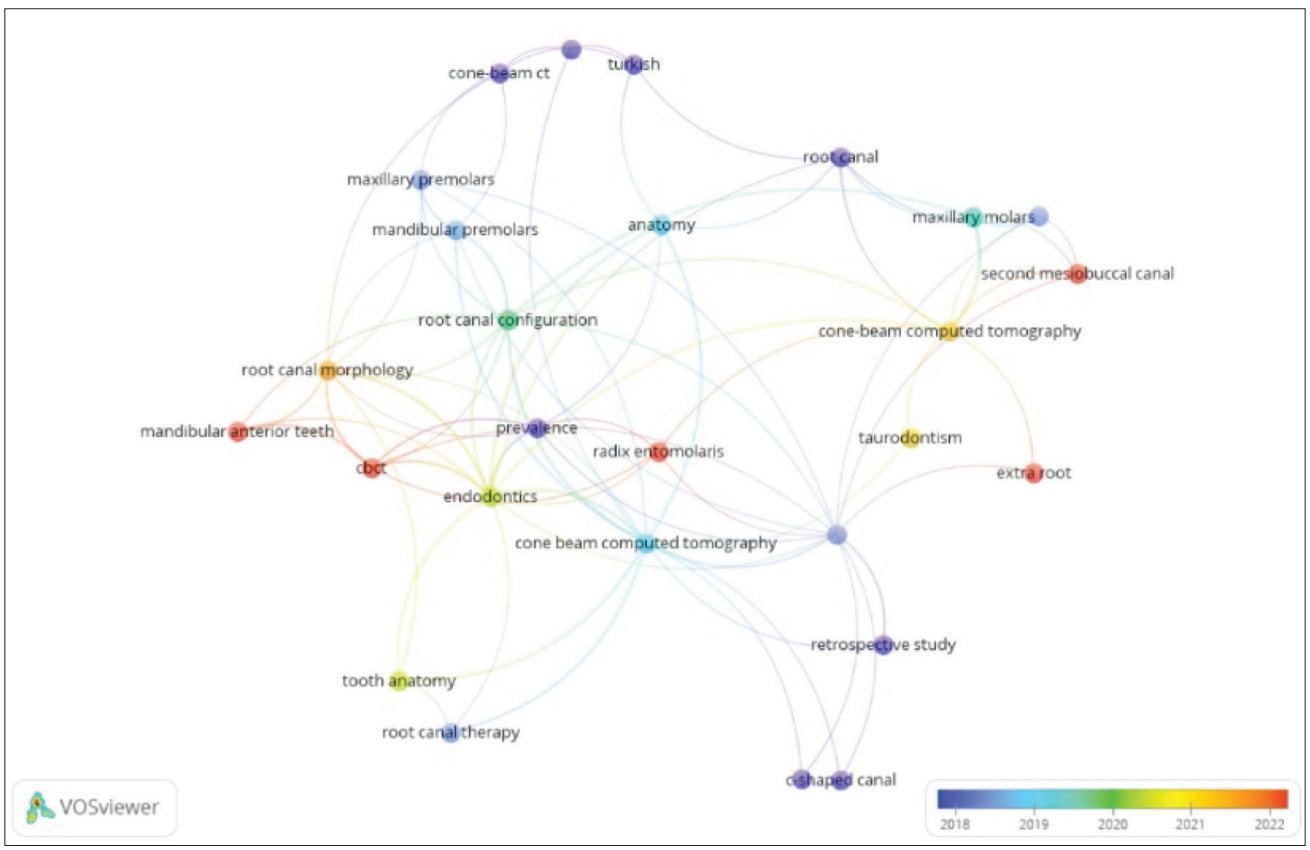


Fig. 3. Keyword network of publications in the WoS database of researchers in Türkiye.

bases covers similar thematic areas (Fig. 5). However, TR Dizin offers broader subject-area classifications rather than standardized article-specific keywords. Therefore, subject headings were used instead of keywords to ensure methodological accuracy and database compatibility.

Analysis of the TR Dizin dataset revealed clear institutional, regional, and authorship patterns. Table 8 presents the institutional distribution, showing that foreign insti-

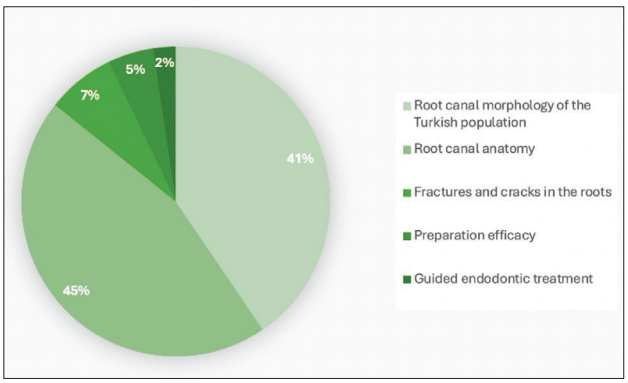


Fig. 4. Subject distribution of studies submitted from Türkiye in the WoS database.

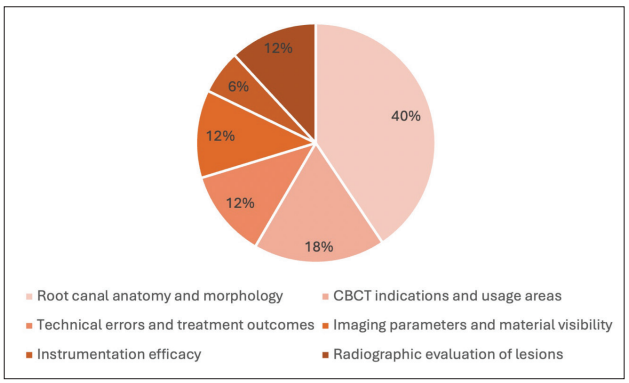


Fig. 5. Subject distribution of publications in TR DİZİN database.

tutions collectively formed the largest category, followed by major state universities and national academic centers. Table 9 outlines the city-level distribution, where Ankara and İstanbul emerged as the principal hubs of scientific output. Collaboration analysis (Table 10) showed that most publications originated from Türkiye, with limited but notable contributions from Germany, the United States, Austria and others.

Regarding authorship productivity (Table 11), Kaan Orhan was identified as the most prolific author in the TR Dizin dataset. Finally, subject-area frequencies (Table 7) confirmed that Dentistry was the dominant subject area, followed by Microscopy and Imaging Science, consistent with the thematic distribution observed in the WoS analysis.

Discussion

This bibliometric analysis aimed to identify research trends in CBCT use in endodontics within the WoS and TR Dizin databases, focusing on study distribution by year, leading countries, and prominent journals.

CBCT has proven to be a valuable diagnostic and treatment planning tool in endodontic practice. However, like all radiological methods, it has limitations, including potential artifacts and exposure to ionizing radiation. Therefore, understanding when CBCT can significantly impact diagnosis and treatment planning versus when it offers little to no additional benefit over conventional imaging is crucial (11).

The literature supports CBCT's role in complex endodontic cases, particularly in endodontic surgery, root canal anatomy assessment, apical periodontitis, vertical root fractures, root and alveolar fractures, and specific types of root resorption, where conventional radiographic techniques may be insufficient (12,13).

Various imaging modalities, including magnification devices, periapical radiographs, and CBCT, have been used to visualize root canal morphology. Among these, CBCT provides three-dimensional reconstructions, allowing for a more detailed evaluation of anatomical complexities (14,15).

Bibliometric analysis is widely used to uncover research trends in endodontics and various other dental specialties. In recent years, such analyses have gained increasing prominence, as they help identify emerging topics and highlight the evolving focus of each field (16-18).

The subject distribution of studies submitted from Türkiye in the WoS database shows that the research orientation is concentrated mainly on morphology and anatomical visualization. Over time, the use of CBCT in endodontics has evolved from visualizing root canal morphology to serving as an integral 3D imaging tool in treatment planning. This shift reflects the broader trend in endodontic research toward incorporating advanced imaging technologies for improved diagnostic accuracy, treatment precision, and clinical decision making (19-21).

The temporal keyword map shows a progressive shift in the research focus of CBCT endodontic studies originating from Türkiye. Earlier work primarily addressed anatomical variations and root canal morphology, whereas recent publications have shifted toward technology oriented applications such as guided endodontic procedures and digital treatment planning. This trend mirrors the global transformation in endodontic imaging research, suggesting that national research priorities are increasingly aligned with international developments.

When evaluated comparatively, the keywords identified in studies from Türkiye show a strong parallel with those of the five most productive countries. This similarity indicates that Türkiye's research trajectory aligns with global scientific trends.

Our analysis revealed that both WoS and TR Dizin datasets include a substantial number of studies focusing on root canal anatomy and morphological variations, consis-

tent with previous literature. The growing emphasis on technology-driven, application-oriented research demonstrates a transition from descriptive imaging studies toward advanced diagnostic and clinical applications.

The numerical results provide further insight into CBCT-related endodontic research activity. WoS data showed an upward trend, with annual publications rising from early single-digit outputs to 45 studies in 2024. TR Dizin displayed a similar concentration of publications between 2020 and 2024. Türkiye's share of 9.7% among SCI-E indexed publications reflects a measurable contribution to the global literature.

Several contextual factors may help explain Türkiye's contribution to the observed increase in CBCT related endodontic publications. Over the past decade, access to CBCT technology has expanded substantially across dental faculties and specialist clinics, facilitating a rise in imaging-based research. In parallel, the number of postgraduate programs and specialist training positions in endodontics has increased, creating a larger pool of researchers who incorporate CBCT into thesis projects and academic studies. Additionally, the strengthening of academic incentive systems, particularly those emphasizing publication in internationally indexed journals, has further encouraged researchers to conduct and publish CBCT focused investigations. Together, these developments may have contributed to the upward trend observed in both WoS and TR Dizin datasets.

Several contextual factors may help explain Türkiye's rising contributions. Increased access to CBCT technology, growth in postgraduate training programs, and academic incentives likely supported the upward trend in both datasets.

Future research may further incorporate citation network analyses, co-authorship mapping, and topic modeling to explore the intellectual and collaborative structures of CBCT endodontic research. Comparative evaluations of national and global trends could also provide deeper insight into Türkiye's growing academic contribution to this field.

In line with the study hypothesis, Türkiye's CBCT related publication trends generally mirror global patterns. Although the overall publication volume remains lower than that of leading countries, the thematic alignment indicates that national research follows international developments.

When WoS and TR Dizin are compared, complementary patterns emerge: WoS reflects global research visibility and standardized indexing, whereas TR Dizin provides granular national-level detail on institutions, regions, and subjects. Together, the databases offer a more comprehensive view of CBCT-related endodontic research.

In addition to quantitative differences, WoS and TR Dizin also exhibit important qualitative distinctions. WoS predominantly indexes internationally oriented journals that publish mainly in English and follow strict visibility and citation standards, as outlined in the Web of Science Journal Selection Criteria. In contrast, TR Dizin functions as a national indexing system designed to support locally produced scientific literature, and many journals within its scope publish primarily in Turkish according to its official evaluation guidelines. These structural differences shape the international dissemination and citation impact of publications, underscoring the importance of bridging national and global publication practices to enhance the visibility of locally produced research.

These findings also align with previous CBCT bibliometric analyses. The Scopus-based study by Karobari et al. (3) reported that global CBCT endodontic research is dominated by countries such as Saudi Arabia, India, China, Brazil, Iran, and the United States, with Türkiye contributing a moderate volume. In our study, Türkiye accounted for 9.7% of SCI-E indexed CBCT publications, consistent with previously reported global patterns.

Limitations

This study is limited to data obtained from the WoS and TR Dizin databases. Although these platforms provide standardized formats for international and national comparisons, publications indexed exclusively in other sources such as Scopus or PubMed were not captured. These databases were intentionally excluded to avoid inconsistencies stemming from differing indexing structures. Additionally, since academic output for 2025 was not yet complete at the time of data collection, only publications up to 2024 were evaluated, and citation counts reflect the retrieval period, which may change with future updates. Another methodological limitation is that TR Dizin does not provide standardized author keywords comparable to WoS; therefore, only general subject categories could be analyzed, limiting the granularity of keyword-based comparisons. Author affiliation data were used as reported in the database exports without manual verification, which may introduce minor inaccuracies in institutional attribution. Finally, duplicate records were removed using Excel-based filtering, and although careful checks were performed, a small risk of metadata-related error remains.

Conclusion

This bibliometric analysis offers a comprehensive overview of both global and national research trends concerning CBCT use in endodontics. The results demonstrate thematic overlap between international and national data-

bases and underscore Türkiye's increasing contribution to this field. These findings can inform future research priorities and facilitate further studies on endodontic imaging and CBCT applications.

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Informed consent: Since no participants were included in the study, participant consent is not required.

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