ORIGINAL RESEARCH ORİJİNAL ARAŞTIRMA

DOI: 10.5336/dentalsci.2025-111687

Artificial Intelligence's Footprint in Dentistry: A Two-Decade Global Bibliometric Analysis (2000-2025)

Yapay Zekânın Diş Hekimliğindeki Ayak İzi: Yirmi Yıllık Küresel Bibliyometrik Analiz (2000-2025)

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ABSTRACT Objective: This study presents a comprehensive bibliometric analysis of artificial intelligence (AI) applications in dentistry between 2000-2025, aiming to reveal global publication trends, thematic concentrations, and collaborative networks. **Material and Methods:** A systematic search was conducted in the Web of Science Core Collection using controlled vocabulary and Boolean operators. A total of 1,445 English-language articles were retrieved. Bibliometric indicators-such as publication growth, authorship patterns, citation impact, keyword clustering, and co-authorship networks-were analyzed using VOSviewer and RStudio. **Results:** AI-related publications in dentistry have shown a 14.07% annual growth rate, with a marked acceleration post-2019. Contributions originated from 92 countries and over 1,100 institutions, with the United States, China, and Türkiye leading in output. Citation impact was highest among authors from Germany and South Korea. Keyword co-occurrence analysis revealed 4 dominant clusters focused on diagnostic imaging, machine learning, radiology, and algorithm performance. High-impact publications centered around deep learning applications in caries detection and radiographic diagnosis. **Conclusion:** The findings underscore AI's transformative role in diagnostic and radiological practices in dentistry, with increasing international collaborations and institutional engagement. However, thematic scope remains concentrated, indicating the need for future research in underexplored areas such as prosthodontics, pediatric dentistry, and ethical dimensions of AI. This study provides an evidence-based roadmap for researchers, educators, and policymakers to guide strategic developments and equitable AI integration in dental science.

Keywords: Artificial intelligence; dentistry; bibliometrics; deep learning; diagnostic imaging

ÖZET Amaç: Bu çalışma, 2000-2025 yılları arasında diş hekimliğinde yapay zekâ (YZ) uygulamalarına yönelik kapsamlı bir bibliyometrik analiz sunmakta olup, küresel yayın eğilimlerini, tematik yoğunlaşmaları ve iş birliği ağlarını ortaya koymayı amaçlamaktadır. **Gereç ve Yöntemler:** Web of Science Core Collection veritabanında, kontrollü kelime dağarcığı ve Boole operatörleri kullanılarak sistematik bir tarama yapılmıştır. Toplamda 1.445 İngilizce dilinde makale elde edilmiştir. Yayın artış hızı, yazarlık eğilimleri, atıf etkisi, anahtar kelime kümelenmeleri ve ortak yazarlık ağları gibi bibliyometrik göstergeler VOSviewer ve RStudio yazılımlarıyla analiz edilmiştir. **Bulgular:** Diş hekimliğinde YZ ile ilgili yayınlar yıllık ortalama %14,07'lik bir artış göstermiş olup, 2019 sonrası belirgin bir ivmelenme gözlemlenmiştir. Yayınlar, 92 ülke ve 1.100'ün üzerinde kurumdan gelmiş; en fazla katkı ABD, Çin ve Türkiye kaynaklı olmuştur. En yüksek atıf etkisi ise Almanya ve Güney Kore'den, araştırmacılar tarafından üretilen çalışmalarda gözlenmiştir. Anahtar kelime eş-oluşum analizinde tanısal görüntüleme, makine öğrenimi, radyoloji ve algoritma performansı odaklı 4 baskın küme belirlenmiştir. En yüksek etki faktörlü yayınlar, çürük tespiti ve radyografik tanıda derin öğrenme uygulamalarına odaklanmıştır. **Sonuç:** Bulgular, YZ'nin diş hekimliğinde tanı ve radyolojik uygulamalardaki dönüştürücü rolünü vurgulamakta; uluslararası iş birliklerinin ve kurumsal katılımın giderek arttığını göstermektedir. Ancak tematik kapsamın hâlâ sınırlı olduğu ve özellikle protetik diş tedavisi, pedodonti ve YZ'nin etik boyutları gibi az incelenmiş alanlarda daha fazla araştırmaya ihtiyaç duyulduğu görülmektedir. Bu çalışma, araştırmacılar, eğitimciler ve politika yapıcılar için stratejik gelişmeleri yönlendirecek ve YZ'nin diş hekimliği biliminde adil entegrasyonunu sağlayacak kanıta dayalı bir yol haritası sunmaktadır.

Anahtar Kelimeler: Yapay zekâ; diş hekimliği; bibliyometrik; derin öğrenme; tanısal görüntüleme

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Peer review under responsibility of Turkiye Klinikleri Journal of Dental Sciences.

Received: 30 Apr 2025 ***Received in revised form:*** 18 Jun 2025 ***Accepted:*** 04 Jul 2025 ***Available online:*** 04 Sep 2025

Artificial intelligence (AI) is a multidisciplinary branch of computer science designed to replicate human cognitive functions such as learning, decision-making, and information processing.[1] Encompassing diverse subfields-such as machine learning, deep learning, natural language processing, and computer vision-AI has recently emerged as a transformative force in healthcare, including dental practice.[2]

In dentistry, AI technologies are being applied across various domains, including diagnostic imaging, treatment planning, prosthetic design, surgical interventions, and patient management.[3-13] For instance, AI has been utilized to detect dental caries, assess maxillary sinus conditions, diagnose periodontal and temporomandibular joint disorders, perform orthodontic and endodontic analyses, enhance prosthodontic workflows, and automate tooth detection and numbering for implant planning.[4-9,10-13] These applications are enabling more accurate diagnostics, improving clinical efficiency, reducing human-related diagnostic variability, and facilitating personalized treatment approaches, thereby enhancing patient care quality and satisfaction.[14]

Despite the accelerating integration of AI into dental practice, challenges such as diagnostic inconsistencies, clinician workload, and procedural inefficiencies persist in conventional dentistry. AI technologies hold promise to address these critical issues by minimizing human error, streamlining workflows, and optimizing treatment outcomes.

Bibliometric analysis is a powerful quantitative method that enables researchers to investigate the structure of scientific literature using indicators such as citation networks, co-authorship patterns, and keyword co-occurrence.[15] It provides valuable insights into research trends, highlights knowledge gaps, and helps forecast future directions.

AI applications have shown a remarkable increase in the dental literature in recent years.[16,17] However, the vast majority of existing bibliometric studies have focused solely on specific subfields such as orthodontics or restorative; thus, they fall short in comprehensively evaluating the integration of AI into dentistry from structural, thematic, and geographical perspectives.[18,19] In the literature, there is a notable scarcity of comprehensive bibliometric analyses that cover all branches, analyze global productivity and collaboration networks in a multifaceted manner, and examine thematic trends over an extended period.[16,17]

In addition to these shortcomings, given the rapid evolution of AI technologies today, it is of great importance that literature maps are updated periodically.[20] The development of new algorithms, the rapidly changing levels of integration into clinical practice, and the increasing diversity of ethical debates cause previous analyses to quickly become outdated.[17] Therefore, there is a need for analyses that not only reflect past knowledge but also reveal current research dynamics and trends.

In this context, the necessity emerges for a comprehensive study covering the years 2000-2025, encompassing all branches of dentistry-not limited to diagnostic applications-and utilizing advanced bibliometric techniques. The present study aims to fill this scientific gap; to evaluate the development of AI in dentistry through a holistic approach at thematic, geographical, and institutional levels; and to provide a strategic roadmap for researchers, educators, and policymakers.

MATERIAL AND METHODS

STUDY DESIGN AND ETHICAL CONSIDERATION

This bibliometric analysis was conducted in accordance with the principles outlined in the Leiden Manifesto. Since the study exclusively relied on publicly available scientific literature and did not involve human participants or sensitive data, no institutional ethics committee approval was required.

DATA SOURCE AND SEARCH STRATEGY

The Web of Science Core Collection (WoSCC) was selected as the primary data source due to its comprehensive indexing of high-quality, peer-reviewed publications and its compatibility with advanced bibliometric tools.[21] WoSCC provides structured metadata and citation information, making it a widely accepted platform for bibliometric studies. To avoid discrepancies caused by daily updates, the search was performed on a single day-February 10, 2025.

The search strategy was constructed using Medical Subject Headings terms and Boolean operators. The following search query was applied: Topic (TS)=("artificial intelligence" OR "AI" OR "machine learning" OR "deep learning" OR "neural network" OR "expert system") AND TS=("oral medicine" OR "oral radiology" OR "dentistry" OR "maxillofacial surgery" OR "prosthodontics" OR "endodontics" OR "periodontology" OR "orthodontics" OR "oral implantology").

Only original research articles and reviews published between January 1, 2000-February 10, 2025 were included in this study. Editorials, letters, meeting abstracts, book chapters, proceedings papers, book reviews, books, and discussion papers were excluded using the document type filter in the Web of Science Core Collection. Additionally, only English-language publications were retained, and 29 non-English articles were excluded during the screening process. Articles not related to dentistry were excluded (this exclusion was done using the "Web of Science Categories" and "Citation Topics Meso" filters). The final dataset was evaluated in terms of publication count, citation frequency, author productivity, institutional and country-level contributions, co-authorship patterns, and keyword distributions (Figure 1).

Inclusion and Exclusion Criteria

The screening process was conducted independently by 2 researchers (F.Ö. and B.E.Y.). Discrepancies were resolved through discussion with a 3rd reviewer (B.N.G.Y.).

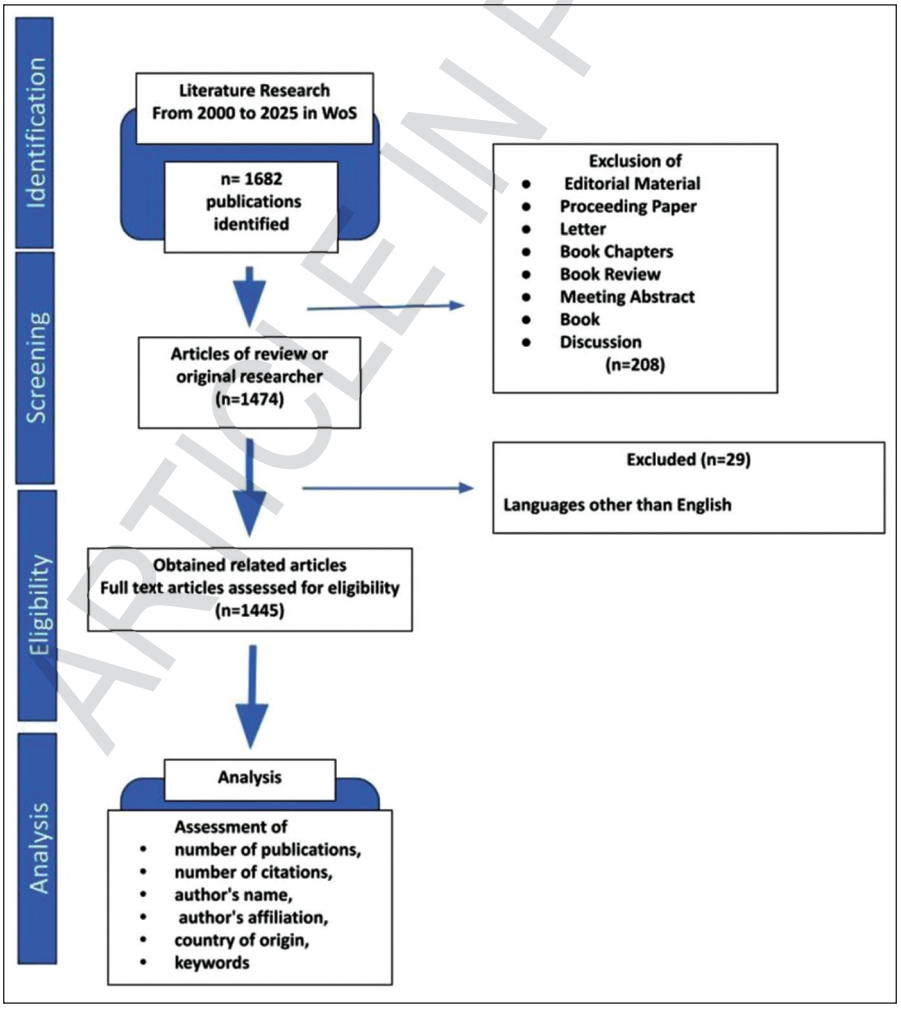

FIGURE 1: Flowchart of the articles analyzed in the study

Inclusion criteria:

- Articles focusing on the application of AI in any field of dentistry
- Original research articles and reviews
- Published in English
- Indexed in WoSCC

Exclusion criteria:

- Editorials, letters, meeting abstracts, book chapters, proceedings
- Studies not related to AI or not connected to dental applications
- Retracted or duplicate publications

DATA CLEANING, MAPPING, AND ANALYSIS

All records retrieved from the WoSCC were exported in plain text and CSV formats. In the first stage, preliminary data cleaning was conducted using Microsoft Excel. During this process, duplicate records were removed, consistency in metadata fields such as author names and institutional affiliations was ensured, and basic descriptive statistics were generated. These included annual publication trends, average citations per document, distribution by journal and document type, and the number of contributing authors, institutions, and countries. As a result, the dataset was structured and prepared for advanced bibliometric mapping.

The cleaned dataset was then imported into 2 analytical environments: VOSviewer (version 1.6.20) and RStudio (version 4.2.1).

VOSviewer was employed to construct and visualize collaborative structures and thematic clusters. The following analyses were performed:

- Co-authorship analysis at the author, institution, and country levels: Only authors with at least 5 publications were included in the network. Collaboration structures were identified using the LinLog/modularity normalization algorithm, which enabled the detection of dense regions of interaction.
- Keyword co-occurrence analysis: This analysis focused exclusively on author-defined keywords. Keywords with a minimum frequency of 10 occurrences were retained, and the full counting method was applied to assign equal weight to each keyword regardless of the number of co-authors. This approach helped to identify dominant thematic clusters across the dataset, such as diagnostic imaging, deep learning, and algorithm performance.
- Bibliographic coupling analysis: The intellectual relatedness of documents was evaluated based on shared references. This technique enabled the identification of latent thematic linkages between publications that may not share direct citations or keywords.

In the generated visual maps, node size represented the number of associated publications, node proximity indicated the strength of conceptual or collaborative relationships, colors denoted thematic clusters, and line thickness reflected the intensity of connections.

While RStudio was used to compute quantitative bibliometric indicators, VOSviewer served as the primary tool for structural network visualization. Using the bibliometrix package in RStudio, the following metrics were calculated:

- Annual growth rate of publications (%)
- Average citations per document
- International collaboration rates
- Comparative productivity by country and institution

The visualization outputs-especially the co-authorship, co-occurrence, and bibliographic coupling maps-generated through VOSviewer provided clear, interpretable representations of research patterns and thematic structures. These graphical insights complemented the numerical findings and facilitated a multidimensional interpretation of the data.

This methodology enabled a comprehensive assessment of the development of AI research in dentistry between 2000 and 2025-not only in terms of publication volume and citation impact but also in terms of collaboration networks, thematic evolution, and institutional productivity.

RESULTS

PUBLICATION GROWTH AND GENERAL CHARACTERISTICS

A total of 1,445 AI-related articles in dentistry were retrieved from the WoSCC between 2000-2025.

These publications appeared in 443 different journals. The annual growth rate of publications was calculated as 14.07%, indicating a substantial increase in scholarly interest over the past 2 decades. The average citation rate was 12.89 citations per article, based on a total of 39,863 references cited across the dataset.

Authorship data revealed contributions from 7,196 unique authors, averaging 6.12 authors per publication. Notably, 31.63% of all publications involved international collaborations, reflecting a growing trend toward global research networking in the field (Table1). Figure 2 illustrates the rising trajectory of both publication output and citation frequency over time. The steady upward curve, especially after 2019, highlights the field's recent acceleration.

TABLE 1: Genel information

Time span	2000-2025
Number of journal	443
Number of article	1,445
Annual growth rate	14.07%
Citations per document	12.89
Total number of documents	39,863
Number of keywords	3,230
Number of authors	7,196
Authors per documents	6.12
International author collaboration rate	31.63%

COUNTRY-LEVEL ANALYSIS

A total of 92 countries contributed to AI-focused dental research. The United States was the most productive country with 253 articles and 4,018 citations, followed by China (n=221) and Türkiye (n=118). While these countries led in output, countries such as Germany (n=118) and South Korea (n=81) demonstrated strong citation performance relative to publication count, suggesting higher average impact (Table 2). As shown in Figure 3, North America, East Asia, and parts of Europe emerged as primary centers of AI research in dentistry. Figure 4 presents a clustering map, revealing distinct regional groupings and collaboration networks. For instance, the United States formed strong bilateral clusters with China and Germany.

INSTITUTIONAL CONTRIBUTIONS

A total of 1,106 institutions contributed to the literature. Sichuan University (n=115) ranked first, followed by Shanghai Jiao Tong University (n=86) and Eskişehir Osmangazi University (n=81) (Table 3). Notably, Charité University Berlin and Ankara University were among the leading institutions in terms of international co-authorship frequency. According to Figure 5, institutions in East Asia and Western Europe exhibited tighter collaboration networks compared to other regions.

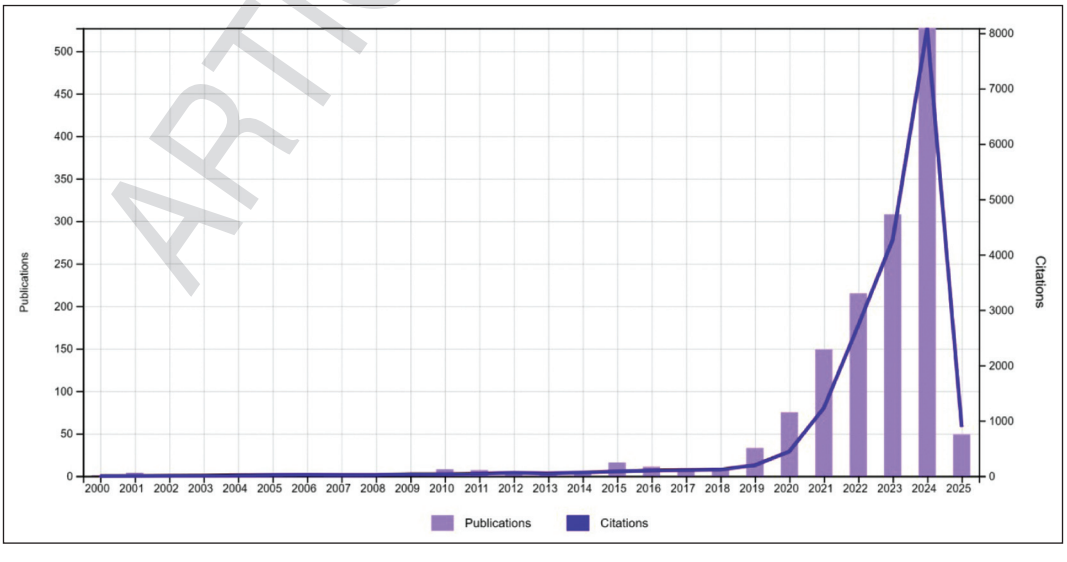

FIGURE 2: Trends in publications and citations on AI in dentistry (2000-2025)

TABLE 3: Top 10 countries by number of articles

Country	Number of articles	Number of citation
United States of America	253	4,018
China	221	3,097
Türkiye	118	1,383
Germany	118	3,012
Saudi Arabia	113	1,382
South Korea	81	2106
Brazil	71	919
Italy	66	631
England	65	613
Japan	57	959

AUTHOR PRODUCTIVITY

Table 4 presents the top 10 most productive authors. Falk Schwendicke (Germany) led with 35 publications and 1,687 citations, followed by Kaan Orhan (Türkiye) and Joachim Krois (Germany). These authors also demonstrated significant collaborative ties, especially within their respective regions. Figure 6 visualizes author collaboration clusters, showing that co-authorship networks tend to be geographically concentrated, though some cross-regional linkages exist.

JOURNAL ANALYSIS

AI-related dental research was disseminated across 443 journals. The Journal of Dentistry published the highest number of articles (n=58) and received 1,658 citations. Other frequently contributing journals included Diagnostics (n=44) and Applied Sciences-Basel (n=44). Notably, Journal of Dental Research-despite a lower article count-received one of the highest total citations (n=1,368), indicating high impact per publication (Table 5).

MOST CITED ARTICLES

The most cited article was titled "Detection and diagnosis of dental caries using a deep learning-based convolutional neural network algorithm" with 440 citations (Table 6). Other highly cited works focused on AI-assisted diagnostics, imaging, and literature reviews. These articles reflect a strong emphasis on deep learning and computer vision applications in diagnostic tasks, underscoring current research priorities in the field.

KEYWORD ANALYSIS

After removing duplicates, 3,230 unique keywords were identified. Commonly recurring terms included "artificial intelligence", "diagnosis", "classification", and "performance" (Figure 7). Keyword co-occurrence mapping revealed four major clusters, representing thematic focuses such as:

- Machine learning and deep learning methods
- Clinical diagnostic applications

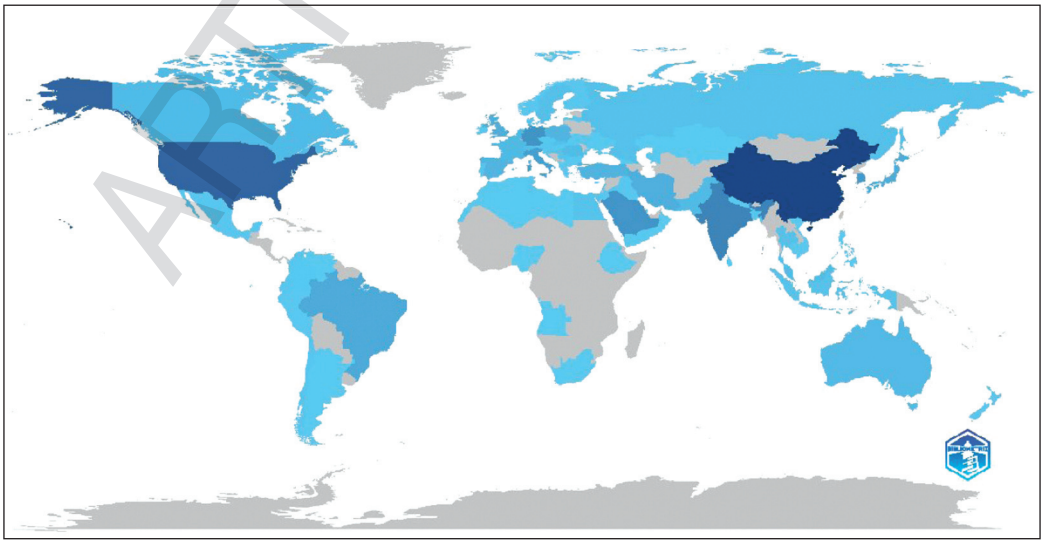

FIGURE 1: Global distribution of AI-related articles in dentistry

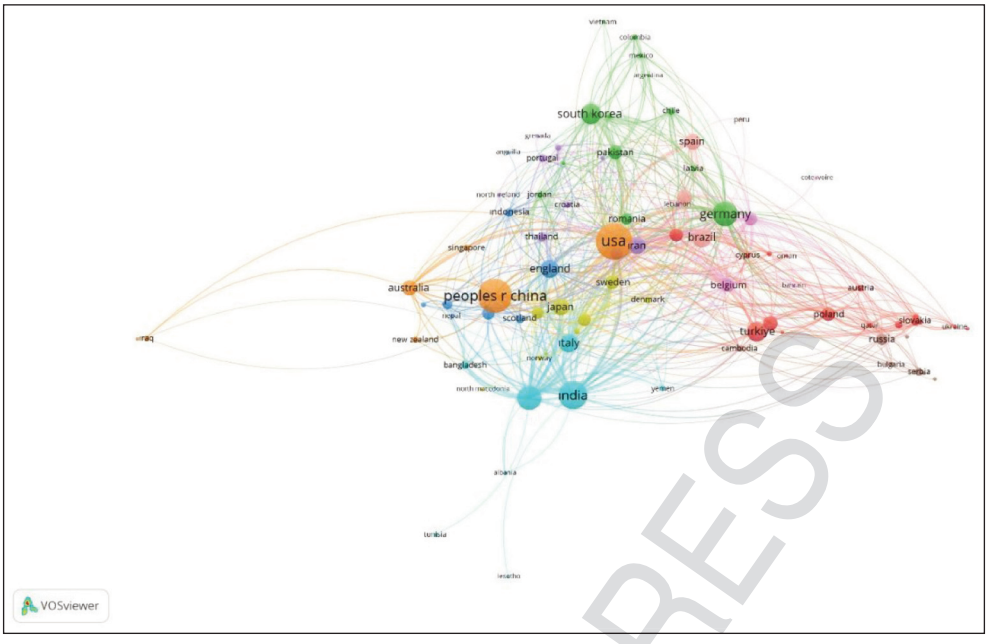

FIGURE 4: Clustering map of countries conducting research on artificial intelligence in dentistry

TABLE 3: Top 10 institutions by number of articles

Institution	Number of articles	Number of citation
Sichuan University	115	1,658
Shangai Jiao Tong University	86	556
Eskisehir Osmangazi University	81	388
Peking University	76	312
Charity University Med Berlin	74	277
Hong Kong University	60	1,368
Ankara University	54	304
Soul University	53	413
Sao Paulo University	52	189
Yonsei University	52	570

- Radiological imaging
- Algorithm performance evaluation

DISCUSSION

This study offers a detailed bibliometric analysis of AI in dentistry, highlighting significant growth in research outputs, especially after 2019. These findings are consistent with previous works by Polizzi et al., who observed that over 80% of orthodontic AI-related articles were published within the last 3 and a half years.[30] Such growth underscores a broader global trend toward integrating AI into dental diagnostics, imaging, and clinical workflows.

The rise in publication volume is also mirrored by increased international collaboration, with over 30% of the articles in our dataset involving cross-national co-authorship. Countries such as the United States, China, and Türkiye emerged as leading contributors in terms of quantity, while Germany and South Korea demonstrated high citation-per-publication ratios. This suggests that while some countries dominate output, others excel in producing high-impact research. Our findings are in line with Wong et al., who also noted regional strengths and disparities in AI research output in orthodontics.[31] In addition this aligns with broader literature recognizing collaboration between countries and institutions as a driving force in the advancement and global visibility of dental AI research.[32,33]

From an institutional perspective, Sichuan University, Shanghai Jiao Tong University, and Eskişehir Osmangazi University ranked among the most productive. Additionally, Charité University Berlin and Ankara University were noted for their active roles in international collaborations. These observations indicate the formation of regional research ecosystems

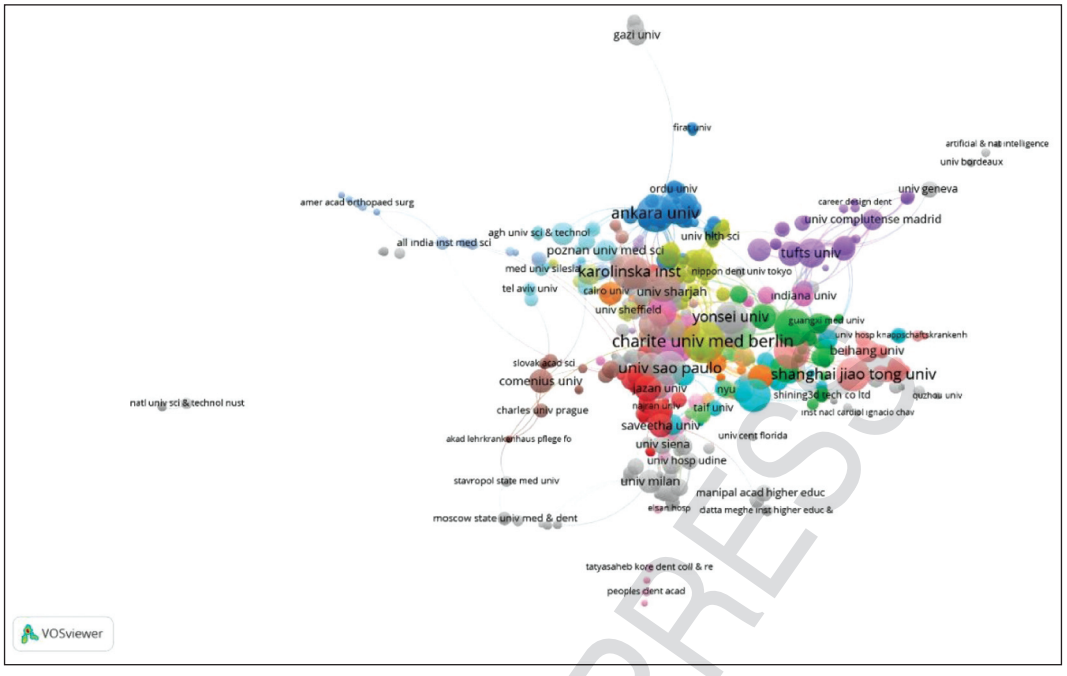

FIGURE 5: Clustering map of institutions conducting research on AI in dentistry

TABLE 4: Top 10 authors by number of articles

Authors	Number of article	Number of citation
Falk Schwendicke	35	1,687
Kaan Orhan	26	580
Joachim Krois	25	1,630
Reinhilde Jacobs	24	464
İbrahim Şevki Bayraktar	23	449
Özer Çelik	22	360
Hossein Mohammed-Rahimi	16	320
Elif Bilgir	14	408
Mohammad Khurshed Alam	12	179
Andrej Thurzo	11	313

supported by well-connected academic hubs. The author-level analysis further reinforces this pattern, with scholars such as Falk Schwendicke, Kaan Orhan, and Joachim Krois emerging as influential figures due to their productivity and citation impact. These authors have not only shaped the field's research direction but also contributed significantly to regional and international research clusters.

The current study also confirmed that while AI research is distributed across 443 journals, a relatively small subset-particularly the Journal of Dentistry, Journal of Dental Research, and Diagnostics-accounts for the majority of high-impact publications. The Journal of Dental Research, for example, although publishing fewer papers, garnered the highest citation-per-article ratio, reflecting its selectivity and scientific influence. These journals serve as critical platforms for disseminating rigorous and clinically relevant AI research in dentistry.

Keyword co-occurrence and citation burst analysis reveal that research continues to prioritize AI applications in radiographic imaging, cephalometric analysis, and convolutional neural networks. While this aligns with the clinical demand for accurate diagnostics-as demonstrated by Miki et al. and Kunz et al.-it also signifies an over-concentration on a narrow range of AI applications.[34,35] Recent studies suggest that domains such as behavioral dentistry, education, and ethics remain notably underexplored.[36,37]

The emerging need for structured evaluation of AI models was emphasized in the development of guidelines such as TRIPOD-AI, CONSORT-AI, and DECIDE-AI, which aim to standardize reporting and evaluation of AI in healthcare.[30] Their adoption in dental AI literature, however, remains limited, suggesting a methodological gap that needs to be addressed in future studies.

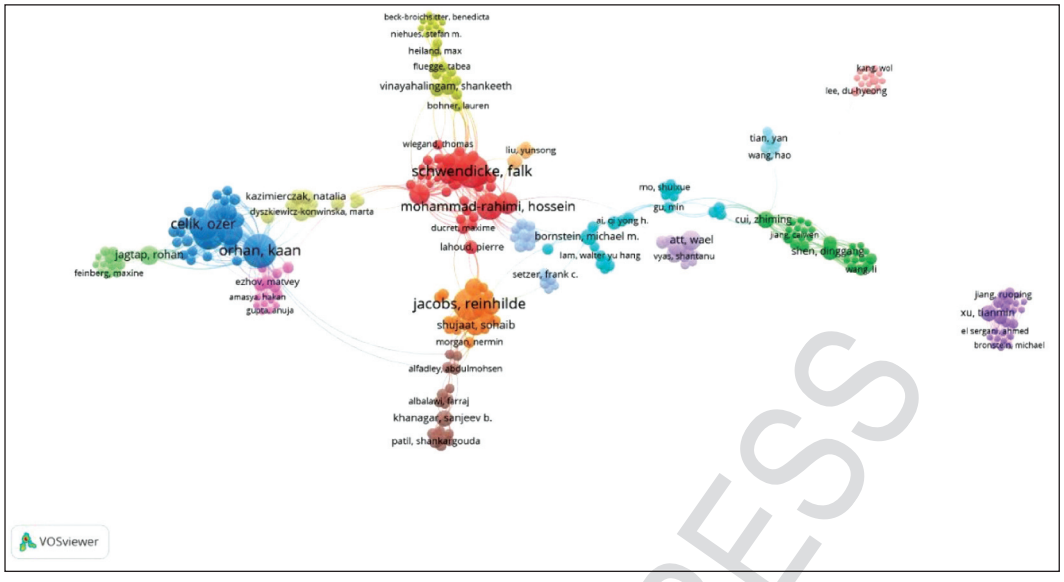

FIGURE 6: Clustering map of countries conducting research on AI in dentistry

TABLE 5: Top 10 journals by number of articles

Journals	Number of articles	Number of citation
Journal of Dentistry	58	1,658
Diagnostics	44	556
Applied Sciences Basel	44	388
Cureus Journal of Medical Sciences	43	312
BMC Oral Health	42	277
Journal of Dental Research	36	1,368
IEEE Access	34	304
Journal of Clinical Medicine	30	413
Journal of Stomotology Oral and Maxillofacial Surgery	30	189
Dentomaxillofacial Radiology	23	570

Collaboration networks mapped in this study reflect dense regional clusters, particularly among East Asian and North American institutions. While collaboration enhances research visibility and output, it may also entrench existing disparities if lower-resourced regions are systematically excluded. As highlighted by Adnan et al., promoting cross-regional partnerships can enhance equity and knowledge exchange in digital dentistry.[38]

Another notable finding relates to the thematic narrowing within AI-based research. Orthodontics has dominated recent publications, with landmark de-

TABLE 6: Top 10 most cited articles

Article title	n
Detection and diagnosis of dental caries using a deep learning-based convolutional neural network algorithm[4]	440
Artificial intelligence in dentistry: chances and challenges[3]	391
Convolutional neural networks for dental image diagnostics: a scoping review[22]	230
Developments, application, and performance of artificial intelligence in dentistry-a systematic review[23]	225
Computer assisted oral and maxillofacial surgery: a review and an assessment of technology[24]	197
Deep learning for the radiographic detection of apical lesions[25]	183
Application of artificial intelligence in dentistry[26]	176
Artificial intelligence in dental research: checklist for authors, reviewers, readers[27]	174
The use and performance of artificial intelligence applications in dental and maxillofacial radiology: a systematic review[28]	167
An overview of deep learning in the field of dentistry[29]	148

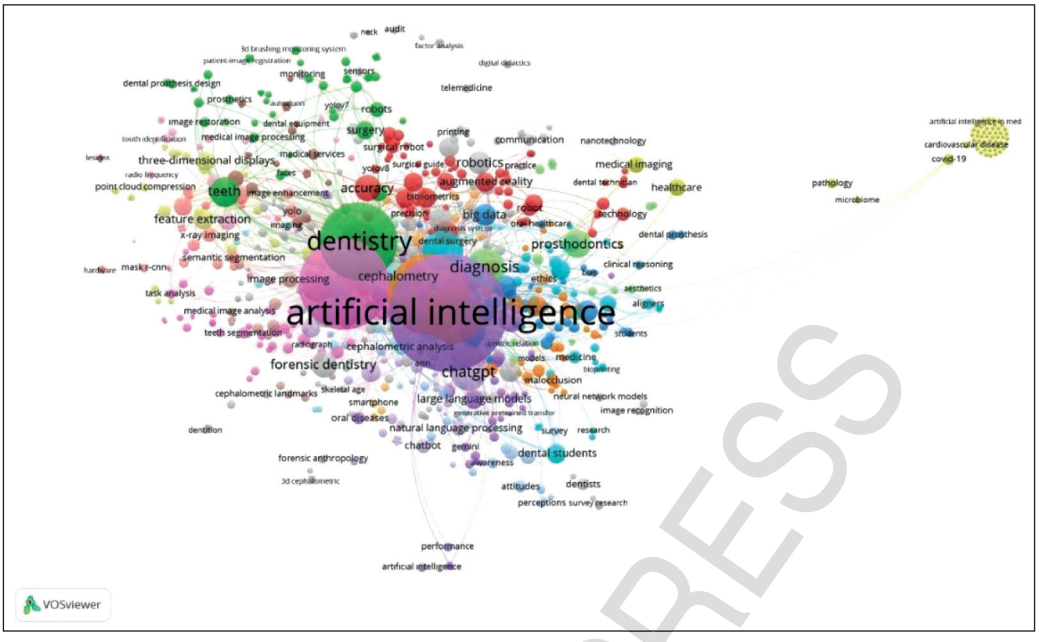

FIGURE 7: Clustering map of keywords on AI in dentistry

tection and segmentation being key research topics.[30] However, areas such as prosthodontics, pediatric dentistry, or psychosocial implications of AI adoption have yet to receive proportionate scholarly attention. Studies like those by Wong et al. and Lee et al. suggest that expanding the thematic scope could foster more holistic AI integration in dental care.[4,31]

Finally, while AI holds promise in transforming dental education and clinical decision-making, its implementation must be guided by a combination of digital competency, ethical training, and robust validation. As Buddhikot et al. noted, the success of digital health tools depends not only on technological sophistication but also on user acceptance, regulatory readiness, and context-specific adaptability.[37]

The rapid proliferation of AI applications in dental practice necessitates multidimensional evaluations not only in terms of technical performance but also from ethical, legal, and clinical responsibility perspectives.[40] While AI-based clinical decision support systems facilitate faster decision-making processes for practitioners, holding clinicians directly accountable for algorithm-generated outputs brings critical issues such as explainability and reliability to the forefront.[41] Moreover, the representativeness of the datasets used to train these systems-particularly in imaging-based algorithms-raises concerns regarding potential biases and errors. For instance, systems developed with data lacking demographic diversity may demonstrate reduced diagnostic accuracy in certain patient populations.[42] On the other hand, the processing of patient data within digital systems underscores the need for stricter regulations concerning privacy, data security, and informed consent. Therefore, during the clinical integration of AI applications, it is essential to conduct evaluations not only based on technical accuracy but also through the lens of ethics, transparency, and patient rights.[41,42]

Despite its comprehensive scope, this study is not without limitations. First, the analysis was based solely on publications indexed in the WoSCC and limited to English-language articles. As a result, relevant studies published in other languages or indexed in alternative databases such as Scopus or PubMed may have been excluded. Second, while the bibliometric methods employed provide valuable macro-level insights, they do not capture the full contextual depth or content quality of individual publications. Finally, the use of author-supplied keywords and variations in indexing practices may have influenced the clustering and thematic mapping results.

There is a need for a multidisciplinary roadmap to ensure that AI technologies in dentistry can be used more effectively, ethically, and in a patient-centered manner in the future.[40-42] Primarily, it is of great importance to enhance algorithm transparency, ensure diversity in training datasets, and develop regulations that protect patient privacy.[42] Strengthening AI literacy within educational institutions, conducting transparent validation processes for clinical decision support systems, and ensuring that such technologies are accessible not only in major centers but also in rural areas should be among the main goals. In this context, future studies should prioritize not only clinical performance but also aspects such as ethical compliance, legal responsibility, and patient trust.

CONCLUSION

This bibliometric study comprehensively analyzed the overall trend of scientific publications on AI in dentistry between 2000-2025 using data from the WoSCC. The findings revealed a marked increase in publication volume, particularly after 2019, with the majority of contributions originating from a limited number of countries and institutions. Keyword co-occurrence and citation analyses identified diagnostic imaging, deep learning, and radiological applications as the primary research themes, whereas interdisciplinary collaboration appeared to be concentrated within a narrower scope.

Despite these advancements, several critical gaps remain. AI-related research in fields such as pediatric dentistry, prosthodontics, and community oral health is notably scarce. Furthermore, deficiencies in ethical principles, data transparency, and adherence to methodological standards (e.g., TRIPOD-AI, CONSORT-AI) continue to hinder the translation of research into clinical practice. Future studies should aim to expand thematic diversity, adopt international reporting guidelines, and address ethical and legal dimensions-such as patient privacy, informed consent, and algorithmic fairness-in greater depth. Bridging these gaps will be essential for the responsible, inclusive, and effective integration of AI technologies into dental practice and education.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

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