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Artificial Intelligence Applications in Oral and Maxillofacial Surgery: A Bibliometric and Science Mapping Analysis of Global Research Trends (2000-2025)

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Abstract

Aim: To map the scientific landscape of artificial intelligence (AI) applications in oral and maxillofacial surgery (OMFS) over the last 25 years using bibliometric and science-mapping methods.

Materials and Methods: Publications related to AI and OMFS were retrieved from the Web of Science Core Collection. A comprehensive search was performed, and the complete set of 2153 records was exported. After restricting the timespan to 2000-2025 and limiting the document type to articles and reviews, 1955 documents were included. Bibliometric indicators were calculated, and science maps were generated in VOSviewer for co-authorship, co-occurrence, citation, and co-citation analyses.

Results: The annual number of publications increased markedly after 2015, with a steep rise from 2020 onwards and a peak of 275 publications in 2025. Overall, 1678 articles (87.8%) and 232 reviews (12.2%) were identified, totaling 38648 citations (mean 20.2 citations per document). The most productive journals were the Journal of Craniofacial Surgery, the Journal of Cranio-Maxillofacial Surgery, and the International Journal of Oral and Maxillofacial Surgery. Keyword co-occurrence analysis revealed major thematic clusters related to orthognathic surgery, mandibular reconstruction, computer-assisted surgery, virtual surgical planning, 3D printing, and deep learning.

Conclusion: AI research at the interface of OMFS has expanded rapidly between 2000 and 2025, particularly in AI-assisted surgical planning, anatomical segmentation for operative workflows, and computer-assisted surgery. These findings highlight how AI-supported technologies are increasingly being investigated for integration into contemporary clinical workflows in OMFS and provide guidance for clinicians regarding future implementation and validation priorities. In addition to clinical insights, these findings provide an overview of the AI research landscape in OMFS, offering guidance for future algorithm development, validation strategies, and interdisciplinary research directions.

Keywords: Artificial intelligence, bibliometric analysis, oral and maxillofacial surgery, science mapping, surgical planning

Introduction

Over the past 10 years, advances in machine learning and deep learning, along with the increased availability of digital surgical data, have driven growing interest in artificial intelligence (AI) in oral and maxillofacial surgery (OMFS). The growing importance of AI in OMFS has been highlighted by recent narrative and systematic studies, particularly in surgical planning, anatomical analysis, and clinical decision-making. (1-4).

Among the various clinical applications, orthognathic surgery has emerged as a key area for integrating digital and AI-assisted technologies. Virtual surgical planning, simulation, and patient-specific surgical guides have been widely investigated as tools to

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improve surgical accuracy and predictability (5-9). In parallel, deep learning–based methods have been introduced to automate tasks such as mandibular segmentation and identification of critical anatomical structures, which are essential components of contemporary OMFS workflows (10-14).

These methods enhance surgical planning and operative decision-making rather than relying solely on stand-alone radiological evaluations, even though they often rely on imaging-derived data. This differentiation highlights the essentially surgical focus of AI applications in OMFS and distinguishes them from studies in diagnostic imaging.

Several authors have discussed the broader implications of AI in dentistry and healthcare, in addition to procedure-specific studies. These contributions offer crucial conceptual and methodological frameworks for comprehending the creation, verification, and constraints of AI-based systems in clinical practice (16-18). More recently, OMFS-specific systematic reviews have synthesised evidence on AI applications across surgical subspecialties, highlighting the field's existing methodological shortcomings and potential advantages (19).

Despite the growing volume of literature, existing reviews primarily offer qualitative or application-focused perspectives and provide limited insight into publication trends, collaborative research structures, and the thematic evolution of AI-related OMFS research over time. Bibliometric and science mapping approaches are well-suited to address these gaps by quantitatively assessing research output, identifying influential contributors, and visualising emerging research themes.

Beyond its clinical relevance, systematically mapping the structure, evolution, and thematic focus of AI research in OMFS is essential to guide future algorithm development, foster interdisciplinary collaboration, and identify methodological gaps within the AI research landscape (16-18).

Therefore, the present study aimed to conduct a comprehensive bibliometric and science-mapping analysis of AI applications in OMFS published between 2000 and 2025.

Materials and Methods

Study Design

This study followed a bibliometric and science-mapping design and was conducted in accordance with reporting recommendations for bibliometric analyses. Because only published literature was analysed and no individual patient data were used, ethical approval was not required.

Data Source and Search Strategy

The Web of Science (WoS) Core Collection was chosen as the data source for its strict indexing guidelines and suitability for citation-based analysis. A thorough search was conducted to find articles on AI applications in OMFS. OMFS and dental imaging terms were merged with free-text terms pertaining to deep learning and AI in the search approach. Excluded were studies with a primary focus on dentomaxillofacial radiography that had no direct bearing on surgical planning, intervention, or results in OMFS. A representative Boolean query was:

Topic search= [(“AI “ or “deep learning” or “machine learning” or “neural network*” or “radiomics”)] and (“oral and maxillofacial” or “maxillofacial surgery” or “orthognathic” or “mandibular reconstruction” or “dentofacial deformit*” or “dental implant*” or “cone-beam computed tomography” or “ CBCT” or “panoramic radiograph*”).

The initial search of the WoS Core Collection retrieved 2153 records with no restrictions. All records were exported in plain-text format with complete records and cited references.

Study Selection and Data Cleaning

In a first screening step, the timespan was restricted to publications from 1 January 2000 to 31 December 2025. Publication counts for 2025 reflect partial-year data, as records were retrieved on 9, 2025, before the calendar year ended. Only items indexed as “article” or “review” were retained; conference proceedings, editorial materials, letters, and corrections were excluded by using WoS document-type filters. After this restriction and the exclusion of records, 1955 documents remained and were included in the quantitative analyses.

To prepare the data for science-mapping analyses, author names, institutional affiliations, and keywords were cleaned and normalised. Variants of the same term (e.g., “computer-aided surgery” and “computer-assisted surgery”) were merged, spelling errors were corrected, and singular and plural forms were unified where appropriate. Author keywords (DE field) and Keywords Plus (ID field) were combined to generate a unified keyword list. Data cleaning was performed using spreadsheet tools and custom scripts before importing the dataset into VOSviewer. Conceptually overlapping terms such as computer-aided surgery, computer-assisted surgery, and computer-aided design (CAD)/ computer-aided manufacturing (CAM) were merged under unified keyword categories prior to frequency analysis. Imaging-related terms were included to ensure comprehensive retrieval of AI studies supporting surgical planning and workflows, while studies focusing solely on diagnostic radiology without surgical relevance were excluded during data cleaning. Following data cleaning procedures and the application of predefined inclusion criteria, 1.955 publications were retained for bibliometric and science mapping analyses.

Bibliometric Indicators

Descriptive bibliometric indicators were calculated for the overall dataset, including the annual number of publications, document types, total and average citations per document, and productivity rankings for countries, institutions, authors, and journals. Citations were counted as of the WoS export date.

Statistical Analysis

Science-Mapping Analysis

Science maps were generated using VOSviewer (version 1.6.20; Centre for Science and Technology Studies, Leiden University, The Netherlands). Co-authorship analyses were performed at the author, institution, and country levels using complete counting. Co-occurrence analyses were conducted for author keywords; only keywords with a minimum of five occurrences in the dataset were included in the maps. Citation and co-citation analyses were carried out for journals and individual documents. Normalisation of similarities was based on the association strength method, and clusters were identified using VOSviewer's default clustering algorithm. Overlay visualisation was used to explore temporal trends, with node colour representing the average publication year of items.

Results

Descriptive Overview of the Dataset

A total of 1955 WoS-indexed documents on AI applications in OMFS were published between 2000 and 2025. Of these, 1720 (87.9%) were original research articles and 235 (12.1%) were review papers. The cumulative number of publications increased modestly in the early 2000s and then accelerated from approximately 2015 onwards, with a marked rise after 2020, peaking at 275 in 2025. (Figure 1) The total number of citations received by the included documents was 38648, corresponding to an average of 20.2 citations per document. Most publications were written in English (97.4%), with only a limited number published in other languages.

The country collaboration network is visualised in Figure 2, revealing dense collaborative clusters among high-output countries and indicating that international co-authorship plays a substantial role in advancing research on AI in OMFS.

Most Highly Cited Publications

Table 1 lists the 20 most highly cited documents in the dataset. These publications predominantly address 3D printing, computer-assisted and image-guided surgery, virtual surgical planning, and mandibular reconstruction, which together form the historical core of digital OMFS.

Most Productive Journals

The most productive journals in this field were Journal of Craniofacial Surgery (n=145), Journal of Cranio-Maxillofacial Surgery (n=138), International Journal of OMFS (n=123), and Journal of Oral and Maxillofacial Surgery (n=108). Several multidisciplinary and engineering journals, such as Applied Sciences and Scientific Reports, also contributed substantially to the literature, reflecting the interdisciplinary nature of AI research in OMFS. The 10 most productive journals publishing AI-related OMFS research are summarised in Table 2. The dominance of core OMFS journals highlights that AI-related research is being increasingly disseminated within speciality-specific surgical outlets rather than general radiology or engineering journals.

Keyword Co-occurrence

Author keywords and Keywords Plus were combined for co-occurrence analysis. Table 3 presents the 20 most frequent keywords in the dataset. Orthognathic surgery, computer-assisted surgery, AI and mandibular reconstruction were among the most common terms, together with virtual surgical planning and CAD/CAM. Imaging-related keywords such as CBCT appeared predominantly in the context of surgical planning, navigation, and outcome assessment in OMFS, rather than as stand-alone radiological applications. "Accuracy" was among the most frequently occurring keywords, particularly with respect to surgical outcome prediction and anatomical segmentation tasks in OMFS. The keyword co-occurrence network is presented in Figure 2, demonstrating several well-defined thematic clusters centred on AI applications in OMFS, including surgical planning, deep learning-based segmentation, and computer-assisted surgical workflows.

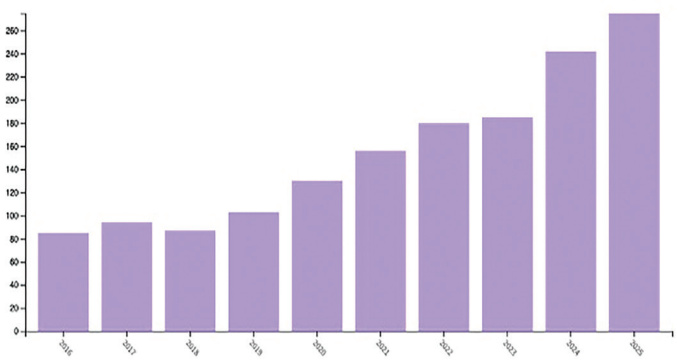

Figure 1. Annual publication trend (2000-2025) Data for the year 2025 represent a partial dataset collected up to December 9, 2025, and therefore do not reflect a complete calendar year

The overlay visualisation shown in Figure 3 illustrates the temporal evolution of research topics, indicating a shift from early computer-assisted surgical approaches toward a more recent emphasis on deep learning, virtual surgical planning, and data-driven decision-support systems in OMFS.

Geographical Distribution of Publications

The geographical distribution of publications revealed that research on AI in OMFS was dominated by a limited number of countries (Table 4). The People's Republic of China and the United States were the most productive countries, followed by Germany, Italy, and South Korea. Other major contributors included Japan, France, and the Netherlands, indicating strong research activity across East Asia and Western Europe. The country collaboration network is visualised in Figure 4, revealing dense collaborative clusters among high-output countries and indicating that international co-authorship plays a substantial role in advancing research on AI in OMFS.

Institutional Productivity

Institutional analysis demonstrated that a small number of academic and clinical centres accounted for a substantial proportion of the published literature (Table 5). Shanghai Jiao Tong University and Peking University emerged as the most productive institutions, followed by several major universities and university hospitals from East Asia, Europe, and North America. This distribution reflects the concentration of AI-related OMFS research within high-volume tertiary care and research-orientated institutions.

Author Productivity

Analysis of author productivity showed that a limited group of researchers contributed disproportionately to the literature (Table 6). Gellrich NC, Lo LJ, and Marchetti C were among the most productive authors, each contributing more than 20 publications. The remaining highly productive authors demonstrated comparable publication outputs, suggesting the

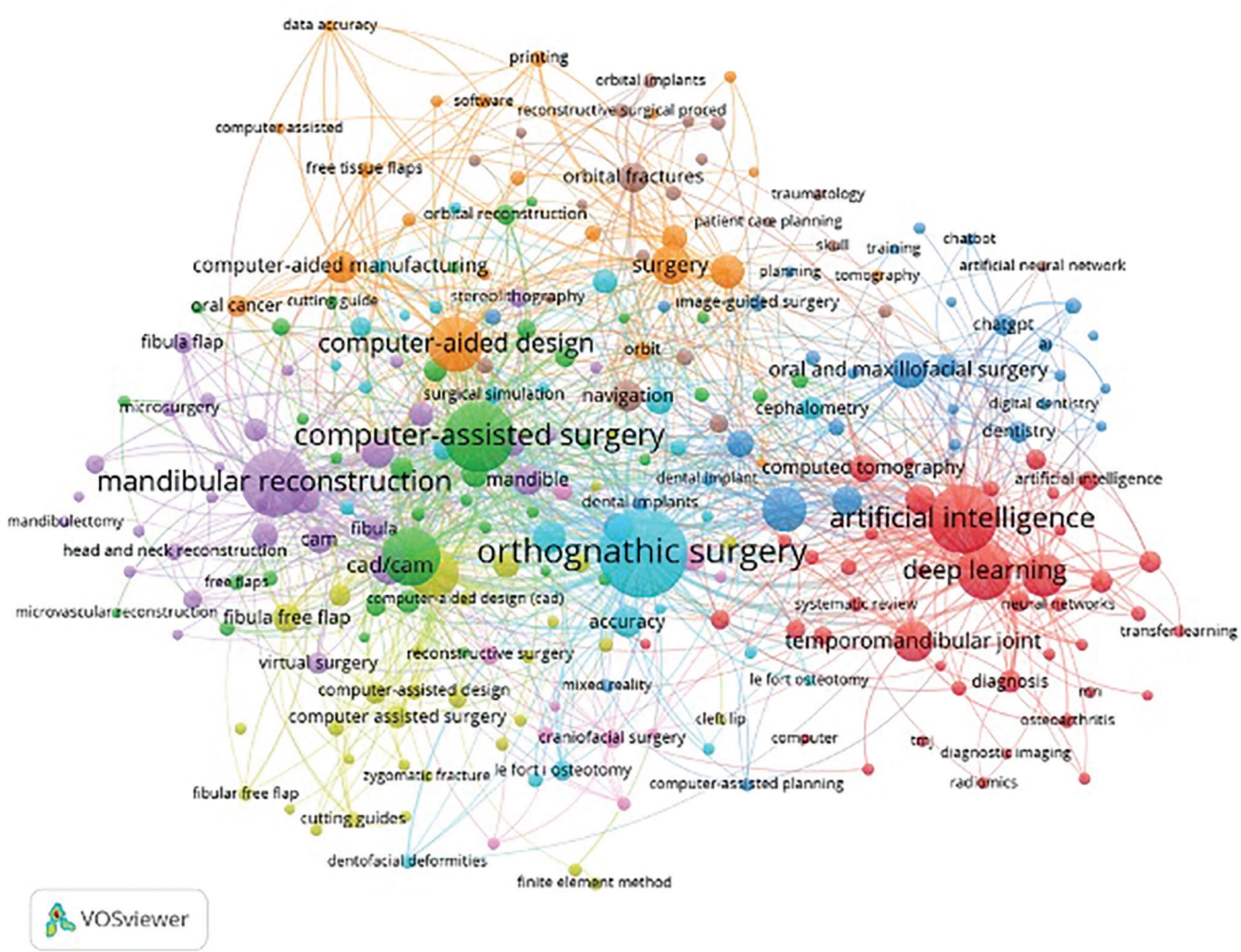

Figure 2. Keyword co-occurrence network generated using VOSviewer. Colours represent thematic clusters, and node size indicates the relative frequency of each keyword in the dataset

Table 1. The 20 most highly cited publications on artificial intelligence applications in oral and maxillofacial surgery (2025-2000)						
Rank	**First author**	**Year**	**Title**	**Journal**	**Document type**	**Citations**
1	Tack, Philip	2016	3D-printing techniques in a medical setting: a systematic literature review	Biomedical Engineering Online	Review	738
2	Warnke, PH	2004	Growth and transplantation of a custom vascularised bone graft in a man	Lancet	Article	537
3	Martelli, Nicolas	2016	Advantages and disadvantages of 3-dimensional printing in surgery: a systematic review	Surgery	Review	460
4	Hsu, Sam Sheng-Pin	2013	Accuracy of a computer-aided surgical simulation protocol for orthognathic surgery: a prospective multicenter study	Journal of Oral and Maxillofacial Surgery	Article	321
5	Cohen, Adir	2009	Mandibular reconstruction using stereolithographic 3-dimensional printing modelling technology	Oral Surgery Oral Medicine Oral Pathology Oral Radiology and Endodontology	Article	281
6	Tian, Yueyi	2021	A review of 3D printing in dentistry: technologies, affecting factors, and applications	Scanning	Review	275
7	Hirsch, David L.	2009	Use of computer-aided design and computer-aided manufacturing to produce orthognathically ideal surgical outcomes: a paradigm shift in head and neck reconstruction	Journal of Oral and Maxillofacial Surgery	Article	267
8	Chae, Michael P.	2015	Emerging applications of bedside 3D printing in plastic surgery	Frontiers in Surgery	Review	257
9	Malik, Hammad H.	2015	Three-dimensional printing in surgery: a review of current surgical applications	Journal of Surgical Research	Review	250
10	Plooij, Joanneke M.	2011	Digital three-dimensional image fusion processes for planning and evaluating orthodontics and orthognathic surgery. A systematic review	International Journal of Oral and Maxillofacial Surgery	Review	221
11	Hoang, Don	2016	Surgical applications of three-dimensional printing: a review of the current literature & how to get started	Annals of Translational Medicine	Review	217
12	Hanasono, Matthew M.	2013	Computer-assisted design and rapid prototype modelling in microvascular mandible reconstruction	Laryngoscope	Article	215
13	Widmann, G	2006	Accuracy in computer-aided implant surgery - a review	International Journal of Oral & Maxillofacial Implants	Review	206
14	Block, Michael S.	2017	Implant placement accuracy using dynamic navigation	International Journal of Oral & Maxillofacial Implants	Article	206
15	Hassfeld, S	2001	Computer-assisted oral and maxillofacial surgery - a review and an assessment of technology	International Journal of Oral and Maxillofacial Surgery	Review	203
16	Ewers, R	2005	Basic research and 12 years of clinical experience in computer-assisted navigation technology: a review	International Journal of Oral and Maxillofacial Surgery	Review	201
17	Eggers, G.	2006	Image-to-patient registration techniques in head surgery	International Journal of Oral and Maxillofacial Surgery	Review	189
18	Stokbro, K.	2014	Virtual planning in orthognathic surgery	International Journal of Oral and Maxillofacial Surgery	Article	187
19	Plooij, J. M.	2009	Evaluation of reproducibility and reliability of 3D soft tissue analysis using 3D stereophotogrammetry	International Journal of Oral and Maxillofacial Surgery	Article	183
20	Antony, Anuja K.	2011	Use of virtual surgery and stereolithography-guided osteotomy for mandibular reconstruction with the free fibula	Plastic and Reconstructive Surgery	Article; Proceedings Paper	182

presence of several active research groups rather than a single dominant author.

Discussion

This bibliometric and science-mapping analysis demonstrates a steep and accelerating increase in AI-related publications in OMFS over the last 25 years. The surge in output after 2015 parallels the broader diffusion of deep learning frameworks and accessible GPU computing in medicine (1,3,15). Recent narrative reviews similarly emphasise that AI has transitioned from experimental proof-of-concept work to an integral component of digital OMFS workflows (1-4).

Geographical Distribution and International Collaboration

Analysis of publication output demonstrated that research activity related to AI in OMFS is concentrated in a limited number of countries. China emerged as the most prolific contributor, followed by several European countries, including Germany and Italy. Similar geographical patterns have been described

Table 2. The most productive journals publishing AI-related OMFS research (2025-2000)

Rank	Journal	Number of Documents
1	Journal of Craniofacial Surgery	145
2	Journal of Cranio-Maxillofacial Surgery	138
3	International Journal of Oral and Maxillofacial Surgery	123
4	Journal of Oral and Maxillofacial Surgery	108
5	Journal of Stomatology Oral and Maxillofacial Surgery	44
6	Journal of Clinical Medicine	43
7	British Journal of Oral & Maxillofacial Surgery	43
8	Applied Sciences-Basel	38
9	Scientific Reports	34
10	Plastic and Reconstructive Surgery	34

AI: Artificial intelligence, OMFS: Oral and maxillofacial surgery

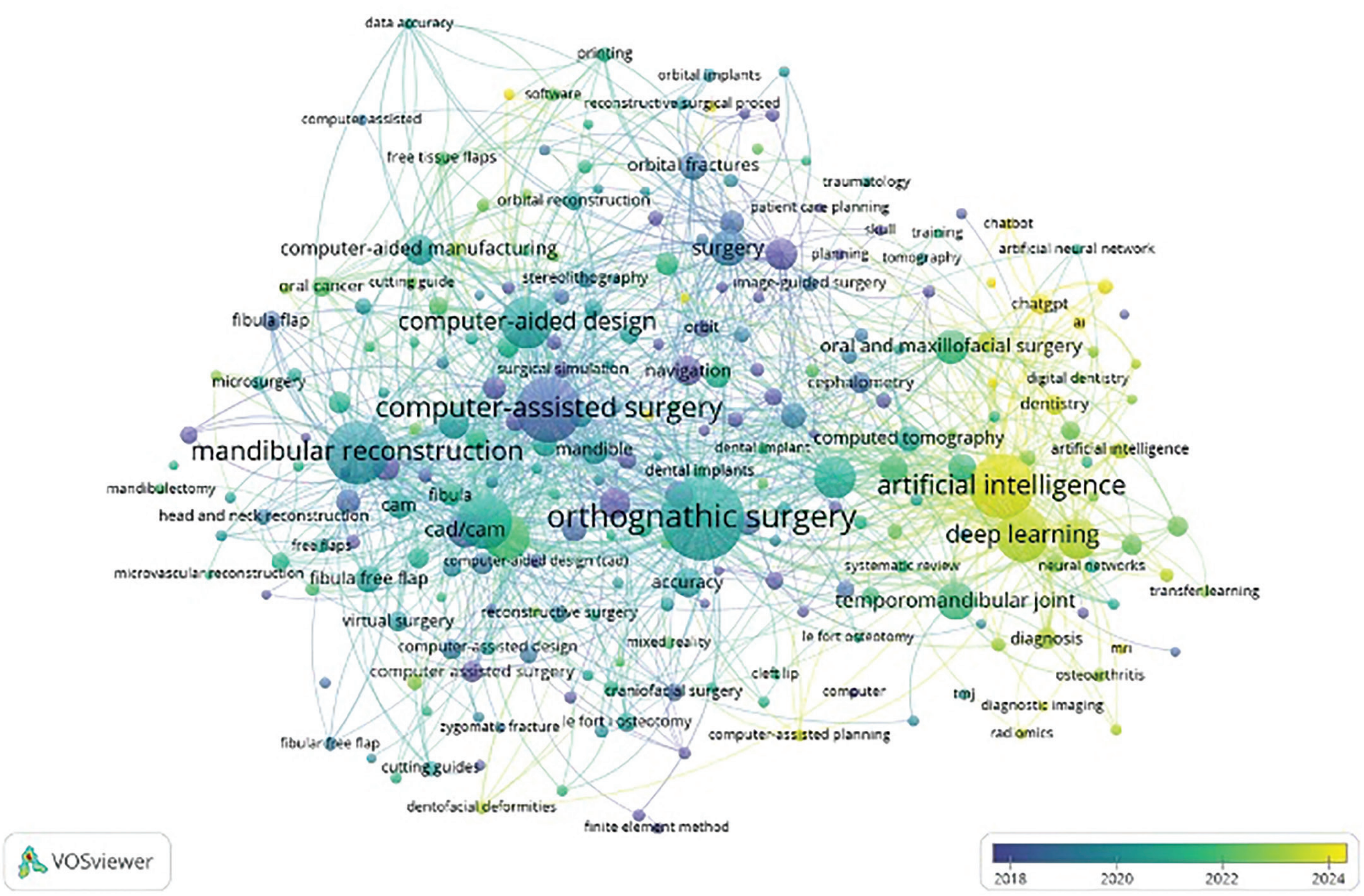

Figure 3. Overlay visualisation of keyword co-occurrence network. Colours indicate the average publication year of studies associated with each keyword, highlighting the shift toward deep learning and virtual surgical planning in recent years

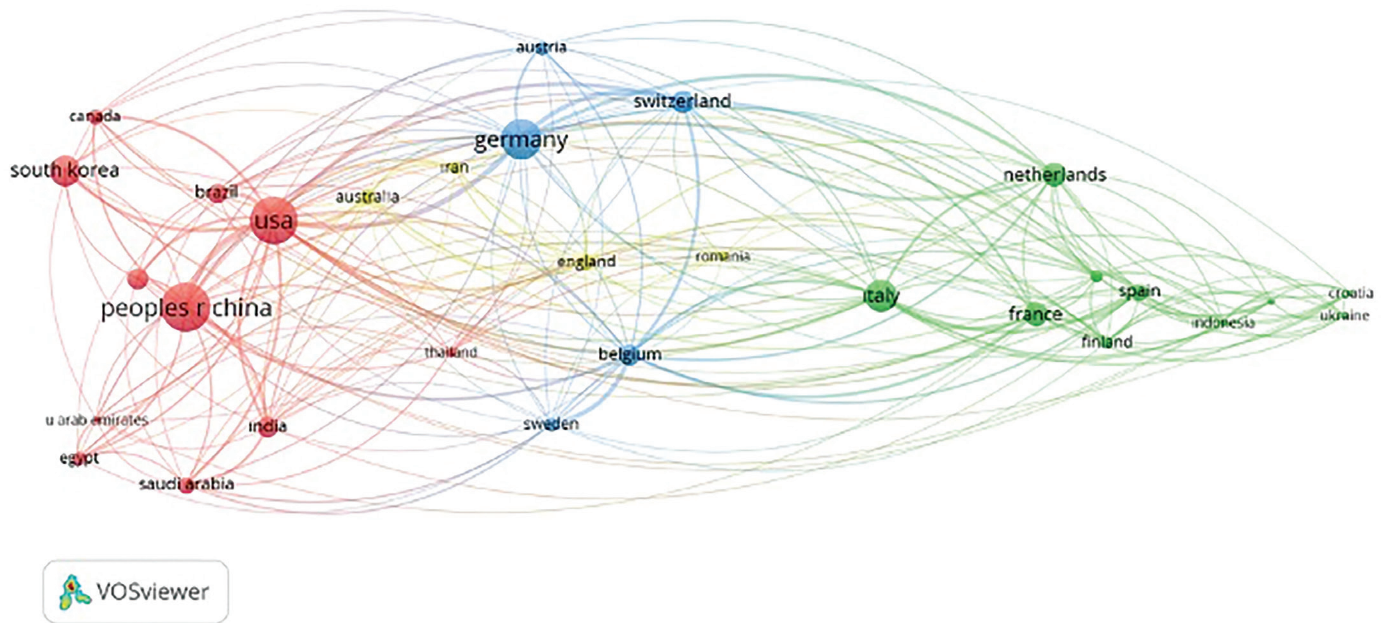

Figure 4. International collaboration network among countries, visualised using VOSviewer. Node size represents publication volume, and link strength reflects the intensity of international co-authorship connections

Table 3. Most frequent keywords related to artificial intelligence applications in oral and maxillofacial surgery		
Rank	**Keyword**	**Occurrences**
1	Orthognathic surgery	318
2	Computer-assisted surgery	244
3	Computer-aided design/CAD/CAM	224
4	Artificial intelligence	186
5	Mandibular reconstruction	179
6	Virtual surgical planning	172
7	3D printing	126
8	Deep learning	124
9	Maxillofacial surgery	81
10	Surgical navigation	77
11	Machine learning	76
12	Temporomandibular joint	65
13	Accuracy	41
14	Cone-beam computed tomography	37
15	Mandible	36
16	Orbital fractures	36
17	Patient-specific implants	29
18	Facial asymmetry	29
19	Cephalometry	22
20	ChatGPT	20
CAD/CAM: Computer-aided design/computer-aided manufacturing		

in previous reviews of AI applications in dentistry and surgical disciplines, where research productivity has been linked to early technological adoption, availability of large digital datasets, and targeted national research funding strategies (1,2,16). The country collaboration network further revealed dense collaborative clusters among high-output countries, suggesting that international co-authorship plays an important role in advancing AI-related OMFS research.

Institutional Productivity and Research Concentration

At the institutional level, AI-related OMFS research was primarily conducted within large academic centres and university-affiliated hospitals. This finding is consistent with observations in the broader healthcare AI literature, where access to advanced computational infrastructure, annotated datasets, and interdisciplinary expertise is often required to develop and validate AI-based systems (18). Systematic reviews focusing on OMFS have similarly noted that methodological innovation and clinical translation are frequently driven by specialised tertiary centres, which may limit the immediate applicability of AI tools in smaller clinical settings (19).

Author Productivity and Collaborative Research Groups

Author productivity analysis indicated that a relatively small group of researchers contributed a substantial proportion of publications in this field. Such authorship patterns are common in emerging research areas and typically reflect the presence of established research groups that function as focal points for

Table 4. The 10 most productive countries in AI-related OMFS publications (2025-2000).

Country	Number of publications	Percentage (%)
People's Republic of China	355	18.16
USA	344	17.60
Germany	252	12.89
Italy	157	8.03
South Korea	144	7.37
Japan	98	5.01
France	92	4.71
Switzerland	85	4.35
Netherlands	82	4.19
Belgium	70	3.58

AI: Artificial intelligence, OMFS: Oral and maxillofacial surgery

Table 5. Leading Institutions in AI-related OMFS Publications (2000-2025)

Rank	Institution	Publications	% of Total records
1	Shanghai Jiao Tong University	87	4.450%
2	Peking University	59	3.018%
3	Sichuan University	50	2.558%
4	Chang Gung Memorial Hospital	49	2.506%
5	Chang Gung University	44	2.251%
6	KU Leuven	40	2.046%
7	Seoul National University	38	1.944%
8	University of Hong Kong	37	1.893%
9	Harvard University	35	1.790%
10	University Hospital Leuven	35	1.790%

AI: Artificial intelligence, OMFS: Oral and maxillofacial surgery

Table 6. Most productive authors in AI-related OMFS publications (2000-2025)

Rank	Author	Publications	% of Total records
1	Gellrich NC	25	1.279%
2	Lo LJ	24	1.228%
3	Marchetti C	24	1.228%
4	Hölzle F	23	1.176%
5	Luo E	23	1.176%
6	Politis C	23	1.176%
7	Modabber A	22	1.125%
8	Schramm A	21	1.074%
9	Sun Y	21	1.074%
10	Lin HH	20	1.023%

AI: Artificial intelligence, OMFS: Oral and maxillofacial surgery

innovation and collaboration (19). Following manual author name disambiguation, no single author was found to dominate the literature overwhelmingly, suggesting that research on AI in OMFS is distributed across multiple active groups rather than centred around a single leading contributor. This distribution may facilitate methodological diversity and promote balanced scientific development within the field.

Thematic Evolution and Emerging Research Trends

Keyword co-occurrence and overlay analyses demonstrated a clear temporal shift in research focus over the study period. Early publications predominantly addressed computer-assisted surgery and basic image-processing techniques, whereas more recent studies increasingly emphasise deep learning, virtual surgical planning, and data-driven decision-support systems. Although not all 3D printing technologies are inherently AI-driven, their frequent integration within AI-supported digital surgical workflows justifies their inclusion in the present analysis. Comparable thematic transitions have been reported in reviews examining AI applications in implant dentistry and related digital workflows (20). Although several studies employed imaging-based data, these approaches were primarily integrated into surgical workflows rather than used as stand-alone radiological analyses, reinforcing the operative orientation of AI research in OMFS. The appearance of generative AI-related keywords, such as ChatGPT, reflects emerging interest in large language models (LLMs) for education, documentation, and decision-support tasks within OMFS. From a bibliometric perspective, the relatively low frequency of generative AI-related keywords compared with established surgical AI themes suggests that LLM-based applications remain an emerging and underrepresented research area within the OMFS literature. While AI has been extensively discussed in dentistry and broader clinical research with respect to its opportunities, limitations, and ethical challenges, the reflection of LLM-focused applications in OMFS publications remains limited. This discrepancy highlights a thematic gap between rapidly evolving AI methodologies and their current representation in OMFS-focused scientific literature, suggesting a potential direction for future research (16). From the perspective of AI research, current bibliometric analysis highlights several key trends and shortcomings. While deep learning-based approaches dominate recent literature, methodological heterogeneity, limited external validation, and reliance on retrospective single-center datasets remain prevalent. Mapping these patterns is essential to guide future AI model development efforts toward standardized evaluation frameworks, transparent reporting, and clinically robust validation strategies. Furthermore, the concentration of research activity in a limited number of

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institutions underscores the need for broader interdisciplinary and multicenter collaboration to improve the generalizability of AI-based systems in OMFS (18,21).

Clinical Implications and Future Directions

From a clinical perspective, the observed trends suggest that AI is becoming increasingly embedded in routine OMFS workflows, particularly in orthognathic surgery, mandibular reconstruction, trauma management, and computer-assisted surgical planning. Despite this progress, existing literature remains dominated by retrospective designs and single-centre datasets, which may constrain external validity and real-world implementation (19). Future research efforts should therefore prioritise multicentre collaboration, standardised evaluation protocols, and prospective validation studies to support the safe and effective integration of AI technologies into everyday OMFS practice. From a clinical medicine perspective, the rapid growth of AI-supported OMFS research underscores the increasing integration of digital technologies into surgical decision-making, planning accuracy, and intraoperative guidance. Understanding these trends is essential for clinicians to critically evaluate emerging AI tools and support evidence-based adoption in daily practice.

AI applications supporting imaging-based components of OMFS workflows are dominated by deep learning-based segmentation and classification tasks. Layered convolutional networks have achieved expert-level performance for 3D segmentation of the mandible and other craniofacial structures on CBCT (10,11), and several comparative studies report clinically acceptable accuracy for mandibular canal or defect segmentation, with substantial reductions in manual workload (11,12,14,22).

Taken together, the existing literature suggests that AI has substantial potential to enhance diagnosis, planning precision, and intraoperative guidance in OMFS, but translation into routine clinical practice will depend on rigorous validation, standardisation of workflows, and careful consideration of ethical issues such as data privacy and algorithmic bias (1-4,15,21).

Study Limitations

A limitation of this study is that the bibliometric analysis was based solely on the WoS Core Collection, which may not capture all relevant publications indexed in other databases such as Scopus or PubMed. However, WoS was chosen for its standardized indexing criteria and widespread use in citation-based and science-mapping analyses.

Conclusion

Over the last 25 years, research at the interface of AI and OMFS has expanded rapidly, shifting from early work on stereolithography and navigation to deep learning-based image analysis and fully digital surgical workflows. The present bibliometric analysis shows that orthognathic surgery, mandibular reconstruction, virtual surgical planning, and computer-assisted surgery constitute the main thematic hubs, with deep learning and 3D printing emerging as key enabling technologies.

Although the existing literature demonstrates that AI has considerable potential to enhance diagnostic accuracy, planning precision, and workflow efficiency in OMFS, the evidence base remains dominated by retrospective, single-centre studies. To translate AI tools into routine clinical practice, future research should focus on multicentre prospective validation, rigorous reporting standards, and careful evaluation of clinical and patient-reported outcomes. The science-mapping results presented here can help researchers and clinicians identify influential contributions, recognise gaps in current knowledge, and prioritise high-impact avenues for future investigation.

Notably, the limited representation of ethics-related keywords in the bibliometric findings stands in contrast to the growing ethical complexity of AI applications in OMFS, including data confidentiality, algorithmic bias, and clinical accountability. This mismatch highlights a critical research gap and underscores the need for more explicit and systematic ethical discourse in future OMFS-focused AI research.

Ethics

Ethics Committee Approval: This study followed a bibliometric and science-mapping design and was conducted in accordance with reporting recommendations for bibliometric analyses.

Informed Consent: Only published literature was analysed and no individual patient data were used, ethical approval was not required.

Footnotes

Authorship Contributions

Concept: CG.T., M.K.H., M.Ü., N.A.G., O.Y., Ö.O.G., Design: CG.T., M.K.H., Data Collection or Processing: CG.T., M.K.H., N.A.G., O.Y., Ö.O.G., Analysis or Interpretation: CG.T., M.Ü., N.A.G., O.Y., Ö.O.G., Literature Search: CG.T., M.K.H., N.A.G., O.Y., Ö.O.G., Writing: CG.T., M.K.H., M.Ü.

Conflict of Interest: No conflict of interest was declared by the authors.

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