

The Impending Obsolescence Of Traditional Dentistry: A Forecast Of AI Integration And Its Transformative Impacts

Aleksandar Naydenov¹

¹Department of Prosthetic Dental Medicine, Faculty of Dental Medicine, Medical University, Sofia

Citation: Aleksandar Naydenov. The Impending Obsolescence Of Traditional Dentistry: A Forecast Of AI Integration And Its Transformative Impacts. Int Dent Jour. 2025;4(3):1-14.

Received Date: 02 September, 2025; **Accepted Date:** 10 September, 2025; **Published Date:** 13 September, 2025

***Corresponding author:** Aleksandar Naydenov, Department of Prosthetic Dental Medicine, Faculty of Dental Medicine, Medical University, Sofia

Copyright: © Aleksandar Naydenov, Open Access 2025. This article, published in Int Dent Jour (IDJ) (Attribution 4.0 International), as described by <http://creativecommons.org/licenses/by/4.0/>.

ABSTRACT

The integration of artificial intelligence (AI) into dentistry is revolutionizing oral healthcare and is evolving from narrow task-specific models to potentially artificial general intelligence (AGI)-led practices. This narrative review synthesizes evidence from 45 sources, including peer-reviewed articles, books, reports, and leading specialists' conclusions (2005-2025), to examine current AI applications, their transformative impact and evolutionary forecasts regarding dental practices.

Current AI, mainly narrow systems like convolutional neural networks (CNNs) and generative adversarial networks (GANs) are enhancing treatment planning, designing, time and benefiting dentists with less errors. Patients benefit from personalized care. Dental technicians are granted streamlined workflows. Challenges include data biases, ethical concerns, and job displacement risks.

Our forecast has four stages: (1) AI surpassing dentists in diagnostics (2025-2035); (2) AI outperforming in virtual planning and construction (2025-2040); (3) AI surpassing dentists in real work execution (2025-2040); and (4) AGI lead dental practices - full autonomy across variable tasks is enabled (? - 2047).

Dentists may need to shift to supervisory roles while dental technicians face high risk of job loss. Patients will gain precision and affordable treatment but struggle with trust issues and data preservation.

Regulatory frameworks are needed to emphasize transparency, privacy, and equity. Curriculum reforms in dental universities will be needed to face new reality.

Keywords: Artificial Intelligence; Transformative; Automation; Job Loss; Forecast

INTRODUCTION

The integration of artificial intelligence (AI) into dentistry is reshaping oral healthcare, introducing great advancements in diagnostics, treatment planning, procedural execution and dental practice management (1). Current AI models in dentistry primarily use narrow AI, encompassing machine learning (ML) techniques such as supervised learning for classification tasks, unsupervised learning for clustering, and deep learning (DL) with models like artificial neural networks (ANNs), convolutional neural networks (CNNs), and generative adversarial networks

(GANs) [1]. These systems are used for detecting dental decays and periapical lesions from X-rays, predicting orthodontic outcomes, designing prosthetic restorations, and automating administrative processes like scheduling and patient communication and much more [2]. Some researchers are exploring even more advanced AI systems, including multimodal AI that integrates diverse data sources (e.g., imaging, genomics, and patient records) [3], and robotics for autonomous procedures, with long-term potential of artificial general intelligence (AGI) to perform all intellectual tasks a human dentist can undertake [4]. These advancements are promising transformative impacts across dental practice in all aspects.

AI has many benefits, such as improved diagnostic accuracy, reduced human error, and enhanced treatment planning through predictive analytics [2]. Patients benefit from faster diagnoses, personalized treatment plans, and improved outcomes, such as precise implant placements or aesthetically optimized smile designs. Dental technicians are facing streamlined workflows through AI-driven automation in digital designing and manufacturing which allows quicker production of high-quality restorations [5]. However, these benefits come with some challenges. Dentists face potential job displacement in routine tasks and the need for upskilling to understand and integrate with AI systems. Patients will have issues with trust due to AI's "black box" nature due to personal data storing, raising concerns about transparency and accountability. Dental technicians risk reduced demand for manual skills as automation increases, though new roles in AI system management emerge.

Limitations of current AI models include data biases which can undermine diagnostic or treatment outcomes [6]. Risks include ethical dilemmas, such as providing equal access to AI-driven care especially in low-middle-income countries [4]. Potential errors in all aspects can occur from over-reliance on AI without human intervention. Regulatory frameworks are evolving to address these concerns like some organizations such as International Dental Federation which emphasize the need for robust standards in safety, validation, and governance to ensure AI's safe and predictable integration. The FDI White Paper on AI underscores the importance of transparency, data privacy, and ethical oversight to mitigate risks while maximizing benefits [7].

This narrative review examines current AI applications, their impact, and forecasts evolutionary stages: (1) AI surpassing dentists in diagnostics (2025–2035); (2) AI outperforming in virtual planning and construction (2025–2040); (3) AI surpassing dentists in real work execution (2025–2040); and (4) AGI lead dental practices - full autonomy across variable tasks is enabled (? - 2047) and addressing the benefits, challenges, and regulatory considerations which occur. By providing a comprehensive overview we aim to guide dentists, dental technicians, policymakers and patients in the AI-driven future of dentistry, balancing technological innovation with ethical and patient centric care.

MATERIALS AND METHODS

This narrative review synthesizes information from peer-reviewed literature, books, videos, and other sources about AI's integration in dentistry and general. A systematic search was conducted across databases including PubMed, Scopus, Web of Science, Google Scholar, IEEE Xplore and others, using keywords such as "artificial intelligence in dentistry," "AI diagnostics dentistry," "AI treatment planning dental," "dental robotics," "AI forecasts dentistry," and "general AI dentistry." The search found publications from 2005 to July 2025, focusing on English-language once.

Inclusion criteria encompassed original research, reviews, case studies, books, conference proceedings, and videos demonstrating AI applications, performance metrics, and future projections. Exclusion criteria include non-AI studies. A total of 45 references were selected, comprising 26 peer-reviewed articles, 3 books, 1 video, and 15 other sources (e.g., conference proceedings, white papers, and reports), after screening abstracts (n=26) and full texts (n=44). Data extraction focused on AI types, current impacts, comparative performance with humans, and timeline forecasts.

RESULTS

Current Types of AI and Their Effects

Current AI in dentistry primarily consists of narrow AI, task-specific systems without human-like generality. This includes machine learning subsets: supervised learning for classification, unsupervised for clustering, and deep learning with multi-layered networks. Prominent models are ANNs for pattern recognition, CNNs for image analysis (e.g., caries detection), and GANs for synthetic data like 3D designs. These enhance diagnostic accuracy (e.g., CNNs reducing radiograph variability), treatment optimization (e.g., ML predicting implant success), and automation (e.g., DL in 3D printing). Benefits include faster workflows and better outcomes, but challenges like data biases persist.

Forecasts of AI Evolution in Dentistry

Forecasts for AI surpassing human capabilities in dentistry are based on current trends in ML/DL advancements, robotics, and data integration, though timelines vary due to ethical, regulatory, and technological hurdles. Predictions are drawn from AI publications, books, white papers, preprints, conference reports, as well as opinions of leading researchers in the field. The timeline of AI evolution stages is visible in [Figure 1](#).

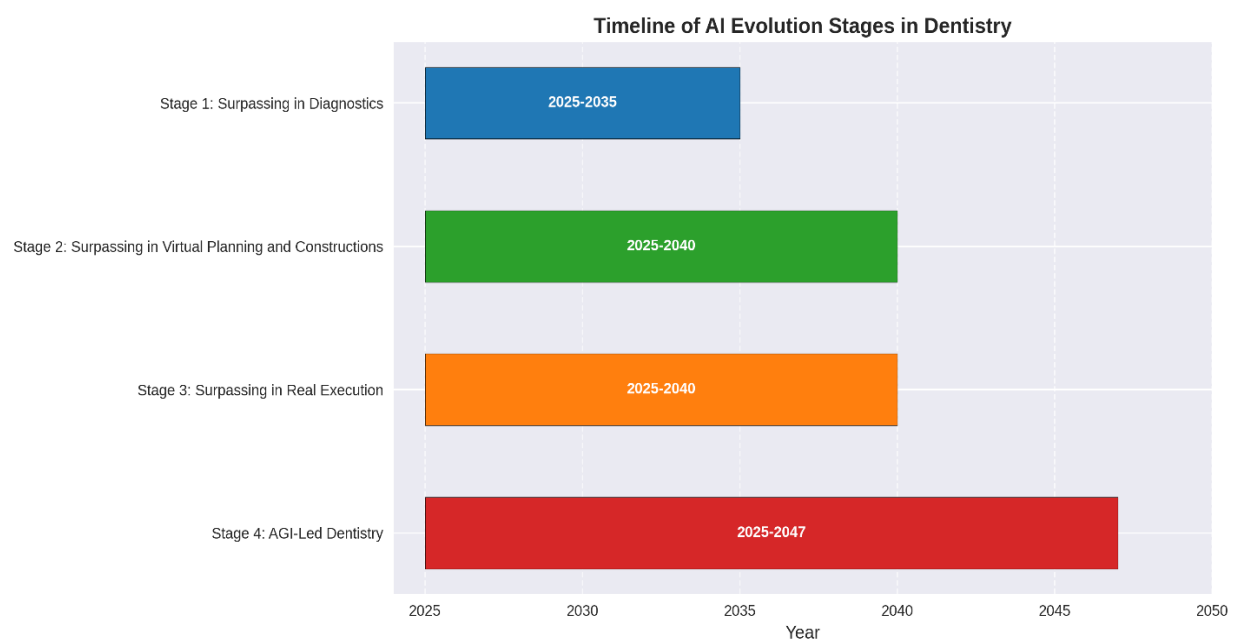


Figure 1: Projected Timeline of AI Evolution Stages in Dentistry (2025–2047). This diagram illustrates the four forecasted stages based on current trends, with overlapping periods reflecting parallel advancements in diagnostics, virtual planning, real execution.

Stage 1: Surpassing in Diagnostics (2025-2035)

AI is already surpassing dentists in specific diagnostic tasks, such as predicting tooth extractions from X-rays [8], detecting periapical lesions [9], where models like CNNs achieve higher accuracy (e.g., outperforming specialists in some studies).

AI tools also possess high accuracy in identifying and classifying dental implant systems using 2-dimensional X-ray images [10].

Broader surpassing, including multi-modal data integration (e.g., combining imagery, biomarkers, and history), is forecasted by 2030-2035, as refinements in DL enable predictive analytics for conditions like gum disease with near-perfect precision, reducing diagnostic errors and costs. This will shift dentists toward oversight roles.

This publication highlights AI's ability to surpass human specialists in specific diagnostic tasks for oral cancer, particularly in analyzing histopathological images and CT scans [11].

Since diagnosis of diseases is not made on a single data like X-ray or symptoms broader aspect of gathering connected information regarding the disease is important.

This PMC article reviews AI's role in combining multi-omics (genomics, proteomics as biomarkers) with imaging (CBCT, MRI) for enhanced diagnostics, improving accuracy by 25-40%. While no exact timeline is given, it forecasts future widespread adoption for precision dentistry, implying surpassing human variability in complex cases soon [12]. Panesar discusses AI surpassing humans in diagnostics via multi-modal integration, including structured data (clinical records/history), unstructured (images, communications), semi-structured (annotated X-rays), sensors (wearables for biomarkers like glucose/heart rate), genomics, and behavioral data. Forecasts include a WHO prediction of a 12.9 million healthcare worker shortage by 2035, implying AI will surpass human capacity in diagnostics and care. Within the "next decade", DNA profiling of embryos will integrate health status, risk profiles, and multi-modal data for surpassing traditional diagnostics [13].

This workshop-based book forecasts AI surpassing human diagnostics with multi-modal integration of imagery (scans), biomarkers (multi-omics/exposomics), history (electronic health records), geospatial data, and wearables. Topol notes AI's ability to "interpret medical scans... far beyond human capability," with multi-modal models (e.g., radiographs + lab results + notes) outperforming in pulmonary disease diagnosis [14]. Other sections predict enhanced disease risk predictions by layering exposome measures (biomarkers) with genetics and clinical data. Timeline: In 5 years (around 2028), AI like ChatGPT will equal skilled humans in scientific writing and predictive algorithms, with broader surpassing in health data integration by 2030-2035 through initiatives like UK BioBank for multi-omics [15]. Stephan Adelson states that by 2040 Self-care will become more effective and integrated into our daily lives through discoveries made by AI and advice offered by personal AI 'assistants' or 'agents' [16].

Judith Donath says "In computer-human interface design, the word 'agent' refers to chatbots and other seemingly autonomous entities that act on behalf of the computer in their interactions with us human users. It does not take a great leap of imagination to predict that soon many of us will ourselves similarly be computer agents, acting on behalf of one AI system or another – a role we will have willingly, even eagerly, chosen [16].

Stage 2: Surpassing in Virtual Planning and Constructions (2025-2040)

Even now we evidence AI tools which can outperform a dentist and dental technicians in designing prosthetic constructions like crowns over natural teeth. AI is much faster in designing while the quality is not less than human one. Regarding dental implantology, virtual planning in some cases is better performed by AI than humans. Smile design also is a procedure in which AI only enhances and outperforms doctors. In orthodontics the digital simulation of the treatment plan is fully AI performed and well adopted these days. Still there is no whole system which enables the use of AI for all dental procedures where the real need for human work is excluded. So yes, AI aids planning and virtual constructing with high accuracy, but full autonomy of the workflow can be expected around 2035-2040, exceeding human speed in personalized designs.

Artificial intelligence (AI) can achieve expert-quality implant planning with greater time efficiency and consistency than human intelligence (HI)-based methods [17].

“These technologies have the potential to streamline workflows, reduce human error, and improve the accuracy of clinical decisions, ultimately leading to better patient care” [18].

AI-generated smile designs were found to be preferred or comparable to manually-created designs [19].

"AI will transform industries, including healthcare, with tailored medical treatments using AI to combine data from genetic sequencing, diagnostics, and biomonitoring." The report suggests these AI-augmented processes will outperform traditional human-led design in speed, accuracy, and personalization for medical tools like tissues or implants [20].

Stage 3: Surpassing in real Execution (2025-2040)

In some branches of dentistry AI is integrated within robot systems and enables fully or partial autonomously of work even now a days. Dental implantology and prosthetic dentistry are the leading subjects integrating such novel approaches of treating patients. Yet there is no such system incorporating AI and robotics for wholesome dental treatment in all dental domains. In the next decade the constant evolution of these systems could lead to a point where the dentist will be only observing the process of treating the patient and will interact only if there is a problem in the treatment process. For that purpose, a capable AI system must be integrated within sophisticated dental hardware capable of executing autonomous tasks. Still the doctor should be the one bearing responsibility for the whole treatment process.

Recent clinical study in 2024 found that in 74 patients treated autonomously by the FZ DISAS I robot (by Sichuan Fengzhun & Kavacol) is demonstrated superior or comparable precision to traditional static and dynamic computer-guided methods-offering real-time automation with minimal human intervention [21].

Zonghe Xu found in their in vitro study that dynamic and robotic computer-aided implant surgery may show good implant accuracy. As well as that the accuracy and stability of implant robots are higher than those of dynamic navigation systems [22].

The 2017 CGTN report provides a real-world example of an AI-driven robot in China autonomously placing dental implants with higher precision (0.2-0.3 mm) than typical human performance (0.5-1.0 mm). This is supported by secondary sources noting the robot's accuracy and consistency advantages. However, the system still required human oversight, and its application was limited to implant placement. AI eliminates human factors like fatigue or hand

tremors, ensuring consistent outcomes. The robot uses extensive preoperative data and real-time imaging, allowing for precise planning and execution that can outperform human estimation in standardized cases [23].

Lei Wang report for ablation experiment which results show that the movement range and the resolution of the robotic system for three-dimensional tooth crown preparation using a picosecond laser can meet the requirements of typical dental operations for tooth crown preparation. The errors of tooth shape and preparation angle are found to satisfy the requirements of real clinical crown preparation [24].

A robot was also used for tooth-arrangement [25]. A 3D virtual tooth-arrangement program was developed using OpenGL and VC++. This application performs several key functions: (a) it allows users to create or access files containing patient medical histories, and to construct dental arch curves and jaw arches based on expert knowledge tailored to the patient's jaw dimensions; (b) it provides a 3D visualization of virtual teeth on the screen, enabling the adjustment of individual tooth positions. The robot system offers a repeatability accuracy of ± 0.05 mm, a peak linear speed of 4.35 m/s, and a maximum carrying capacity of 3 kg [26].

Moreover, AI systems integrated within robots are described as being used in oral and maxillofacial surgery, endodontics, orthodontics, oral radiology and dental education. Oral and Maxillofacial Surgery: Robots like da Vinci enable minimally invasive transoral procedures for cancers and sleep apnea, improving precision, reducing errors, and enhancing outcomes (e.g., lower morbidity in studies). Endodontics: Assist in root canal therapy by supplying tools or using micro-robots to eradicate biofilms, boosting precision and infection control. Orthodontics: Used for bending arch-wires in malocclusion treatment via systems like SureSmile, ensuring reproducibility and personalized appliances. Oral Radiology: Position X-ray equipment and perform subtraction radiography, minimizing radiation exposure and improving image quality through high dexterity. Dental Education: Facilitate training with patient simulators (e.g., SIMROID), VR haptics, and demonstrations, enhancing realism and skill development in procedures like anesthesia and prosthodontics [27].

Yuan et al describes a tooth preparation robotic system, consisting of a 6-DOF robotic arm, a low-heat laser, a tooth fixture, and CAD/CAM software for 3D motion path generation. This system autonomously prepares teeth for crowns using laser ablation. It achieved a precision of 0.089 ± 0.026 mm, significantly better than human clinicians (typically 0.1-0.5 mm). A comparison with a human clinician using a rotating diamond tool showed the robotic system's repetition accuracy (~ 40 μ m) was superior. Compared to humans the robotic system minimizes soft tissue damage and ensures consistent preparation, reducing complications like pulp inflammation compared to human handpiece use [28].

Anonymous respondent which is well-known internet standards developer wrote, "By 2040, almost 75% of all employees will be laid off and replaced with AI. Corporate takeover artists will acquire public companies, fire most of the employees, and turn the work over to AI. By 2040 over half of U.S. colleges will have closed, and many of the remaining institutions will have been taken over by private equity. There will be hospitals with virtually no doctors, only nurses and AI. In restaurants, food will be prepared and delivered by robots. [16]"

Stage 4: AGI take the lead in Dentistry (? - 2047)

Artificial General Intelligence (AGI) refers to a type of artificial intelligence that possesses the ability to understand, learn, and perform any intellectual task that a human can do, across a wide range of domains. Unlike narrow AI, which

is designed for specific tasks (e.g., image recognition or chess playing), AGI can generalize its intelligence to any problem, adapt to new environments, and exhibit reasoning, creativity, and problem-solving capabilities comparable to or surpassing human cognition. AGI is characterized by its flexibility, autonomy, and ability to handle unfamiliar tasks without requiring task-specific programming [29].

A survey of 2,778 AI researchers reported a median expectation of AGI to become real by 2047, with a 10% chance by 2027. This reflects a shift from their 2022 survey (median 2060), driven by unexpected progress in LLMs like GPT-4 [30].

There are Some Industry Leaders which predict even sooner time revealing of the AGI: Sam Altman (OpenAI) stated in 2025 that AGI could arrive by 2025–2030(31), [32]. Dario Amodei (Anthropic) predicts AGI by 2026–2027, defining it as AI smarter than a Nobel Prize winner across most fields [33]. Demis Hassabis (Google DeepMind) estimates AGI in 5-10 years (2030–2035), emphasizing challenges in generalizing beyond controlled environments [34]. Elon Musk said that if we define AGI as smarter than the smartest human, he think it's probably next year, within two years, suggesting AGI by the end of 2025 or 2026 [35]. The “Godfather of AI” Geoffrey Hinton saying we are going to have AGI up to next 20 years or sooner [36].

AGI could streamline administrative tasks (e.g., scheduling, billing, inventory) and optimize practice workflows by analyzing large datasets for efficiency. Dental practices could become more efficient, reducing costs. It could also revolutionize dental education by creating immersive, personalized training environments using virtual reality (VR) or augmented reality (AR). However, AGI's ability to train students autonomously might disrupt traditional dental education, requiring new curricula focused on AGI collaboration and ethical oversight.

AGI's ability to perform most dental tasks could reduce demand for general dentists, particularly in routine procedures. A survey show job loss to be the main disadvantage of AI in dentistry as well new challenges on doctor–patient relationships [37].

AGI's “black-box” nature could raise issues of transparency, bias, and data privacy. Patients and professionals may question accountability if AGI errors lead to adverse outcomes.

AGI integration will require robust standards for safety, validation, and governance, as highlighted in the FDI White Paper on AI [3]. Dentists will need to adapt by specializing in AGI oversight, ethics, and patient-centric care, potentially redefining the profession as a blend of technology management and clinical expertise.

AGI could enhance access to dental care in underserved areas (e.g., low-middle-income countries) by powering teledentistry or autonomous clinics. It could analyze population data to predict oral health trends and optimize preventive strategies. This could democratize care but exacerbate inequalities if AGI systems are costly or inaccessible in resource-poor settings, as noted from Fahad Umer et al [38].

All cited sources upon which the forecast is made are listed in Table 1.

Table 1: Cited References upon which is made the forecast for AI evolution in dentistry. The type of the cited reference is mentioned and its purpose. Totally 32 sources are listed.

Number	Type	Purpose
1(3)	Journal Article	Highlighting the need for robust standards in safety, validation, and governance for AGI integration in dentistry.
2(8)	Journal Article	Predicting tooth extractions from X-rays, surpassing dentists in specific diagnostic tasks.
3(9)	Journal Article	Detecting periapical lesions, achieving higher accuracy than specialists.
4(10)	Journal Article	Identifying and classifying dental implant systems using 2-dimensional X-ray images.
5(11)	Journal Article	Surpassing human specialists in diagnosing oral cancer through analysis of histopathological images and CT scans.
6(12)	Journal Article	Combining multi-omics (genomics, proteomics as biomarkers) with imaging for enhanced diagnostics, improving accuracy by 25-40%.
7(13)	Book	Surpassing humans in diagnostics via multi-modal integration of various data including clinical records, images, biomarkers, genomics, etc.
8(14)	Book	Surpassing human diagnostics with multi-modal integration of imagery, biomarkers, history etc.; interpreting medical scans beyond humans.
9(15)	Conference Proceedings/Report	Enhancing environmental and biomedical data integration through multimodal AI.
10(16)	Report	Forecasting self-care integration through AI discoveries and personal AI assistants; predicting job displacement including in healthcare.
11(17)	Journal Article	Achieving expert-quality implant planning with greater time efficiency and consistency.
12(18)	Journal Article	Streamlining workflows, reducing human error, and improving accuracy in clinical decisions for better patient care.
13(19)	Journal Article	Generating smile designs that are preferred or comparable to manually-created designs.
14(20)	Report	Transforming healthcare using AI; outperforming traditional human-led design in speed, accuracy, and personalization.
15(21)	Journal Article	Autonomous dental implant placement with superior or comparable precision to traditional methods.
16(22)	Journal Article	Improving accuracy and stability in implant surgery using dynamic and robotic computer-aided systems.
17(23)	News Article	Autonomous placement of dental implants with higher precision than human performance.
18(24)	Journal Article	Three-dimensional tooth crown preparation using a picosecond laser, meeting requirements for tooth shape and preparation angle.
19(25)	Journal Article	Manufacturing complete dentures using a robotic system.
20(26)	Journal Article	Reviewing robotic applications in prosthodontics and orthodontics, including tooth-arrangement with high accuracy and speed.
21(27)	Journal Article	Applications in oral and maxillofacial surgery, endodontics, orthodontics, oral radiology, and dental education, improving precision and outcomes.
22(28)	Journal Article	Autonomous tooth preparation for crowns using laser ablation with superior precision to human clinicians.
23(29)	Book	Defining and discussing Artificial General Intelligence (AGI) capabilities.
24(30)	Preprint	Surveying AI researchers on timelines for AGI realization.
25(31)	Blog/Online Article	Predicting AGI arrival by 2025–2030.
26(32)	Blog Post	Industry leader prediction on AGI timelines.
27(33)	Essay/Blog	Predicting AGI by 2026–2027.
28(34)	Magazine Article	Estimating AGI in 5–10 years (2030–2035).
29(35)	News Article	Predicting AGI by the end of 2025 or 2026.
30(36)	Video	Predicting AGI within the next 20 years or sooner.
31(37)	Journal Article	Surveying disadvantages of AI in dentistry, including job loss and challenges to doctor-patient relationships.
32(38)	Journal Article	Enhancing access to dental care in underserved areas through AGI-powered teledentistry or autonomous clinics.

DISCUSSION

Artificial intelligence (AI) is increasingly integrated into tools used by dentists and dental technicians to perform everyday tasks in clinical and laboratory settings. In recent years, AI has been incorporated into nearly every software and hardware system in dentistry, from diagnostic imaging to CAD/CAM systems. Beyond dentistry, AI is beginning to replace humans in executing specific tasks across various professions, marking a significant shift. The World Economic Forum's 2025 "Future of Jobs Report" projects that 92 million jobs globally could be displaced by 2030 due to automation (including AI) [39]. A prediction by KRIVS states that by 2030, AI can be the cause of job displacement among an enormous range of industries. Since 2022, no jobs were anymore categorized as "low risk" for replacement. Dental professionals were included in the "medium-risk" group, along with 461 other job categories [40]. Previously, only physical tasks, such as milling processes in CAD/CAM systems, were automated. Now, with AI's evolution, cognitive processes like reasoning and decision-making are being delegated to AI systems, which often outperform humans due to their ability to process vast amounts of data. This development raises questions about the future roles of dentists and dental technicians as AI surpasses human capabilities in tasks traditionally considered exclusive to human intellect [41].

Dental technicians face a significant risk of job displacement due to AI-driven systems. This source specifically addresses the automation risk for dental laboratory technicians, estimating a 75% probability of automation, placing it in the "High Risk" category (61-80% chance of automation) [42]. Their work often involves less need for correlating real-time patient data with treatment plans, making it more susceptible to automation. For instance, AI can now design a single crown over a natural tooth in seconds (via ExoCad TM 3Shape TM, etc), export the file, and produce it in a dental office, reducing manual labor. Although current AI applications in prosthodontics are limited, they are evolving rapidly. We consider that the future role of dental technicians will shift toward quality control of AI-designed and produced restorations, with occasional manual adjustments for final tuning.

Dentists are also at risk of being outperformed by AI, particularly in tasks involving data correlation. Multimodal AI systems are expected to reshape dentistry in integrating patient data (e.g., imaging, biomarkers, and clinical history) for diagnostics [6]. AI already excels in treatment planning and virtual design of restorations, such as implant placements and orthodontic simulations, enabling dentists to save time and treat more patients with high precision. Keeping transparency, standardizing evaluation criteria, and prioritizing clinical relevance are from great importance for integration of effective AI in dentistry [43]. However, AI's role in procedural execution remains underdeveloped across most dental domains, requiring further advancements in robotics and automation. When fully autonomous systems are developed, capable of performing all tasks currently handled by dentists, the dentist's role will likely shift to supervising the treatment process-from diagnosis to execution-intervening only in cases of system errors. Nevertheless, we consider dentists will likely retain responsibility for overseeing and approving AI decisions at every step.

The introduction of artificial general intelligence (AGI) will be a game-changer for dentistry. AGI, capable of performing any intellectual task a human can, is projected to emerge by 2047, with some estimates suggesting as early as 2025-2030. With advanced hardware, AGI could replace dentists and dental technicians in every task, requiring minimal human intervention [44]. In such scenarios, we consider that responsibility for treatment outcomes should be

shared between AI systems and dentists, particularly if scientific evidence demonstrates AGI's superior speed and decision-making accuracy. If a dentist agrees with an AGI's diagnosis or treatment plan and an issue arises, shared accountability may be appropriate, given AGI's proven reliability. However, it remains unclear whether the critical doctor-patient relationship, essential for treatment success, will be preserved when AI-driven hardware performs procedures. Concerns about trust, transparency, and the "black-box" nature of AI systems could challenge this relationship [7].

The discussed timelines for AI's evolution in dentistry - diagnostics (2025-2035), virtual planning and construction (2025-2040), real execution (2025-2040), and AGI-led dentistry (?-2047)-are based on trends in AI development, dental market dynamics, scientific publications, books, and interviews with AI industry leaders. These timelines are subject to change, heavily influenced by regulatory frameworks [45]. The mentioned year 2025 means that the process has already started in aspects, while the time standing behind the mark - "?" for the beginning of the 4th stage means that it is questionable when it will happen. Even if AGI become reality in 2025, still much sophisticated hardware, then existing nowadays will be needed to achieve full anatomy of action in dental practices, the regulations could be one more obstacle for fast integration. For instance, the FDI White Paper on AI emphasizes the need for robust regulations to address data privacy, bias, and accountability to ensure safe AI integration [7]. Delays or advancements in these regulations could either postpone or accelerate AI's adoption in dentistry.

CONCLUSION

The integration of AI into dentistry, as outlined in four evolutionary stages: (1) AI surpassing dentists in diagnostics (2025-2035); (2) AI outperforming specialists in virtual planning and construction (2025-2040); (3) AI surpassing dentists in real work execution (2025-2040); (4) AGI lead dental practices (? - 2047) - some of which are already happening, signals progressive role erosion: dentists shifting from active treatment to supervision, while dental technicians face near-total replacement as AI automates design, fabrication, and workflows.

Patients will greatly benefit from AI's precision, personalization, reduced errors, streamlined procedures, and enhanced access via teledentistry, elevating outcomes and care quality.

To ensure a safe transition, regulations must prioritize data privacy, transparency, bias mitigation, and shared accountability, fostering trust among dentists, patients, technicians and all AI systems.

University programs should reform curricula with AI literacy, machine learning, robotics, ethics, and interdisciplinary training, plus lifelong learning due to the temp of constant changes.

Dentists must adapt to their new upcoming role in the dental office through upskilling in AI knowledge.

REFERENCES

1. [Khanagar SB, Al-Ehaideb A, Maganur PC, Vishwanathaiah S, Patil S, Baeshen HA, et al. Developments, application, and performance of artificial intelligence in dentistry - A systematic review. J Dent Sci. 2021;16\(1\):508-22.](#)
2. [Schwendicke F, Singh T, Lee JH, Gaudin R, Chaurasia A, Wiegand T, et al. Artificial intelligence in dental research: Checklist for authors, reviewers, readers. Journal of Dentistry. 2021;107:103610.](#)
3. [Tuygunov N, Samaranayake L, Khurshid Z, Rewthamrongsrir P, Schwendicke F, Osathanon T, et al. The Transformative Role of Artificial Intelligence in Dentistry: A Comprehensive Overview Part 2: The Promise and Perils, and the International Dental Federation Communique. Int Dent J. 2025;75\(2\):397-404.](#)
4. [Fawaz P, Sayegh PE, Vannet BV. What is the current state of artificial intelligence applications in dentistry and orthodontics? J Stomatol, Oral Maxillofac Surg. 2023;124\(5\):101524.](#)
5. [Lin GSS, Ng YS, Ghani NRNA, Chua KH. Revolutionising dental technologies: a qualitative study on dental technicians' perceptions of Artificial intelligence integration. BMC Oral Health. 2023;23\(1\):690.](#)
6. [Gao S, Wang X, Xia Z, Zhang H, Yu J, Yang F. Artificial Intelligence in Dentistry: A Narrative Review of Diagnostic and Therapeutic Applications. Med Sci Monit. 2025;31:e946676.](#)
7. [Schwendicke F, Blatz M, Uribe S, Cheung W, Verma M, Linton J, et al. Artificial Intelligence for dentistry.](#)
8. [Motmaen I, Xie K, Schönbrunn L, Berens J, Grunert K, Plum AM, et al. Insights into Predicting Tooth Extraction from Panoramic Dental Images: Artificial Intelligence vs. Dentists. Clin Oral Investig. 2024;28\(7\):381.](#)
9. [Güneç HG, Ürkmez EŞ, Danacı A, Dilmaç E, Onay HH, Cesur Aydın K. Comparison of artificial intelligence vs. junior dentists' diagnostic performance based on caries and periapical infection detection on panoramic images. Quant Imaging Med Surg. 2023;13\(11\):7494-503.](#)
10. [Accuracy of Artificial Intelligence Models in Dental Implant Fixture Identification and Classification from Radiographs: A Systematic Review \[Internet\]. \[cited 2025 Jul 16\].](#)
11. [Sahoo RK, Sahoo KC, Dash GC, Kumar G, Baliarsingh SK, Panda B, et al. Diagnostic performance of artificial intelligence in detecting oral potentially malignant disorders and oral cancer using medical diagnostic imaging: a systematic review and meta-analysis. Front Oral Health \[Internet\]. 2024 Nov 6 \[cited 2025 Jul 16\];5.](#)
12. [Das N. Advancing precision dentistry: the integration of multi-omics and cutting-edge imaging technologies- a systematic review. Front Dent Med. 2025;6:1581738.](#)
13. [Panesar A. Machine Learning and AI for Healthcare: Big Data for Improved Health Outcomes \[Internet\]. Berkeley, CA: Apress; 2021 \[cited 2025 Jul 16\].](#)
14. [Panesar A. Machine Learning and AI for Healthcare: Big Data for Improved Health Outcomes \[Internet\]. Berkeley, CA: Apress; 2021 \[cited 2025 Jul 16\].](#)
15. [Standing Committee on Emerging Science for Environmental Health Decisions, Board on Environmental Studies and Toxicology, Board on Life Sciences, Board on Mathematical Sciences and Analytics, Division on Earth and Life Studies, Division on Engineering and Physical Sciences, et al. Advances in Multimodal](#)

- Artificial Intelligence to Enhance Environmental and Biomedical Data Integration: Proceedings of a Workshop-in Brief [Internet]. Luhachack L, Armstrong N, editors. Washington, D.C.: National Academies Press; 2023 [cited 2025 Jul 16].
16. Rainie L, Anderson J. Experts Imagine the Impact of Artificial Intelligence by 2040.
 17. Elgarba BM, Fontenele RC, Mangano F, Jacobs R. Novel AI-based automated virtual implant placement: Artificial versus human intelligence. J Dent. 2024;147:105146.
 18. Afrashtehfar KI, Abuzayeda MA, Murray CA. Artificial Intelligence in Reconstructive Implant Dentistry- Current Perspectives. Prosthesis. 2024;6(4):767-9.
 19. Ceylan G, Özel GS, Memişoglu G, Emir F, Şen S. Evaluating the Facial Esthetic Outcomes of Digital Smile Designs Generated by Artificial Intelligence and Dental Professionals. Applied Sciences. 2023;13(15):9001.
 20. Global Trends 2040 : A More Contested World. Washington, D.C.: National Intelligence Council; 2021.
 21. Wu Y, Zou S, Lv P, Wang X. Accuracy of an autonomous dental implant robotic system in dental implant surgery. J Prost Dent. 2025;133(3):764-70.
 22. Xu Z, Zhou L, Han B, Wu S, Xiao Y, Zhang S, et al. Accuracy of dental implant placement using different dynamic navigation and robotic systems: an in vitro study. NPJ Digit Med. 2024;7(1):182.
 23. South China Morning Post [Internet]. 2017 [cited 2025 Jul 16]. Robot dentist is first to fit implants without a human touch.
 24. Wang L, Wang D, Zhang Y, Ma L, Sun Y, Lv P. An automatic robotic system for three-dimensional tooth crown preparation using a picosecond laser. Lasers Surg Med. 2014;46(7):573-81.
 25. Robotic system approach for complete denture manufacturing | IEEE Journals & Magazine | IEEE Xplore [Internet]. [cited 2025 Jul 16].
 26. A Review on Robot in Prosthodontics and Orthodontics - Jin-gang Jiang, Yong-de Zhang, Chun-ge Wei, Tian-hua He, Yi Liu, 2015 [Internet]. [cited 2025 Jul 16].
 27. Ahmad P, Alam MK, Aldajani A, Alahmari A, Alanazi A, Stoddart M, et al. Dental Robotics: A Disruptive Technology. Sensors. 2021;21(10):3308.
 28. Yuan FS, Wang Y, Zhang YP, Sun YC, Wang DX, Lyu PJ. Study on the appropriate parameters of automatic full crown tooth preparation for dental tooth preparation robot. Zhonghua Kou Qiang Yi Xue Za Zhi. 2017;52(5):270-3.
 29. Goertzel B, Pennachin C, editors. Artificial General Intelligence [Internet]. Berlin, Heidelberg: Springer Berlin Heidelberg; 2007.
 30. Grace K, Stewart H, Sandkühler JF, Thomas S, Weinstein-Raun B, Brauner J. Thousands of AI Authors on the Future of AI [Internet]. arXiv; 2024. 2025.
 31. OpenAI CEO Sam Altman Predicts Artificial General Intelligence by 2025: Is AGI Within Reach? – Impact Lab [Internet]. 25025.
 32. Sam Altman [Internet]. [cited 2025 Jul 16]. Three Observations. 2025.
 33. Dario Amodei — Machines of Loving Grace [Internet]. 2025.

34. FinTech Magazine Article [Internet]. 2025 [cited 2025 Jul 16]. The Race Toward Artificial General Intelligence (AGI): Progress, Skepticism, and Real-World Focus - FinTech Weekly. 2025.
35. Tesla's Musk predicts AI will be smarter than the smartest human next year | Reuters [Internet]. 2025.
36. Godfather of AI: I Tried to Warn Them, But We've Already Lost Control! Geoffrey Hinton [Internet]. 2025.
37. Ayad N, Schwendicke F, Krois J, van den Bosch S, Bergé S, Böhner L, et al. Patients' perspectives on the use of artificial intelligence in dentistry: a regional survey. Head & Face Medicine. 2023;19(1):23.
38. Umer F, Adnan S, Lal A. Research and application of artificial intelligence in dentistry from lower-middle income countries – a scoping review. BMC Oral Health [Internet]. 2024;24(1).
39. World Economic Forum (WEF). Future of Jobs Report 2025 [Internet]. Geneva: World Economic Forum; 2025.
40. Dental Professionals at Relatively Low Risk of AI-induced Job Displacement, Korean Study says | DENTAL RESOURCE ASIA [Internet]. 2025.
41. Frey CB, Osborne MA. The future of employment: How susceptible are jobs to computerisation? Technological Forecasting and Social Change. 2017;114:254-80.
42. Will Dental Laboratory Technicians be replaced by AI & Robots? 2025.
43. Lal A, Nooruddin A, Umer F. Concerns regarding deployment of AI-based applications in dentistry – a review. BDJ Open. 2025;11(1):27.
44. Examples of Artificial General Intelligence (AGI) | IBM [Internet]. 2024.
45. AI Governance in a Complex and Rapidly Changing Regulatory Landscape: A Global Perspective. 2024.