REVIEW ARTICLE

CHATGPT in Periodontology: Revolutionizing Dental Practice

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ABSTRACT

Periodontology focuses on the prevention, diagnosis, and treatment of diseases affecting the gingiva and supporting structures of the teeth and is fundamental to maintaining overall oral health. Recent technological advancements have increasingly influenced dental practice, including the emergence of artificial intelligence applications such as ChatGPT. ChatGPT is an artificial intelligence–powered chatbot that uses natural language processing to generate human-like responses and has shown potential utility in healthcare settings. In dentistry, its proposed applications include disease risk assessment, information retrieval, patient education, appointment scheduling, and clinical decision support. Despite growing interest in artificial intelligence, there remains limited research on the use of ChatGPT within dentistry, and currently no published studies specifically address its application in periodontics. This review compiles and analyzes findings from 26 relevant publications identified through electronic searches of PubMed and Google Scholar between 2021 and 2023 to explore the potential role of ChatGPT in periodontal practice and research. While direct evidence in periodontics is lacking, existing literature from broader dental and healthcare contexts suggests that natural language processing models may assist in answering clinical queries, improving communication between clinicians and patients, and supporting administrative tasks. Future integration of ChatGPT into periodontal care may include virtual consultations, symptom triaging, automated follow-up reminders, and literature synthesis to support evidence-based practice. As artificial intelligence technologies continue to evolve, further empirical research is required to evaluate their accuracy, reliability, ethical considerations, and clinical applicability within periodontology.
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INTRODUCTION

Periodontology, a specialized discipline in the field of dentistry, plays a crucial part in maintaining oral health by concentrating on the prevention, identification, and management of conditions that impact the gums and the teeth's supporting tissues. The practice of periodontology has a rich history of adapting to technological advancements, and its latest frontier is the integration of artificial intelligence, with Chat Generative Pre-trained Transformer (ChatGPT) at the forefront. ChatGPT is a computer program rooted in artificial intelligence (AI), meticulously trained on extensive datasets to generate human-like responses to user queries. Its goal is to improve communication efficacy, the discipline of computational linguistics, and the general responsiveness of AI chatbots. This is accomplished by using methods like deep learning and machine learning, mostly in text-based interfaces, and it also generates responses to natural language inquiries that are human-like, making it a very big language model (1).

ChatGPT can provide healthcare professionals in the fields of dentistry and healthcare with a variety of services, such as improved diagnosis, decision-making support, digital data recording, image analysis, disease prevention, disease treatment, fewer treatment errors, and exploration and research opportunities. In particular, ChatGPT can benefit patients who are having surgery by answering their medical questions, teaching them before and after the treatment, and giving them a realistic expectation of how the surgery will go. By improving patient empowerment and independence, increasing service efficacy and safety, improving sustainability, increasing access to and quality of care, or empowering and enabling patients, these ChatGPT applications should demonstrate a substantial advantage

in both health care and periodontics (2). ChatGPT, with its exceptional natural language processing capabilities, offers a wealth of possibilities within periodontology, from revolutionizing education and training to enhancing diagnostic accuracy, treatment planning, patient communication, and research endeavors. Moreover, the advent of telemedicine has opened up new avenues for remote consultations, and ChatGPT is well-suited to play a vital role in this expanding domain. As this review article delves deeper into the applications and implications of ChatGPT in periodontology, it becomes evident that this technology holds the potential to optimize patient care, improve the professional development of dental practitioners, and contribute to the ever-evolving body of knowledge within the field. The following sections will explore how ChatGPT stands as a revolutionary tool in the service of oral health, providing a comprehensive overview of its impact on periodontology.

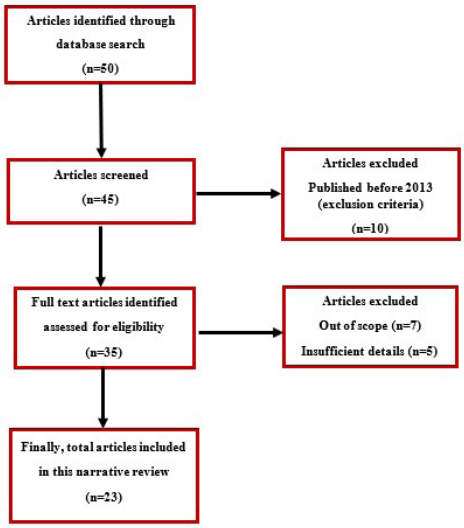

Figure 1: PRISMA flow diagram of articles screening and selection

METHODS

Search strategy

This study conducted a thorough evaluation of published studies that addressed the application of ChatGPT in the healthcare and periodontal domains. What is the advantage of ChatGPT over other approaches in dentistry and other medical disciplines like periodontics? This question was answered using the population, intervention, control, and outcomes (PICO) framework. Relevant publications were gathered from a variety of databases, including PubMed and Google Scholar. ChatGPT in periodontics has been the subject of a comprehensive electronic literature search from 2021 to 2023 using PubMed and Google Scholar databases with relevant keywords. Combinations of the following keywords were used for the identification of the studies to be considered in this review: “periodontics,” “ChatGPT,” “Dentistry,” and “health care.” Selected article references were examined in order to increase the scope of the search for pertinent papers. Overall, by considering several published papers, this study investigated the usefulness of ChatGPT in dentistry and healthcare. (Figure 1)

The inclusion criteria is studies involving implementation of ChatGPT in dentistry and periodontics. The exclusion criteria is case reports, case series.

ARTIFICAL INTELLIGENCE IN DENTISTRY

Artificial intelligence (AI) advancements have raised hopes and fears in the medical field, especially in the field of dentistry. AI has the power to transform healthcare and advance dental care, despite these reservations. In order to ensure that AI is applied to improve dental care, lower costs, and benefit patients, providers, and society at large, dental research can play a significant role. Artificial intelligence (AI) is revolutionizing dentistry by enabling increased precision, fewer mistakes, and a reduction in workforce needs. AI is capable of carrying out a variety of duties in the dental office such as clinical diagnosis support, treatment planning, and appointment scheduling. It can identify abnormalities in the teeth and maxillofacial region, including bone lesions, periodontal disease, root caries, and facial defects. AI algorithms are also capable of classifying dental restorations on panoramic radiographs, thereby aiding in comprehensive radiographic interpretation (3).

According to Grischke et al.'s article, dentistry stands to gain a great deal from the current surge in human-centered digital automation, which will usher in a new era of robotics, machine learning, and artificial intelligence. By utilizing contemporary dental technologies like medical robots and specialized AI, this new era, known as Dentronics, has the potential to greatly increase dentistry's precision, efficiency, reproducibility, and dependability. It also has the potential to improve disease prediction, risk assessment, and treatment outcomes, while deepening our understanding of oral disease pathophysiology, all of which could result in improved treatment outcomes (4).

The field of dentistry is now researching artificial intelligence (AI) for a number of purposes, with a focus on identifying normal and abnormal structures, diagnosing diseases, and forecasting treatment results. Machine learning (ML) methods have been applied across various dental disciplines to support clinical decision-making, prognosis, and outcome prediction. According to Kьhnisch et al., combining standardized radiographic imaging with AI can lead to cavity detection accuracies above 90%. In endodontics, it helps to evaluate pulp conditions, root canal morphology, and detect periapical pathology or root fractures (5).

In orthodontics, neural networks can assist in diagnosis, cephalometric analysis, growth assessment, and treatment outcome evaluation. They are also useful in helping with orthognathic surgery planning, bone lesion detection, implant treatment, and predicting post-extraction complications. Though still developing, AI shows potential in identifying implant types, predicting implant success, and improving implant design.

Furthermore, the most recent developments in AI for prosthodontics emphasize its application as an automated diagnostic tool, a prediction measure, and a tool for classification and identification, according to Bernauer et al. In pediatric dentistry, artificial intelligence (AI) is frequently used to help clinicians, dentists, and pediatric dentists make clinical decisions, establish effective treatment plans, devise preventive measures, and make correct diagnoses. AI is still in its infancy and is not yet fully applied in periodontology and implantology. But the fact that it can help with diagnosis, data analysis, and comprehensive regression indicates that there is a lot to gain from using this tool (6).

ARTIFICAL INTELLIGENCE IN PERIODONTICS

Artificial intelligence has made significant inroads into the field of periodontics, revolutionizing the way oral healthcare is practiced. With the ability to analyze vast datasets, machine learning algorithms are proving invaluable in diagnosing periodontal diseases with unprecedented accuracy. AI-powered tools, such as image recognition software, can detect subtle changes in oral radiographs and scans, aiding in early disease detection and risk assessment. AI-powered tools like ChatGPT can enhance patient communication by offering instant explanations, answering queries, assisting in appointment management, and supporting post-treatment follow-up. These technologies help streamline clinical processes, improve treatment planning, and ultimately lead to better patient outcomes. As AI continues to evolve, its integration into periodontics is expected to play a significant role in advancing precision-driven, patient-centric oral healthcare (7)

ROLE OF ChatGPT IN PERIODONTICS

Education and Training

ChatGPT can be a valuable tool in educating dental students, hygienists, and practitioners about periodontal diseases and their management. Its natural language processing capabilities allow it to create interactive and informative learning modules, making it easier for individuals to understand complex concepts. By providing comprehensive information, ChatGPT can enhance the quality of education and training in periodontology (8).

Diagnostic Assistance

Accurate diagnosis is the foundation of effective periodontal treatment. Artificial intelligence tools like ChatGPT can assist dental professionals by analyzing patient data such as clinical records, radiographs, and medical histories, to generate differential diagnoses, identify risk factors, and suggest appropriate treatment options (9).

Periodontal charting involves recording clinical indicators like probing depths, bleeding on probing (BOP), clinical attachment levels, gingival recession, furcation involvement, and tooth mobility. This data can be complex and time-consuming to interpret manually. ChatGPT could streamline this process by detecting disease patterns, highlighting sites of concern, and proposing diagnoses aligned with standardized classification systems. Additionally, it can generate summaries useful for treatment planning and patient discussions, ultimately improving efficiency and supporting early detection of disease (10).

Probing depth measurements are essential for assessing periodontal disease severity, especially across multiple sites and visits. ChatGPT could help synthesize this data by tracking changes in pocket depth over time, flagging sites that may require intervention, and presenting trends in visual or narrative formats. These summaries can assist clinicians in evaluating treatment response and help patients better understand their condition (11).

In large-scale community settings—such as dental screening camps, outreach programs, or population-based surveys—manual chart interpretation and data entry become even more labor-intensive. ChatGPT could significantly enhance workflow efficiency in these environments by rapidly processing bulk patient data, identifying high-risk individuals, and generating standardized reports for follow-up. This would enable clinicians to triage patients more effectively, allocate resources efficiently, and provide immediate, actionable insights during high-volume screening events (12).

Peri-implantitis is a progressive inflammatory condition affecting tissues around dental implants, where early detection is key. ChatGPT could support monitoring by comparing peri-implant probing depths to baseline values and correlating clinical signs such as bleeding, suppuration, or radiographic bone loss with disease progression. It may also alert clinicians to deviations from normal peri-implant health and recommend timely follow-up based on identified risk factors. In future applications, integration with dental software could enable predictive insights for patients at higher risk of implant complications (13).

Treatment Planning

ChatGPT can contribute to the development of customized treatment plans for patients with periodontal concerns. By analyzing disease severity, patient-specific data, and current clinical guidelines, it can suggest

strategies tailored to the patient's needs.This approach ensures that patients receive the most appropriate and effective care. However, the treatment plan must be interpreted with caution. The accuracy and reliability of AI-generated outputs remain variable, and there is an inherent risk of misinformation if such outputs are applied directly to clinical decision-making without professional oversight. In complex periodontal scenarios where individualized treatment planning is essential, clinician judgment must remain paramount, with ChatGPT serving only as an adjunctive tool rather than a substitute for evidence-based clinical expertise (14).

Patient Communication

Effective communication between patients and dental professionals is essential in periodontal care. ChatGPT can assist in patient communication by providing information about the disease, treatment options, and post-treatment care in a clear and understandable manner. It can answer patient queries, alleviate concerns, enhance understanding, empower individuals to make informed decisions regarding their oral health and support shared decision-making, thereby improving patient engagement and trust (15).

Patient Compliance Tracking

Long-term periodontal success depends heavily on patient compliance with oral hygiene practices and regular maintenance visits. ChatGPT could support compliance monitoring by analyzing appointment histories and oral hygiene assessments to identify non-compliant patients, sending personalized reminders or motivational messages to improve follow-up attendance, engaging with patients through AI-powered chat interfaces to reinforce oral care instructions, summarizing compliance trends for the clinician to tailor future interventions or education.Furthermore, ChatGPT could assist in generating progress reports that highlight improvements or setbacks in periodontal health, thereby improving patient accountability (16).

Research and Evidence-Based Practice

Periodontology is a field that constantly evolves as new research emerges. ChatGPT can help periodontal researchers stay updated with the latest findings by summarizing and categorizing research papers, assisting in literature reviews, and offering insights into emerging trends and treatment modalities. This facilitates evidence-based practice and ensures that patients receive the most up-to-date and effective treatments (17).

Telemedicine and Remote Consultations

The rise of telemedicine has made remote consultations more accessible. ChatGPT can be integrated into telemedicine platforms, allowing patients to consult with periodontal specialists remotely. This enhances access to care, particularly for individuals in underserved areas, and can lead to timely intervention for periodontal issues (18).

Uninterrupted availability

ChatGPT can provide dental professionals and patients with constant access to information and assistance. This round-the-clock availability is invaluable in emergencies or when patients have pressing questions or concerns (19).

DISCUSSION

In dentistry, ChatGPT contributes significantly in various aspects, offering valuable support to both practitioners and patients. Dental professionals can utilize ChatGPT for quick access to the latest research, treatment protocols, and case studies, aiding in evidence-based decision-making. It can serve as a virtual assistant, helping dentists stay informed about the ever-evolving field of dentistry. Moreover, ChatGPT can be employed for educational purposes, assisting in the training of dental students and providing them with a vast repository of dental knowledge. It can simulate patient scenarios, allowing students to practice and refine their diagnostic and treatment planning skills. For patient interactions, ChatGPT can enhance communication by providing accurate and easily comprehensible information about various dental procedures, treatment options, and oral hygiene practices. It can address common queries, thereby improving patient understanding and satisfaction. Additionally, ChatGPT can be integrated into dental websites or apps, offering users a convenient way to seek preliminary information before scheduling appointments. In the realm of telemedicine, ChatGPT can contribute to virtual consultations, guiding patients through initial assessments and offering recommendations for emergency situations or preventive care. Overall, ChatGPT's applications in dentistry extend across education, professional support, patient communication, and telemedicine, contributing to the advancement of oral healthcare (20).

Advanced artificial intelligence (AI) software has been investigated by Strunga et al. in the field of orthodontics, particularly focusing on CBCT-based diagnosis, treatment progress monitoring, and outcome stability during follow-up. Their findings suggest that AI integration in orthodontic practice has the potential to enhance diagnostic precision and treatment outcomes. As the field advances, the development and implementation of AI-powered tools are expected to become more prevalent. To maximize their effectiveness, it is essential that orthodontists must be appropriately trained and actively engage with these technologies (21).

Balel and colleagues assessed the application of ChatGPT-generated data in the field of maxillofacial and oral surgery, particularly for providing patient information. Their findings suggest that while ChatGPT shows potential in supporting patient education, its use in clinical training remains limited and may pose risks. As such, surgeons are advised to use it cautiously and

only as a supplement to their clinical expertise (22).

Furthermore, Heo et al. clarified that because they are specialists in radiographic imaging, oral and maxillofacial radiologists will be crucial to the development of AI applications in their field. AI can enhance diagnosis and treatment, leading to superior endodontic treatment outcomes, according to a prior study. AI has demonstrated accuracy in endodontic diagnosis and outcome prediction. Its application can enhance treatment regimens and increase their success rates. In order to detect root fractures and periapical pathologies, as well as to determine working lengths, trace the apical foramen, identify root shape, and anticipate diseases, endodontics mostly depends on artificial intelligence (AI) for clinical applications. Furthermore, an increasing amount of research is being conducted on the application of AI and machine learning to assist in identifying (23).

ChatGPT has the potential to significantly support the field of periodontics by assisting both dental professionals and patients. As a specialized branch of dentistry focused on the prevention, diagnosis, and treatment of diseases affecting the supporting structures of the teeth, periodontics demands continuous access to updated clinical knowledge. ChatGPT can function as a virtual assistant, offering quick access to research, treatment protocols, and case references, while also enhancing collaboration among dental professionals. For patients, it can provide clear, accessible information about periodontal conditions, prevention strategies, and post-treatment care. By improving communication and education on both sides, ChatGPT may contribute to more effective periodontal care and better oral health outcomes (9).

Advanced language models like ChatGPT hold significant potential to enhance both dental research and clinical applications. When applied judiciously, they can transform diagnostic accuracy and treatment planning in dentistry. These models also support the goals of personalized care and precision medicine through the analysis of diverse clinical datasets (24). The integration of multi-modal large language models (LLMs) may further improve medical efficiency and reduce healthcare costs. According to Eggmann et al., LLMs offer several advantages as supplementary tools in dental practice; however, their implementation must be approached with caution. It is essential to evaluate both the benefits and the inherent limitations of these technologies to ensure their responsible use. The author clarified that generative AI-based systems have the potential to revolutionize virtual learning, notwithstanding their present drawbacks. Dental educators should modify their instruction and evaluation procedures to maximize the advantages for students while preventing the unethical usage of AI-based tools (25).

ChatGPT has both advantages and disadvantages. Although both instructors and students might benefit from it, it can also offer assignments and responses, which promotes academic dishonesty. It can completely transform online learning, notwithstanding certain drawbacks. Dental educators must know to modify their teaching methods and examinations such that students gain from them without turning to academic dishonesty, as opposed to viewing it as a threat. Furthermore, before incorporating AI models into routine healthcare procedures, it's critical to confirm their dependability, affordability, and usefulness. Patients can receive individualized, trustworthy, and up-to-date information on dental health and hygiene from ChatGPT. It also supports dental professionals by assisting with tasks such as appointment scheduling, billing, diagnosis, treatment planning, and patient follow-up through automated reminders and check-ins. Despite these advantages, it is important to acknowledge ChatGPT's limitations. While it offers valuable guidance and educational support, it cannot replace professional judgment, provide emotional reassurance, or perform clinical procedures. Therefore, it should be used as a supplementary tool rather than a substitute for in-person dental care. It is essential to weigh the benefits and drawbacks of using ChatGPT in dentistry and use it sparingly in order to guarantee the best results for patients (26).

Chatbots, like ChatGPT, can provide readers with additional resources, instant feedback, and answers to their questions. Additionally, they can ensure that readers are kept up to date on the most recent research by informing them about recently released articles. Unquestionably, artificial intelligence (AI) and natural language processing technologies, such as ChatGPT, have a significant impact on publication since they make it possible for researchers to share their findings more fully, accurately, and efficiently. ChatGPT offers concise language, fast answers, and up-to-date information, which could revolutionize the way scientific knowledge is shared and distributed (27).

While ChatGPT shows promise in periodontology, several limitations warrant consideration. Currently, there is a lack of large-scale clinical trials or feasibility studies assessing its integration into periodontal practice. Existing evidence is limited to preliminary reports and pilot applications, which, though encouraging, do not provide sufficient data on safety, efficacy, or long-term clinical utility. Most available studies are descriptive, with small sample sizes and limited methodological rigor, often lacking critical evaluation of study design, limitations, and potential bias. This restricts the reliability and generalizability of conclusions and highlights the need for systematic reviews and well-structured clinical trials to establish evidence-based applications. Additionally, current literature is predominantly English-based, which may introduce linguistic and regional bias

by overlooking valuable contributions from non-English sources. Including such studies in future analyses would broaden the global perspective, particularly in regions with a high burden of periodontal disease. Addressing these gaps through rigorous, multicentric, and multilingual research will be essential to define the true potential of ChatGPT in revolutionizing periodontal practice.

FUTURE PERSPECTIVES

1. Enhanced Domain-Specific Training: Future iterations of natural language models could undergo specialized training in periodontics, incorporating a more extensive and specific dataset related to periodontal health. This could improve the model's understanding of dental terminology, treatment protocols, and emerging research.
2. Integration with Electronic Health Records (EHRs): ChatGPT or similar models might be integrated into electronic health record systems to assist dentists in quickly accessing relevant patient information, treatment history, and the latest research during clinical interactions.
3. Clinical Decision Support Systems: Advanced AI systems, including natural language models, could evolve to provide more sophisticated clinical decision support. This might involve analyzing patient data, research literature, and treatment guidelines to offer personalized recommendations for periodontal care.
4. Real-Time Updates and Knowledge Transfer: To address the dynamic nature of medical knowledge, future ChatGPT models may be designed to receive real-time updates, ensuring that the information provided is current and aligns with the latest advancements in periodontics.
5. Virtual Assistant for Patient Engagement: ChatGPT could be further developed into a virtual assistant for patient engagement, providing ongoing support and education to individuals with periodontal conditions. This could include reminders for oral hygiene practices, follow-up appointments, and guidance on lifestyle factors affecting periodontal health.
6. Multi-Modal Integration: Future iterations of AI models may incorporate multi-modal capabilities, including the analysis of images and diagnostic data such as dental X-rays. This could enhance the model's ability to assist in the interpretation of visual information relevant to periodontics.
7. User Feedback Mechanisms: To improve accuracy and user satisfaction, future developments might include mechanisms for users (both patients and healthcare professionals) to provide feedback on the responses generated by ChatGPT. This feedback loop could be used to continuously refine and enhance the model.
8. Ethical and Bias Mitigation: Efforts to address ethical considerations and mitigate biases in AI systems could become a key focus. This involves ensuring that AI models are fair, transparent, and respectful of diverse patient populations.

CONCLUSION

An important advancement in dentistry has been made with the use of ChatGPT into periodontology. The quality of care given to patients is improved by its capacity to enable telemedicine, research, education, diagnosis, treatment planning, patient communication, and round-the-clock assistance. As artificial intelligence technology continues to advance, the potential for ChatGPT to revolutionize periodontology is substantial. Dental professionals should embrace and leverage this tool to improve patient outcomes, enhance education and training, and further the field's scientific knowledge. In doing so, ChatGPT can contribute to a brighter future for periodontal health and the overall well-being of dental patients.

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