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ChatGPT and The Future of Dentistry: A Short Communication

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ABSTRACT

ChatGPT integration in the healthcare system has ushered in a new era of dental innovation. For instance, recent studies have exhibited that ChatGPT can provide information in various fields of dentistry for both patients and dentists. However, the accuracy of ChatGPT answers varies based on the type of questions asked and the version of ChatGPT being used. In other words, the knowledge level of ChatGPT version 4 is higher than the previous versions. Moreover, ChatGPT has demonstrated higher accuracy when responding to multiple-choice questions compared with open-ended questions. Based on the obtained results, the application of ChatGPT in dentistry has the potential to shape the future of this field. Nevertheless, the way forward necessitates precise consideration of limitations and ethical implications. Therefore, future research should focus on addressing these challenges, developing more advanced dental-specific models, and establishing ethical guidelines.

Keywords: Artificial Intelligence, Dentistry, Natural Language Processing

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INTRODUCTION

Artificial intelligence (AI) is a branch of computer science that includes intelligent machines performing tasks that normally require human intelligence. Natural language processing models, including ChatGPT, are one of the most prominent subcategories of AI, which have the capability to communicate with humans, comprehend their questions, and produce relevant answers accordingly. Therefore, a majority of people around the world tend to apply these models in their daily lives, and a growing trend of using this technology is expected in the future [1].

In recent years, integration of ChatGPT into dentistry has ushered in a new era of improved patient care, clinical decision-making, educational advancement, and public health initiatives. Nonetheless, the versatility of ChatGPT can enhance treatment outcomes in different branches of dentistry, which is discussed below [2].

RESULTS & DISCUSSION

The use of ChatGPT in different fields of dentistry

The most prominent aspect of ChatGPT in dentistry is its ability to integrate patient data, including medical and dental history, imagery data, and patient preferences, with the results from clinical dental examination and suggest a treatment plan. Since natural language processing models are trained with a vast amount of data extracted from reliable sources,

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the outcome presented by ChatGPT is well-founded. Despite the high validity of ChatGPT outcomes, inspection and approval of the final treatment plan by a dental clinician should always exist in clinical practice [2].

Dentists often hesitate diagnosis and treatment planning when facing an oral lesion in clinical practice. It has been shown that ChatGPT can accelerate the decision-making process to reach a diagnosis [2]. For instance, Diniz-Freitas et al. [2] explored the ChatGPT's information regarding potentially malignant oral disorders. It was shown that ChatGPT's answers had an accuracy rate of 58%. Although ChatGPT provided reliable information regarding the prevalent potentially malignant oral disorders, its knowledge about the less prevalent potentially malignant oral disorders was not reliable.

ChatGPT can also aid in preparing a differential diagnosis list for a dental lesion based on radiographs. In other words, ChatGPT can generate task-specific responses, including the lesion's location, extent, size, shape, radiographic appearance, effect on surrounding structures, clinical implication, appropriate differential diagnosis, and recommendations when precise prompts are given by a radiologist [3].

The accuracy and validity of information delivered by ChatGPT regarding oral pathologies is a matter at hand [4,5]. In a study by Wiwanitkit and Wiwanitkit [4], ChatGPT's answers to board-style questions about oral lesions were not acceptable. Nonetheless, in a study by Albagieh et al. [5] ChatGPT's answers to multiple-choice oral pathology-based questions were comparable to the answers of third- and fourth-year pathology residents. Based on the results of both studies, the performance of ChatGPT in the field of oral pathology is controversial and requires further research [4,5].

Nowadays, ChatGPT is perceived to help periodontists with their diagnosis and decision-making process. However, this conception was doubted when ChatGPT's knowledge was put to the test. It was revealed that ChatGPT can be beneficial in answering patient questions regarding the most frequent topics in the field of periodontology. In contrast, ChatGPT's information is not complete for diagnosis and treatment planning purposes. Hence, ChatGPT, especially version 4, may be used to answer only patient questions in this field [6].

In the field of implantology, ChatGPT is deemed to be dependable when dental implant-based questions are asked. In other words, it has been reported that ChatGPT versions 3.5 and 4 can answer multiple-choice questions regarding dental implants with high accuracy [7].

The impact of ChatGPT on dental surgery is witnessed to be acceptable. To prove this matter, two separate studies evaluated ChatGPT's performance in generating accurate answers to oral and maxillofacial surgery-based questions. Both studies came to a consensus that ChatGPT's answers have a high accuracy rate between 71%-84% [8,9].

The emergence of ChatGPT has affected the field of endodontics as well as other fields of dentistry. However, the accuracy and completeness of ChatGPT's knowledge in this field appear to be lower than expected [10]. For example, a study performed by Suárez et al. [10] illustrated that the accuracy rate of ChatGPT answers to yes/no endodontic-based questions was 57.33%. This average rate proposed that ChatGPT's current form cannot take the dentist's role in clinical practice.

ChatGPT's performance in identifying dental lesions and previous endodontic treatments based on periapical radiographs also does not reach a promising level [11]. For Instance, Bragazzi et al. [11] reported that ChatGPT can identify previous endodontic treatments on periapical radiographs in merely 38% of the cases. Moreover, it was witnessed that endodontic oral lesions were missed in 56% of the cases.

The role of ChatGPT in the field of restorative dentistry has been discussed in a number of studies, with findings varying according to the type of task and assessment method [11,12]. For example, Bragazzi et al. [11] reported that ChatGPT can correctly identify dental caries in 31% and dental restorations in 62% of the cases on periapical radiographs. Nevertheless, ChatGPT's overall correct interpretation rate was 11% in this study, which indicates its lack of validity in clinical practice. On the other hand, Künzle and Paris [12] evaluated ChatGPT's performance on 151 multiple-

choice questions related to restorative dentistry and reported an overall accuracy of 72% for ChatGPT-4o, compared with 62% for ChatGPT-4 and 25% for ChatGPT-3.5. Notably, ChatGPT-4o achieved accuracy rates of 84% for direct restorations and 71% for caries-related questions, suggesting its potential for knowledge-based applications in restorative dentistry. Nevertheless, its performance in clinical image interpretation appears considerably more limited.

The ChatGPT's performance in aiding prosthodontists with treatment planning is controversial [13,14]. In one study, the authors showed that the reliability of answers generated by ChatGPT version 4 to short questions regarding removable dental prostheses and tooth-supported fixed dental prostheses was 25.6% [13]. This low reliability rate is a contrast to the outstanding performance of ChatGPT in treatment planning for a clinical patient in a case report study [14]. In this case report study, ChatGPT explained the several factors influencing the specific treatment plan for rehabilitating a long-span edentulous arch and suggested multiple treatment options. Moreover, ChatGPT provided information about occlusal plane analysis. Due to contrasting outcomes of the abovementioned two studies, more research is necessary on the validity and accuracy of ChatGPT answers to prosthodontics-based questions [13,14].

Research regarding the applications of ChatGPT in the field of pediatric dentistry accentuates its effective use in preventive treatments. In other words, ChatGPT plays a noticeable role in providing accurate and sufficient information regarding fluoride therapy as a preventive measure in children. Therefore, ChatGPT enables parents to have quick and easy access to accurate and reliable information regarding preventive dental treatments and ultimately contributes to reducing the rate of dental caries among children [15].

Several studies have investigated the potential applications of ChatGPT in orthodontics. ChatGPT has been reported to positively contribute to patients' knowledge regarding orthognathic surgery and other orthodontic procedures [16-18]. In a study, the accuracy of ChatGPT's responses to orthodontic-related questions has been estimated at 60%–71%, suggesting its potential as an adjunct in this field [16]. Supporting these findings, Daraqel et al. [17] reported a median accuracy score of 9 out of 10 when evaluating ChatGPT-3.5 responses to 100 general orthodontic questions. Similarly, Hatia et al. [18] reported a median accuracy score of 4.9 out of 6 when assessing ChatGPT-4 responses to questions and clinical scenarios involving interceptive orthodontics. Overall, these findings suggest that ChatGPT may serve as a useful supplementary tool for orthodontic education and patient information, although professional supervision remains essential to ensure the accuracy and clinical appropriateness of its responses [16-18].

Limitations of ChatGPT

Despite the significant advantages of ChatGPT, it is necessary to address its specific disadvantages. One of the most prominent challenges that ChatGPT has to face is its ethical use in practice. In other words, ChatGPT has access to a vast source of patient data, which raises noticeable privacy and data security concerns. Hence, there is a need for robust mechanisms to protect patient data and ensure that the use of ChatGPT does not compromise patient privacy. Another important limitation of ChatGPT is its complexity and the need for specialized training, which can be expensive. Therefore, simplifying the user interface and interaction with ChatGPT can eliminate the need for extensive training and make it accessible to a wider dental community. Moreover, since the performance and accuracy of ChatGPT outputs strongly depend on the quality and variety of data it is trained on, the validity and the amount of input data are extremely critical. Ensuring that ChatGPT is trained on a comprehensive, diverse, and high-quality dataset is essential to reduce the risk of maltreatment [2].

While this short communication highlights the promising applications of ChatGPT in dentistry, certain limitations should be acknowledged. The findings are based on current ChatGPT capabilities, which may evolve rapidly, necessitating continuous updates. Additionally, ethical concerns, such as

data privacy, diagnostic accuracy, and over-reliance on AI without clinical validation, require further scrutiny. Therefore, future studies are recommended to focus on real-world implementation, dentist-AI collaboration frameworks, and standardized guidelines to ensure safe, effective integration into dental practice. Long-term assessments of ChatGPT's impact on clinical outcomes and patient trust, and comparing its performance with different chatbots, are also recommended.

CONCLUSION

The integration of ChatGPT in dentistry has led to improved diagnosis and treatment planning and increased knowledge regarding various dental topics for both patients and dentists. However, it is observed that ChatGPT's performance in some fields of dentistry, including pediatric dentistry and dental surgery, is more accurate compared to other fields, which is probably related to enhanced training of ChatGPT in the abovementioned fields. Ultimately, it should be noted that ChatGPT's immense and valid application as an auxiliary tool in dentistry can only be achieved after solving its fundamental challenges, which require more research in the future.

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CONFLICT OF INTEREST

None declared.

GENERATIVE AI IN SCIENTIFIC WRITING

None declared.

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