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Dental specialization in the digital knowledge: Discover Artificial Intelligence powered platforms for knowledge in oral health - A Comparative Trial

[1]Lrennan M, Dental Surgon and Private Practitioner

[2]Kennett P, Dental Surgon and Private Practitioner

Corresponding Author: Lrennan M, Dental Surgon and Private Practitioner

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Abstract

Artificial Intelligence involves creating computer programs or algorithms that mimic human intelligence, enabling them to perform tasks typically done by humans.

The aim of this study is to analyze the oral health knowledge of AI Chatbots pertaining to oral health and to understand how patients perceive and interact with AI-driven chatbots in the context of dentistry. From November 5th to November 9th, 2023, a qualitative search was conducted using Open AI (Open AI, L.L.C., San Francisco, CA, USA - Chatgpt), Bard, Youchat, Poe, Perplexity, Bing chat, and Click Sonic. Two dentists with an MDS degree debated and chose ten open-ended questions, which were then verified by a pilot research. The subjects of general oral health, tooth pain and discomfort, and tooth anatomy comprised the questions. Each of the two researchers independently scored an item. Based on the "3C" Criteria, these evaluation standards for ChatGPT answers were evaluated. (1) Response clarity; (2) concision; and (3) scientific accuracy of material (correctness). The overall score of chatgpt, bard, youchat, poe, bing, clicksonic is 3 that shows that the chatbots have generated almost correct, clear and concise reponses. The overall score of perplexity is 4 that shows the chatbots have generated completely clear, correct and concise response. AI-powered platforms have the capability to transform the field of dentistry by providing clinicians and patients with access to high-quality, evidence-based knowledge in oral health. The integration of AI chatbots in dentistry represents a double-edged sword, presenting both opportunities and challenges for dental professionals, patients, and the broader healthcare landscape.

Keywords: Artificial Intelligence, Chatbots, Tooth Anatomy, Medical Diagnostic Tools, Virtual Consultations

Introduction

Artificial Intelligence involves creating computer programs or algorithms that mimic human intelligence, enabling them to perform tasks typically done by humans. AI systems are crafted to handle tasks such as perception, understanding language, learning, reasoning, problem-solving, and making decisions. They process extensive data, identifying patterns, and drawing predictions or conclusions from their analyses. They can be trained to perform specific tasks by learning from examples or by being programmed with predefined rules. There are various approaches to AI, including symbolic AI, which includes the use of symbols and rules to characterize knowledge by solving problems, and machine learning, which targets on developing algorithms that can gain information from data and fine tune during the course of time without being programmed.

AI finds extensive use in various sectors such as healthcare, finance, transportation, entertainment, and more. Examples of AI applications span virtual assistants like Siri and Alexa, recommendation systems in online retail and streaming services, self-driving vehicles, medical diagnostic tools, and natural language processing technology. Artificial Intelligence (AI) is increasingly being utilized in dentistry to improve patient care, diagnosis, practice management and treatment planning, and Image Analysis, Treatment Planning, Virtual Consultations, Predictive Analytics, education and training, are different ways in which AI is making an impact in dentistry. AI chatbots can serve various purposes in the dental industry, offering benefits to both dental practices and patients. Appointment Scheduling, Patient Education, Symptom Assessment, Post-Procedure Support, Practice Information and FAQs, Follow-Up Communication.

Many patients turn to AI chatbots as a first step to gather information about dental treatments, symptoms, and oral health concerns, they may search for specific topics such as "toothache remedies" or "dental implant options" to learn more about their condition and available treatment options. Some people may use AI chatbots to self-diagnose dental issues or check symptoms as these platforms can provide general information and guidance. These platforms can offer convenience, accessibility, and real-time advice particularly for non-emergency concerns.

AI chatbots offer the convenience of accessing information anytime and anywhere, without the need to wait for office hours or appointments. Patients can quickly get answers to their questions or concerns without having to physically visit a dental office or make a phone call. Chatbots are accessible through various digital platforms such as websites, mobile apps, or messaging services, making them available to a wide range of patients, including those in remote areas or with limited mobility. AI chatbots can provide real-time advice and guidance on dental treatments, symptoms, and oral health concern. Patients can receive immediate responses to their queries, allowing them to take timely action or seek further medical attention if necessary. For non-emergency dental issues or general inquiries about oral health, AI chatbots can be a valuable resource. Patients can use chatbots to learn about toothache remedies, dental implant options, oral hygiene practices, and more, without the need for an in-person consultation. While AI chatbots are not a substitute for professional medical advice, some patients may use them for self-diagnosis or to check symptoms. Chatbots

can provide general information about dental conditions and common symptoms, helping patients better understand their situation and decide whether they need to seek further medical evaluation.

AI chatbots also have its own disadvantages like AI chatbots may struggle to understand complex queries or requests that deviate from their programmed capabilities, leading to frustration for users and potentially unresolved issues. AI chatbots may misinterpret user input or provide inaccurate responses, especially when dealing with ambiguous or colloquial language, leading to misunderstandings and dissatisfaction. Thus the aim of this study is to analyze the oral health knowledge of AI Chatbots pertaining to oral health and to understand how patients perceive and interact with AI-driven chatbots in the context of dentistry so that chatbots can be implemented in scheduling reminders, and can be used for basic queries thus the administrative tasks in dental practice can be streamlined.

Materials and Methods

From November 5th to November 9th, 2023, a qualitative search was conducted using Open AI (Open AI, L.L.C., San Francisco, CA, USA - Chatgpt), Bard, Youchat, Poe, Perplexity, Bing chat, and Click Sonic. Two dentists with an MDS degree debated and chose ten open-ended questions, which were then verified by a pilot research. The subjects of general oral health, tooth pain and discomfort, and tooth anatomy comprised the questions. Each of the two researchers independently scored an item. Based on the "3C" Criteria, these evaluation standards for ChatGPT answers were evaluated. (1) Response clarity; (2) concision; and (3) scientific accuracy of material (correctness) (Figure 1).

For every one of the three criteria, the items were graded according to the following classification scheme: (1) totally clear, accurate, and concise (scored as a 4); (2) almost clear, correct and concise (scored as a 3); (3) partially clear, accurate, and concise (scored as a 2); and (4) completely unclear, incorrect, and not concise (scored as a 1). Two distinct responses were produced for each topic answered on each AI platform.

The stratification was trichotomous for the bias criteria in the assessment of the 10 pre-validated myth questions [9] and dental myth items: (1) positive, given a score of "3", (2) neutral, given a score of "2", and (3) unfavorable, given a score of "1". In accordance with deliberative session and the backdrop of dental myths, AI responses that refuted common misconceptions about oral cleanliness and health were deemed favorable, but those that confirmed or supported these assertions were deemed unfavorable. It was decided that the perceived impartiality provided a neutral refutation of dental myths (Figure 2).

Each researcher compiled and personally assessed each evaluator's responses from trials 1 and 2. The degree of agreement for each of the four assessment criteria (correctness, clarity, conciseness, and bias) was then ascertained by comparing the results. The Cohen's kappa value, which was approximately 0.96 and was regarded as almost perfect agreement, was used to evaluate the inter-examiner dependability. Following the analysis and evaluation of the responses, the 3C Criteria were used to determine the overall rating of each AI platform.

The data was tabulated and analyzed in the SPSS software (version 26.0). The individual overall scores were described with median. Shapiro Wilk test was used to assess the normality of the data. Kruskal Wallis test was used to analyse the mean score differences between the different AI platforms with p value less than 0.05.

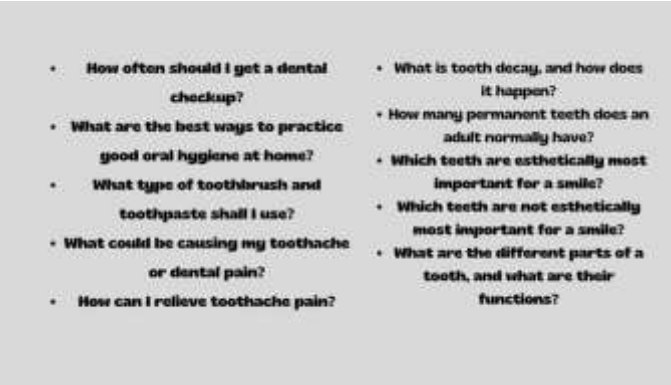

Figure 1: questionnaires given to AI Chatbots

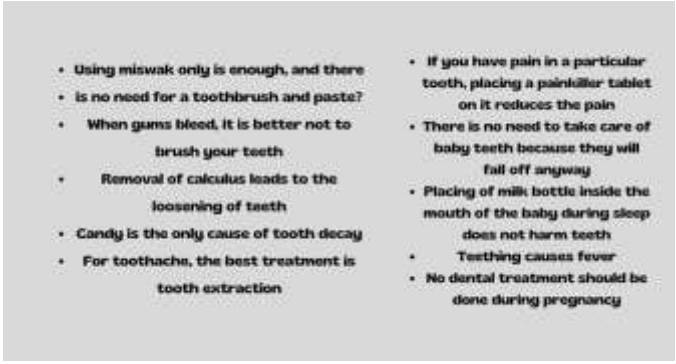

Figure 2: misconceptions given to AI chatbots

Results

The inter observer reliability of the study was 0.89 which was very good agreement. median value of all AI Chatbots. The results were as follows:

Table 1: Scores given for the questionnaires using AI Chatbots

Questions	Chat GPT	Bard	You chat	Poe	Perplexity	Bing	Click sonic
1.How often should I get a dental checkup?	4	4	4	4	4	4	4
2. What are alternative strategies for maintaining optimal oral hygiene within one's own home environment?	3	3	3	3	4	4	3
3. What type of toothbrush and toothpaste shall I use?	3	3	3	3	3	3	3
4. What could be causing my toothache or dental pain?	3	3	3	3	3	3	3
5. How can I relieve toothache pain?	3	2	3	3	3	3	2
6. What is tooth decay, and how does it happen?	3	3	3	3	3	3	3
7. What is the usual number of permanent teeth found in adults?	3	3	3	3	4	4	3
8. Which teeth play the most significant role in enhancing the aesthetics of a smile?	2	3	3	3	3	3	3
9. Which teeth do not primarily contribute to the aesthetic appeal of a smile?	2	2	2	2	2	2	2
10. What are the different parts of a tooth, and what are their functions?	1	1	2	2	2	1	2
Overall	3	3	3	3	4	4	2

Table 2: Mean rank, Chi square value and p value for the AI Chatbots

	Groups	N	Mean Rank	Chi square value	P value
Scores	Chat Gpt	11	35.05	4.896	0.557
	Bard	11	35.05		
	You chat	11	38.64		
	Poe	11	38.64		
	Perplexity	11	46.68		
	Bing	11	45.86		
	Clicksonic	11	33.09		
	Total	77			

All the AI chatbots gave totally accurate, clear and concise response with the score of 4 for the first question, for the second, third and fourth the chatbots gave almost accurate, clear and concise with the score of 3, for the fifth and sixth question, the chatbots gave a partially correct response with a score of 2. For the ninth and tenth questions, the chatbots gave incorrect reponses with score of 1 and 2. The overall score of chatgpt, bard, youchat and poe is 3, perplexity and bing is 4 and the least score is given to the clicksonic chatbots. The median of all AI chatbots is the same that is 3 but the mean rank is highest for perplexity.

Table 3: Scores given for the misconceptions using AI Chatbots

Questions	Chat Gpt	Bard	You chat	Poe	Perplexity	Bing	Clicksonic
1. Using mistake only is enough, and there is no need for a toothbrush and paste	3	3	3	3	4	4	4
2. When gums bleed, it is better not to brush your teeth	3	4	4	3	3	4	4
3. Removal of calculus leads to the loosening of teeth	3	3	4	4	3	4	3
4. Candy is the only cause of tooth decay	3	4	3	4	3	4	3
5. For toothache, the best treatment is tooth extraction.	3	4	3	3	4	3	3
6.If you have pain in a particular tooth, placing a painkiller tablet on it reduces the pain.	3	3	3	3	4	3	3
7. There is no need to take care of baby teeth because they will fall off anyway	3	3	3	3	3	3	3
8. Placing of milk bottle inside the mouth of the baby during sleep does	3	3	3	3	3	3	3

not harm teeth							
9. Teething causes fever	3	3	3	3	3	2	3
10. No dental treatment should be done during pregnancy	3	4	3	3	3	2	3
Overall	3	3	3	3	4	3	3

The mean rank of all the chatbots were in the range of 30 to 45. The mean rank of chatgpt is 31, the mean rank of bard and perplexity is 44.64, youchat, poe and clicksonic is 37.82, The mean rank of perplexity is 44.64 which is the highest of all the chatbots.

Discussion

The overall score of 3. This score suggests that chat GPT, Bard, You Chat, Poe, Bing, and Clicksonic have collectively produced responses that are partially correct, clear, and concise. A score of 3 implies the responses may not be flawless, they are generally accurate, understandable, and presented in a reasonably concise manner. This is a positive indicator of the chatbots' ability to communicate effectively with users. The emergence of AI chatbots like ChatGPT, bing, bard, youchat, poe, perplexity and clicksonic are merely has both negative and positive aspects. The AI chatbots and its underlying updation mark a transformative shift in education, offering access to information and revolutionizing the way the users seek and comprehend knowledge. On the other hand, the AI chatbots can also be misleading leading to misinformation and fake news.

While with the misconceptions' score, the overall score of 3 for chatbots including ChatGPT, Bard, You Chat, Poe, Bing, and Clicksonic indicates a good level of performance suggesting that these chatbots have consistently produced responses that are partially correct, clear, and concise. Achieving an overall score of 3 indicates that the chatbots have demonstrated competency in generating responses that align reasonably well with expected criteria. This finding underscores the potential of these chatbots to effectively engage with users and provide meaningful interactions across various applications. Perplexity's score of 4 further emphasizes the quality of responses generated by the chatbots. This level of performance indicates a high degree of accuracy and coherence in the scientific evidence and language fluency generated by the chatbots, contributing to a more natural and engaging conversational experience for patients

The recent research was carried out amid a lively discussion about AI's knowledge on oral health, AI has been used a language model particularly in healthcare education. The goal was to assess the usefulness of different AI chatbots in healthcare education through a comparison trial and thus examining responses generated by all the AI and subjectively evaluating these responses based on the viewpoints of authors in the healthcare. Consequently, this study aimed to assess the potential of AI response to the users or the patients asking AI to generate basic dental treatment and procedures before approaching a dental physician, thus offering an immediate solution. Many studies have examined various aspects of chatbot performance, including diagnostic accuracy, patient interaction, and adherence to clinical guidelines.

Several studies have demonstrated the potential of chatbots to accurately identify and triage medical conditions based on user-reported symptoms. For example, research has shown that chatbots powered by

natural language processing algorithms can effectively differentiate between common ailments and provide preliminary diagnoses with a high degree of accuracy. While chatbots may not replace human clinicians, they can serve as valuable tools for early detection and initial assessment, particularly in settings where access to healthcare services is limited. Studies have explored various strategies for enhancing patient interaction, such as incorporating conversational agents with emotional intelligence capabilities or tailoring responses to individual preferences and communication styles. By nurturing a connection and building confidence, chatbots have the potential to encourage patient involvement and commitment to treatment regimens, leading to better health results in the end. AI chatbots can also play a role in promoting adherence to clinical guidelines and best practices. By leveraging evidence-based algorithms and medical knowledge databases, chatbots gives exact and updated information on treatment options, medication adherence, and lifestyle recommendations. Moreover, chatbots can assist healthcare providers in delivering personalized care plans and monitoring patient progress over time, thus ensuring continuity of care and optimizing health outcome.

Despite the promising potential of AI chatbots in healthcare, several challenges and limitations persist. These include considerations related to patient privacy and security of the data, the risk of algorithmic bias and discrimination. Additionally, ensuring seamless integration with existing healthcare systems and workflows remains a significant hurdle for widespread adoption of chatbot technologies in clinical practice. Future research in healthcare AI chatbots is likely to focus on addressing these challenges and advancing AI. This includes developing more sophisticated chatbot architectures capable of handling complex medical queries, enhancing natural language understanding and generation capabilities, and conducting large-scale clinical trials to evaluate the impact of chatbots on patient outcomes and healthcare delivery and thus chatbots can be incorporated in administrative tasks and documentation tasks in healthcare system.

Conclusion

AI-powered platforms have the capability to transform the field of dentistry by providing clinicians and patients with access to high-quality, evidence-based knowledge in oral health. The integration of AI chatbots in dentistry represents a double-edged sword, presenting both opportunities and challenges for dental professionals, patients, and the broader healthcare landscape.

The opportunities include improved patient education, efficient appointment scheduling, remote consultations, enhanced diagnosis and treatment planning. The challenges include privacy and security concerns, accuracy and reliability, ethical considerations and integration with existing systems. AI chatbots offer promising opportunities to enhance various aspects of dental care delivery, they also present challenges that must be addressed to realize their full potential responsibly. By carefully navigating these opportunities and challenges, dental professionals can leverage AI chatbots as valuable tools to improve patient care, enhance practice efficiency, and advance the field of dentistry.

References

1. Cheng L, Yu T. A new generation of AI: A review and perspective on machine learning technologies applied to smart energy and electric power systems. International Journal of Energy Research 2019;43(6):1928-73.
2. Goddard M. The EU General Data Protection Regulation (GDPR): European regulation that has a

global impact. International Journal of Market Research 2017;59(6):703-5.

3. Azarkhish I, Raoufy MR, Gharibzadeh S. Artificial intelligence models for predicting iron deficiency anemia and iron serum level based on accessible laboratory data. Journal of medical systems 2012;36(3):2057-61.
4. Nieri M, Crescini A, Rotundo R, Baccetti T, Cortellini P, Prato GPP. Factors affecting the clinical approach to impacted maxillary canines: A Bayesian network analysis. American journal of orthodontics dentofacial orthopedics 2010;137(6):755-62.
5. Xie X, Wang L, Wang A. Artificial neural network modeling for deciding if extractions are necessary prior to orthodontic treatment. The Angle orthodontist 2010;80(2):262-6.
6. De Bruijn M, ten Bosch L, Kuik DJ, Langendijk JA, Leemans CR, Leeuw IV- d. Artificial neural network analysis to assess hypernasality in patients treated for oral or oropharyngeal cancer. Logopedics phoniatrics vocology 2011;36(4):168-74.
7. A. Fuchs, T. Trachsel, R. Weiger, and F. Eggmann, "ChatGPT's performance in dentistry and allergyimmunology assessments: a comparative study," SWISS DENTAL JOURNAL SSO – Science and Clinical Topics, vol. 134, no. 2, pp. 1 17, Oct. 2023, doi: 10.61872/sdj-2024-06-01.
8. Kıyak, Y. S., Coşkun, Ö., Budakoğlu, I. İ., & Uluoğlu, C. (2024). ChatGPT for generating multiple-choice questions: Evidence on the use of artificial intelligence in automatic item generation for a rational pharmacotherapy exam. European journal of clinical pharmacology, 1- 7.
9. Alsadhan, A., Al-Anezi, F., Almohanna, A., Alnaim, N., Alzahrani, H., Shinawi, R., & Herzallah, N. (2023). The opportunities and challenges of adopting ChatGPT in medical research. Frontiers in Medicine, 10.
10. Monill-González, A.; Rovira-Calatayud, L.; d'Oliveira, N.G.; Ustrell-Torrent, J.M. Artificial intelligence in orthodontics: Where are we now? A scoping review. Orthod. Craniofac. Res. 2021, 24 (Suppl. S2), 6–15.
11. M. M. Meghil, P. Rajpurohit, M. E. Awad, J. McKee, L. A. Shahoumi, and M. Ghaly, "Artificial intelligence in dentistry," Dentistry Review, vol. 2, no. 1, p. 100009, Mar. 2022, doi: 10.1016/j.dentre.2021.100009.
12. Muftić, F., Kadunić, M., Mušinbegović, A., & Abd Almisreb, A. (2023). Exploring Medical Breakthroughs: A Systematic Review of ChatGPT Applications in Healthcare. Southeast Europe Journal of Soft Computing, 12(1), 13-41.
13. Rojas-Carabali, W., Cifuentes-González, C., Wei, X., Putera, I., Sen, A., Thng, Z. X., (2023). Evaluating the diagnostic accuracy and management recommendations of ChatGPT in uveitis. Ocular immunology and inflammation, 1-6.
14. T. T. Kevin X. Zhou, "Applications of Contemporary Artificial Intelligence in Dental Surgery," Analysis Artificial Intelligence, 2023.
15. K. Rahad et al., "ChatGPT to Enhance Learning in Dental Education at a Historically Black Medical College," Dental Research and Oral Health, vol. 07, no. 01, 2024, doi: 10.26502/droh.0069