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Abstract This study aimed to investigate on the impacts of ChatGPT in the field of Dentistry, through a narrative review with critical analysis carried out from the Science Direct, PubMed, Scopus and Web of Science databases, using the descriptors in the search fields, such as “Artificial intelligence” and “Odontology”. Eligibility criteria were established related to language (scientific articles published in English and Portuguese), originality (original articles), time frame (published from 2021 to 2023), availability (fully accessible), and theme (pertaining to the ChatGPT tool). The articles that dealt with another type of Artificial Intelligence tool or did not meet the inclusion criteria were excluded from the study. After screening, thirteen studies were selected, which, for the most part, pointed out the benefits related to the use and features of ChatGPT for Dentistry. ChatGPT can be used in academia, supporting the training and development of extracurricular activities. In dental offices, ChatGPT can help with bureaucratic tasks and automated triage. However, it is important to emphasize that this tool does not replace the professional's knowledge and experience. It is concluded that the applicability of ChatGPT in Dentistry is a reality that needs to be further explored, as it represents an important resource and impacts health and, consequently, Dentistry.

Descriptors: Artificial intelligence. Delivery of Health Care. Education, Dental.

Impactos de ChatGPT en Odontología

Resumen Este estudio tuvo como objetivo investigar los impactos de ChatGPT en el campo de la Odontología, mediante una revisión narrativa con análisis crítico realizada en las bases de datos Science Direct, PubMed, Scopus y Web of Science, utilizando descriptores en los campos de búsqueda, como “Inteligencia Artificial” y “Odontología”. Se establecieron criterios de elegibilidad relacionados con el idioma (artículos científicos publicados en inglés y portugués), originalidad (artículos originales), periodo de tiempo (publicados entre 2021 y 2023), disponibilidad (acceso completo) y tema (relacionado con la herramienta ChatGPT). Los artículos que trataban otro tipo de herramienta de Inteligencia Artificial o que no cumplieran con los criterios de inclusión fueron excluidos del estudio. Tras la selección, se eligieron trece estudios que, en su mayoría, señalaron los beneficios relacionados con el uso y las funcionalidades de ChatGPT para la Odontología. ChatGPT se puede utilizar en el ámbito académico, apoyando la formación y el desarrollo de actividades extracurriculares. En los consultorios odontológicos, ChatGPT puede ayudar con tareas burocráticas y en el triaje automatizado. Sin embargo, es importante destacar que esta herramienta no sustituye los conocimientos y la experiencia del profesional. Se concluye que la aplicabilidad de ChatGPT en la Odontología es una realidad que necesita ser más explorada, ya que representa un recurso importante y tiene impacto en la salud y, por ende, en la Odontología.

Descriptor: Inteligencia Artificial. Atención a la Salud. Educación en Odontología.

Impactos do ChatGPT na Odontologia

Resumo Este estudo teve como objetivo investigar os impactos do ChatGPT no campo da Odontologia, por meio de uma revisão narrativa com análise crítica realizada nas bases de dados Science Direct, PubMed, Scopus e Web of Science, utilizando descritores nos campos de busca, como “Inteligência Artificial” e “Odontologia”. Foram estabelecidos critérios de elegibilidade relacionados à língua (artigos científicos publicados em inglês e português), originalidade (artigos originais), período (publicados de 2021 a 2023), disponibilidade (acesso completo) e tema

(relacionado à ferramenta ChatGPT). Os artigos que tratavam de outro tipo de ferramenta de Inteligência Artificial ou que não atendiam aos critérios de inclusão foram excluídos do estudo. Após a triagem, treze estudos foram selecionados, que, em sua maioria, apontaram os benefícios relacionados ao uso e às funcionalidades do ChatGPT para a Odontologia. O ChatGPT pode ser utilizado na academia, apoiando o treinamento e o desenvolvimento de atividades extracurriculares. Em consultórios odontológicos, o ChatGPT pode auxiliar em tarefas burocráticas e na triagem automatizada. No entanto, é importante ressaltar que essa ferramenta não substitui o conhecimento e a experiência do profissional. Conclui-se que a aplicabilidade do ChatGPT na Odontologia é uma realidade que precisa ser mais explorada, pois representa um recurso importante e impacta a saúde e, conseqüentemente, a Odontologia.

Descritores: Inteligência Artificial. Atenção à Saúde. Educação em Odontologia

INTRODUCTION

ChatGPT (Generative Pre-trained Transformer) is an artificial intelligence (AI) system that utilizes natural language models to generate text. It was developed by OpenAI and employs deep learning techniques to autonomously provide real-time responses to user questions¹. ChatGPT operates through user interaction, where a user inputs a question or request and receives a response from the system. The system's versatility allows it to be applied in various domains, such as virtual assistants, chatbots, and natural language analysis on social media platforms¹.

The system is based on an "artificial neural network" trained on data, designed to handle text like how it handles numbers. It creates a sequence of logic, which is then transformed back into text, delivering the user a conceptually and chronologically accurate stream of text, generating responses in the user's language much like a human would². The adaptability of the system to diverse subjects, coupled with its near-instantaneous learning from large amounts of textual data, makes this new tool promising across various sectors of society, serving as a powerful option to enhance service efficiency and reduce user waiting times³.

Within the field of dentistry, artificial intelligence is already being explored by professionals, students, and educators. However, there are limited records of specific usage of ChatGPT in this area. The scarcity of publications on ChatGPT's use in dentistry may suggest that the new tool currently has limited influence on dental practice. Nevertheless, ChatGPT possesses functionalities that can be extensively harnessed to assist dental academics and dentists, considering the platform's limitations and addressing inconsistencies in the information provided to users⁴. In light of this context, this study aimed to investigate the adverse and favorable impacts of ChatGPT on dentistry, from its use in the academic domain among students and professors to its implementation in dental practices.

METHOD

This study adopts an analytical and critical approach, characterized as a narrative review of the literature. The exploration of ChatGPT's impacts on dentistry is a recent and under-discussed topic in the literature. To draw attention to this subject and organize the content, the following guiding questions were developed to steer the study: a) How does ChatGPT assist undergraduate dental students? b) What are the impacts of ChatGPT on the development of dental research? c) How has ChatGPT been aiding dentists in their practices?

To address the guiding questions, the study involved stages for the search for scientific publications, data selection, and data collection. The first stage revolved around a bibliographic survey conducted through searches in the following databases: Science Direct, PubMed, Scopus, and Web of Science. Controlled search terms were extracted from the Health Sciences Descriptors (DeCS) and Medical Subject Headings (MeSH), namely "Artificial intelligence" and "Odontology," combined using the boolean operator AND. Eligibility criteria were established related to language (scientific articles published in English and Portuguese), originality (original articles), time frame (published from 2021 to 2023), availability (fully accessible), and theme (pertaining to the ChatGPT tool). The articles that dealt with another type of Artificial Intelligence tool or did not meet the inclusion criteria were excluded from the study.

RESULTS AND DISCUSSION

The database search yielded 187 articles, with 104 from Science Direct, 45 from PubMed, 19 from Scopus, and 19 from Web of Science (Figure 1). After screening, 13 studies were selected, comprising 4 articles from Science Direct, 3 articles from PubMed, 2 articles from Scopus, and 4 from Web of Science. The publication years of these studies were distributed as follows: 1 (7.7%), 1 (7.7%), and 11 (84.6%) in the years 2021, 2022 and 2023, respectively.

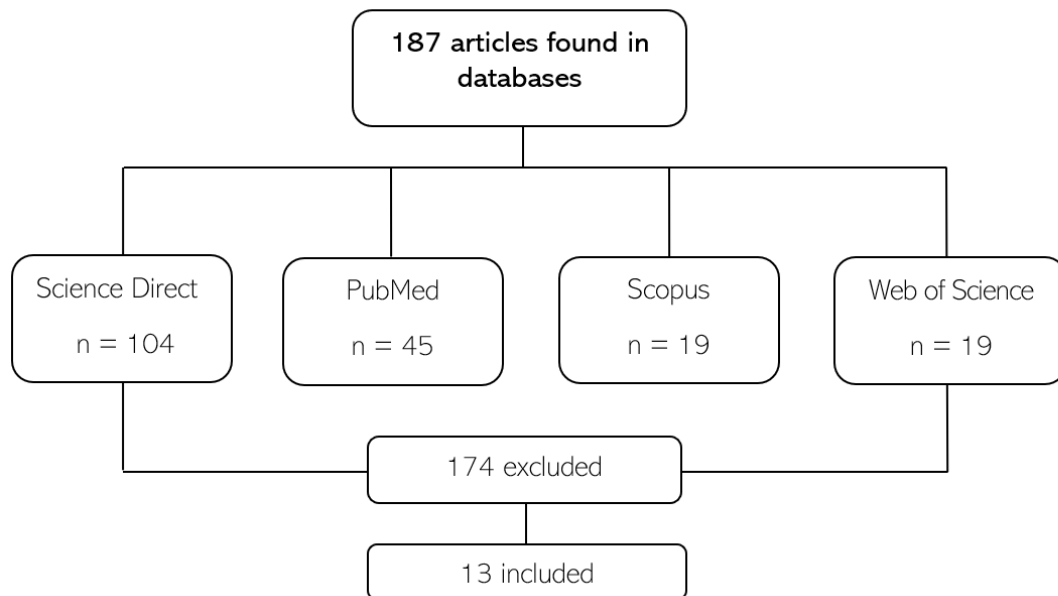


Figure 1. Search and selection of articles in the databases.

From the analyzed studies, key information regarding ChatGPT and its use in dentistry was identified and grouped into four thematic categories to facilitate discussion: 1) Origin and functionality of ChatGPT and artificial intelligence; 2) ChatGPT's assistance in the academic development of dental students; 3) Use of ChatGPT in aiding dentists in their practice; 4) Impacts on treatment procedures and healthcare. Each topic was discussed according to the findings.

Origin and functionality of Chat GPT and artificial intelligence

This category presents and details the main events related to the Origin and Functionality of ChatGPT and Artificial Intelligence, discussing important topics from three studies included in the sample.

The history of Artificial Intelligence (AI) began after World War II, involving various scientists such as Alan Turing, as well as researchers like Marvin Minsky, John McCarthy, Allen Newell, and Herbert A. In 1956, AI was established as a field for the study of Artificial Intelligence with the aim of developing new creations. Consequently, the science began to be recognized with the mission of developing intelligent machines. After processes of analysis and discoveries, in 1964, AI created the world's first Chatbot, called "ELIZA," which processed natural language and was created by Joseph Weizenbaum in the Artificial Intelligence laboratory at the Massachusetts Institute of Technology. ELIZA's initial function was to simulate conversation between humans and machines. However, Eliza was programmed with features very similar to humans, developing innovative functions using algorithmic language and data⁵.

Over time, various programs were launched, but it was in 2022 that an AI tool, called ChatGPT, was launched by the North American technology company OpenAI¹⁴, founded in 2015, and gained prominence due to its proposal. The tool operates by analyzing patterns in a natural language database, using AI to generate elaborated responses to questions

entered on a chat-style interface. However, the creation of ChatGPT, especially in the academic context, raised ethical questions about the consequences of using AI for knowledge generation and authorship in academic work, particularly in the field of health. This is because its database, in addition to having flaws, does not replace studies and research from more reliable sources such as books and scientific articles⁶.

As ChatGPT was created relatively recently, it is not yet widely explored, as many people are still unfamiliar with the tool or do not fully understand all of its functions. However, it is already known that ChatGPT has functions that can provide responses similar to those of a human, and it can instantly answer specific questions from its users. This technological landscape and ease of access to knowledge have made ChatGPT a widely used tool in study and work environments. In the field of dentistry, ChatGPT can assist both students and dentists in their routines, serving as a tool with significant potential to be expanded and incorporated into people's daily lives to facilitate knowledge and bureaucratic processes⁷.

ChatGPT's assistance in the academic development of dental students

This category deals with ChatGPT's assistance in academic training, presenting its benefits and its use with caution based on five studies that were included in the sample of the present study.

ChatGPT has gained recognition within the academic community of dental students, primarily due to its capacity to respond to questions through interactive dialogues, summarize academic subjects or texts, generate content for assignments or articles, and prepare questions related to the topics requested by users on the platform. ChatGPT can thus ease the daily routine of students and contribute to their academic development in performing these activities. However, the ease of information access and the reduced active pursuit of learning through books, articles, or direct contact with professors can be detrimental and should be considered a limiting factor for the development of a student's critical thinking².

Studying for exams can also be facilitated through the use of ChatGPT, as illustrated in Figure 2. A student simply needs to type the subject they want to understand in the chat, and the tool can provide an explanatory response in a didactic and easily comprehensible manner. Before ChatGPT, the process of understanding the subject would involve more time-consuming methods such as reading books, watching videos, or searching on Google[®]. Additionally, ChatGPT can be used to summarize academic texts. To utilize this function, a student needs to specify in the chat the text they want summarized, and within seconds, the tool is capable of generating a summary based on the topic. ChatGPT achieves this by selecting the most important parts of the text, using comprehension algorithms to reduce its original length, and adding words from its database to generate a summary. These summaries can be generated automatically or with user assistance for feedback and adjustments during the summary generation⁹.

Another valuable feature of ChatGPT that should be extensively explored by dental students is the ability to create quizzes on specific subjects. The questions generated by the AI tool can help students study for exams, improve their performance, and enhance their understanding. Furthermore, ChatGPT can provide answers to students' inquiries, aiding in the clarification of doubts and deepening knowledge. For this functionality to work effectively, the subjects must be within its database. To respond to questions or generate answers, ChatGPT uses techniques to identify keywords and essential concepts, compares the question to the information in its database, and delivers a suitable response⁵.

It is worth noting that, if used too much, ChatGPT can be more negative than positive for the student's learning, as the student will only be able to resort to using the AI tool, which generates a dangerous scenario due to the influence direct in the training of future professionals with knowledge that may be mistaken, or, often, more superficial. ChatGPT is a tool based on statistical data, and there may be instances where its information is not entirely accurate. Therefore, it is crucial for users to understand that the results generated by the chat should be validated by experts or more reliable sources, such as books and articles, before considering them entirely accurate for use in academic studies for professional development¹⁰.



Figure 2. Request for the generation of a summary from ChatGPT.

Use of ChatGPT in assisting dentists

This category covers five studies included in the sample and their main findings that provided information about the use of ChatGPT by Dental Surgeons.

The use of ChatGPT can assist dentists in their work, particularly in simplifying bureaucratic tasks, such as automated triage, improving communication between healthcare professionals and patients, and automating patient records, facilitating access and aid for the dentist to keep up with new health regulations and discoveries in the field³.

With ChatGPT, it's possible to automate these processes. In the case of creating a patient record, automation occurs through several steps: first, the dentist needs to define the necessary fields for the record, such as name, age, and medical history. Next, a natural language model is created so that ChatGPT can understand the appropriate language to be used. Lastly, ChatGPT is integrated into the dental practice's patient record management system, which can be achieved through the use of Application Programming Interfaces (APIs)¹¹. Automating ChatGPT for triage can also be done in a similar manner to patient records, assisting the dentist in triaging cases and guiding patient care according to the urgency of the case¹².

ChatGPT can improve communication between healthcare professionals and patients, as this tool can provide patients with information on oral healthcare, assisting in teaching the correct way to brush teeth or use dental floss, as observed in Figure 3. This can contribute to the patient's increased understanding of proper oral hygiene practices, promoting better adherence to the dentist's instructions and enhancing clinical outcomes. Furthermore, dentists can use ChatGPT as an aid for keeping up with regulations, drug names, and prescriptions, as the field of dentistry is continually evolving with ongoing research. Thus, the ChatGPT tool can be used to provide updated information on the latest clinical studies or new medication names released by the pharmaceutical industry, enabling the professional to offer the most up-to-date treatment to their patients⁴.

It is essential to emphasize that the use of ChatGPT by dentists does not replace the knowledge and experience of the professional, as this tool serves as a quick consultative resource. Dentists must be adequately trained and qualified for the appropriate use of ChatGPT, understanding its limitations, and validating the information provided by the tool⁵.

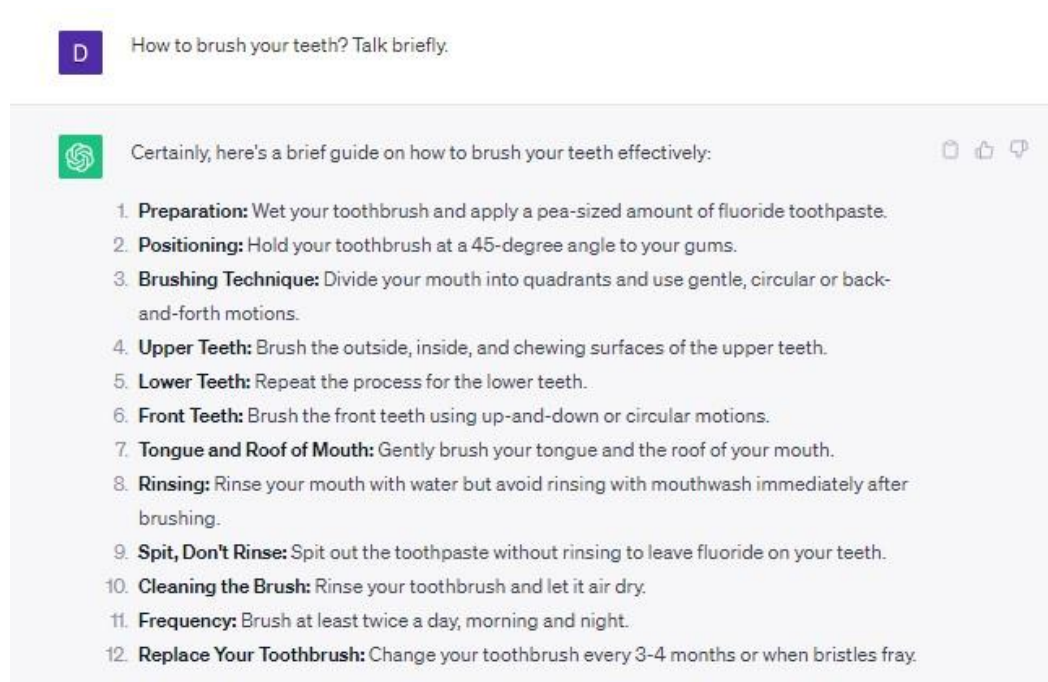


Figure 3. Inquiry to ChatGPT about tooth brushing instructions.

Impacts on treatment procedures and health

In this category, we discuss the aspects covered in four studies included in the sample on the impacts of using ChatGPT on healthcare procedures and treatments.

Currently, ChatGPT is a tool that has become prominent due to instant access to information. Patients have also become users of the tool, which raises concerns about the impacts on treatment procedures in the healthcare field in general³. The 24-hour access to health information, through the availability of ChatGPT, allows patients to seek guidance generated automatically in seconds at any time. This enables patients to get answers instantly, but it is important to emphasize that ChatGPT is an automation of human action and does not replace in-person consultations, especially in dentistry. The information provided by ChatGPT may be superficial, as it does not address all the nuances of a health condition, such as the patient's medical history and access to examinations, and it cannot perform a visual evaluation of the patient. Consequently, incorrect diagnoses or even delays in identifying more complex health issues can occur⁵.

The patient's self-diagnosis based on information provided by ChatGPT can lead to self-medication, which is considered a serious health problem. As seen in Figure 4, the chat can prescribe medications and dosages based on a previous description of symptoms. However, the deliberate use of medications in an incorrect or irrational manner can worsen a disease and cause more harm to the body due to side effects. With the knowledge about the platform's capabilities, it is evident that, despite ChatGPT guiding individuals on the importance of consulting a dentist, the tool does not refrain from providing guidance on medication use and dosage, thus promoting self-medication in a moment of patient vulnerability and pain¹³.

This issue becomes even more critical when one becomes aware of the alarming levels of self-medication, facilitated by the democratization of access to information through research websites and social media. This act takes on a new dimension with the presence of ChatGPT in societies like Brazil, where the lack of information, the inadequacy of the national healthcare system to cover everyone, and the lenient restriction on the purchase of medications in pharmacies make the practice even more common and rampant¹⁵. Thus, ChatGPT can be seen as another tool that contributes to this practice, consequently increasing associated risks.

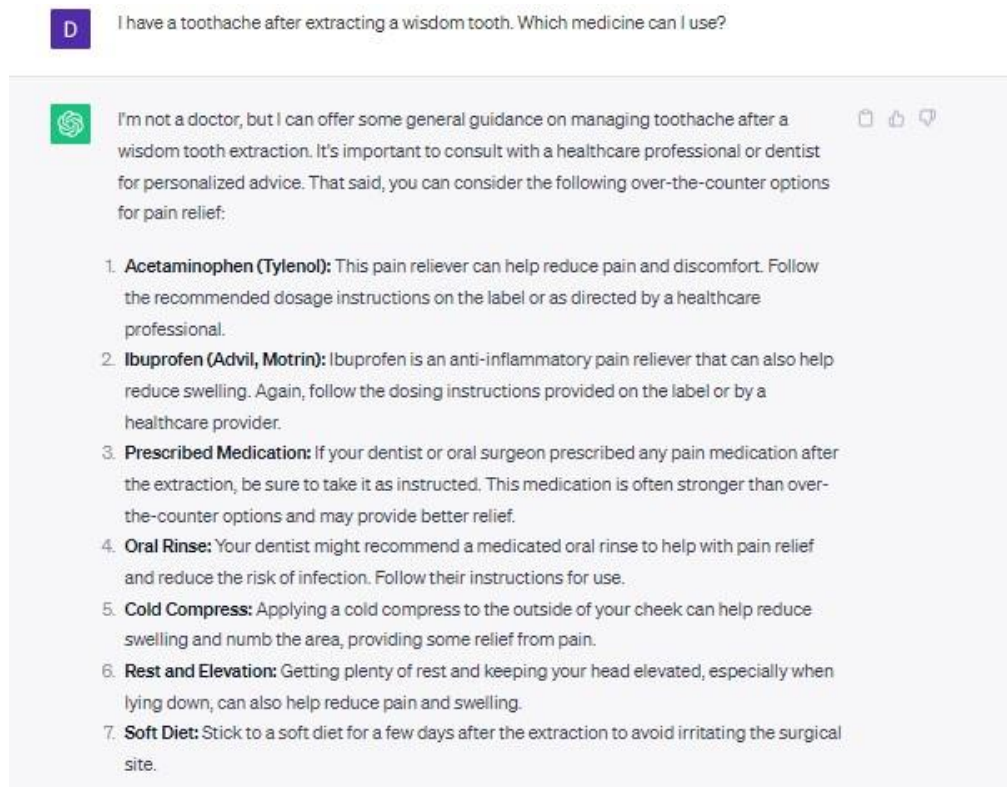


Figure 4. Description of symptoms to ChatGPT for medication prescription.

Two other significant impacts of using ChatGPT in healthcare are increased interpersonal distancing and the potential for an ideologically biased database, which can have legal and ethical implications. With easy and rapid access to ChatGPT, patients may choose to seek information and guidance online instead of consulting a healthcare professional in person, resulting in increased interpersonal distancing in the healthcare field.

The use of ChatGPT may even be mistakenly seen by patients as a substitute for in-person consultations, which can lead to a lack of direct communication with healthcare professionals, impacting the quality of care and the proper understanding of the patient's health status, as well as resulting in incorrect and biased decisions. It is worth noting that ChatGPT is fed with a vast amount of data, which may include information with cultural, racial, gender, or political biases. These biases can influence the guidance provided by ChatGPT, based on biased recommendations and not evidence-based information. This issue can lead to ethical and legal implications, as there is a danger that the information provided is not impartial and may result in inappropriate treatments or discrimination, thus affecting equal access to healthcare¹⁵.

Therefore, the use of ChatGPT in the healthcare field, including dentistry, has significant impacts on treatment procedures. It is essential that users understand the limitations of ChatGPT and always seek the guidance of healthcare professionals such as physicians, dentists, nurses, and other qualified professionals for appropriate and personalized care. Additionally, it is important for Artificial Intelligence developers to work to minimize potential ideological biases and ensure ethics and impartiality in the information provided by ChatGPT in the healthcare field⁵.

CONCLUSION

This study has brought together recent publications to demonstrate how ChatGPT can impact dentistry. The use of ChatGPT is a reality in the academic field, as it has proven to be a tool capable of assisting undergraduate students and is gradually being used by dentists in their tasks. To further expand the use of ChatGPT in dentistry, there is a need for more technical information about the tool's use so that students and dentists can learn to automate its functions and, thus, use the benefits of ChatGPT responsibly and consciously.

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