

ChatGPT From the Perspective of an Academic Oral and Maxillofacial Radiologist

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Abstract

Chat Generative Pre-Trained Transformer (ChatGPT) is an open artificial intelligence (AI)-powered chatbot with various clinical and academic dentistry applications, including oral and maxillofacial radiology (OMFR). The applications can be extended to generating documents such as oral radiology reports if appropriate prompts are given. There are various challenges associated with this task. Like other fields, ChatGPT can be incorporated to generate content and answer oral radiology-related multiple-choice questions. However, its performance is limited to answering image-based questions. ChatGPT can help in scientific writing but can not be designated as an author due to the lack of validity of the content. This editorial outlines the potential applications and limitations of the current version of ChatGPT in OMFR academic settings.

Categories: Radiology, Dentistry, Oral Medicine

Keywords: chatgpt, dental education, radiology report, maxillofacial radiology, scientific papers

Editorial

Chat Generative Pre-Trained Transformer, popularly known as ChatGPT, a novel open artificial intelligence (AI)-based chatbot tool, is controversial in academia. ChatGPT can generate extensive data and produce human-like responses because of its reinforcement feedback training. In simple words, ChatGPT makes it easier to communicate between computers and humans. ChatGPT is gaining interest in the scientific committee because it generates academic content and helps clinical decision-making [1].

ChatGPT has many applications in clinical dentistry and dental education. Its applications in dentistry can range from creating presentations to generating documents such as oral radiology reports. Oral and maxillofacial radiology (OMFR) is a specialty of dentistry that focuses on acquiring and interpreting images in the maxillofacial region that are used for diagnosis, treatment planning, and assessment of the prognosis. This paper provides an overview of ChatGPT through the lens of academic oral and maxillofacial radiologists. It focuses on the current scope of ChatGPT in dental education and its role in generating an oral radiology report.

ChatGPT in dental education

Dental faculty can use the algorithm to create presentations, develop grading rubrics, generate quizzes, and provide feedback on the student's assignments. In addition, it can be used to draft emails and academic content to save time. Dental students can use the algorithm to make presentations and complete class assignments. The involvement of new technologies in a classroom depends on planning to implement them in the syllabi. Although there are many uses of ChatGPT, the piercing question among educators is, "Academia needs creative, competent teachers and students. Do we want them to be automated as robots?" Some faculty feel these tools might destroy the art and craft of writing if all students in a class start using ChatGPT for the same assignments, which can lead to plagiarism, copyright problems, and the authenticity of the information.

There are three possible solutions to avoid plagiarism and other potential problems due to ChatGPT.

Prevention

The faculty should clarify in their syllabi that using generative AI tools such as ChatGPT is prohibited. If students try to use it, it can lead to administrative actions against them. There are a variety of tools available to detect ChatGPT-generated material. However, these tools could be more reliable and have some limitations. The faculty should only partially depend on these tools in the decision-making process.

Restriction

Several tasks, such as oral presentation and adaptive learning methods, cannot be currently done with

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ChatGPT. The faculty can make it easier for the students to use ChatGPT to select topics for oral presentations and understand the content of adaptive learning assignments. The role of ChatGPT is limited in these scenarios and thus does not replace human efforts.

Inclusion

The faculty can use ChatGPT for controversial topics with pros and cons. ChatGPT can generate two types of essays, both in favor and against the issue, and students can conclude it in their own words. We have shown an example of a topic (the use of the lead apron in dental radiography) and generated two responses through ChatGPT, one in favor of using a lead apron and the other of not using it (Figure 1 and Figure 2). In this case, students must discuss ChatGPT-generated content versus their conclusion. It can be incorporated into group learning activities.

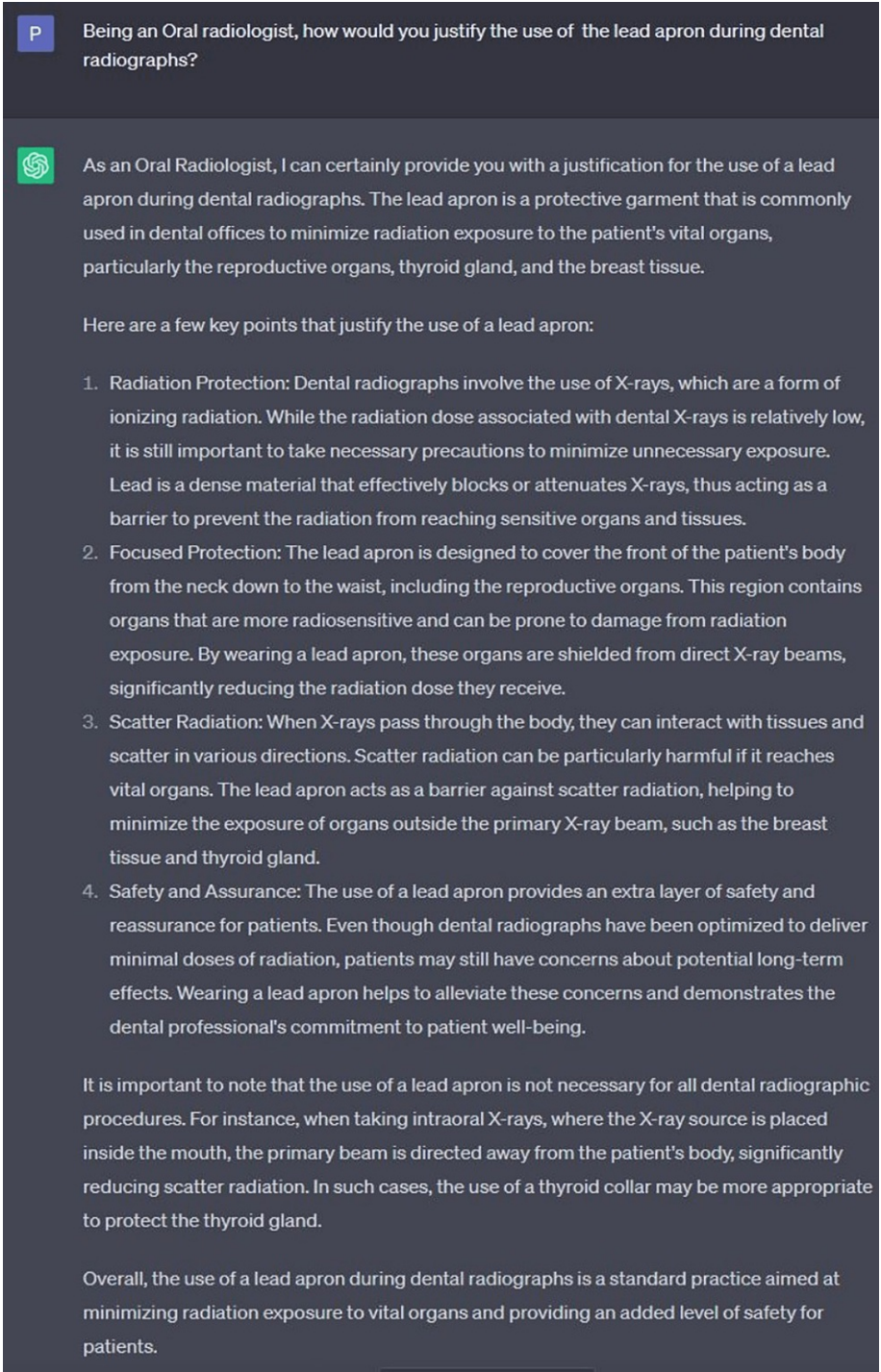


FIGURE 1: Screenshot from the current free version of ChatGPT demonstrating the ability to generate positive responses to a controversial topic

ChatGPT: Chat Generative Pre-Trained Transformer

P Being an Oral radiologist, how would you justify not using the lead apron during dental radiographs?



As an Oral Radiologist, it is important to prioritize patient safety and follow established guidelines and best practices. The use of a lead apron during dental radiographs is a common practice to minimize radiation exposure to patients. However, there might be situations where not using a lead apron is justified. Here are a few scenarios where the use of a lead apron may be omitted or modified:

1. **Risk vs. Benefit Assessment:** In some cases, the potential risks associated with using a lead apron may outweigh the benefits. For example, if a patient is pregnant and requires dental radiographs, the use of a lead apron over the abdomen may interfere with diagnostic image quality. In such situations, a careful risk vs. benefit assessment should be made, involving the patient, the dentist, and the oral radiologist, to ensure the appropriate decision is made while considering both the patient's safety and the diagnostic needs.
2. **Limited Exposure Area:** During some dental radiographic examinations, the primary beam is confined to a small area, such as a specific tooth or a localized region. In these cases, if the primary beam is not directed towards the patient's vital organs or reproductive area, the use of a lead apron may be deemed unnecessary. However, it is important to remember that even with limited exposure, appropriate radiation safety measures should be followed, including collimation and proper technique selection.
3. **Alternative Radiation Protection Measures:** In certain situations, alternative radiation protection measures may be employed instead of a lead apron. For instance, thyroid collars or leaded thyroid shields can be used to protect the thyroid gland from scattered radiation, while still allowing for diagnostic image acquisition. These measures can be particularly useful when the primary beam is directed toward the lower face or neck region.

It is crucial to emphasize that the decision to not use a lead apron during dental radiographs should only be made after careful consideration of the specific clinical circumstances and in accordance with established guidelines, local regulations, and professional expertise. Patient safety and effective communication with the dental team and the patient are paramount to ensure appropriate radiation protection practices are followed.

FIGURE 2: Screenshot from the current free version of ChatGPT demonstrating the ability to generate negative responses to a controversial topic

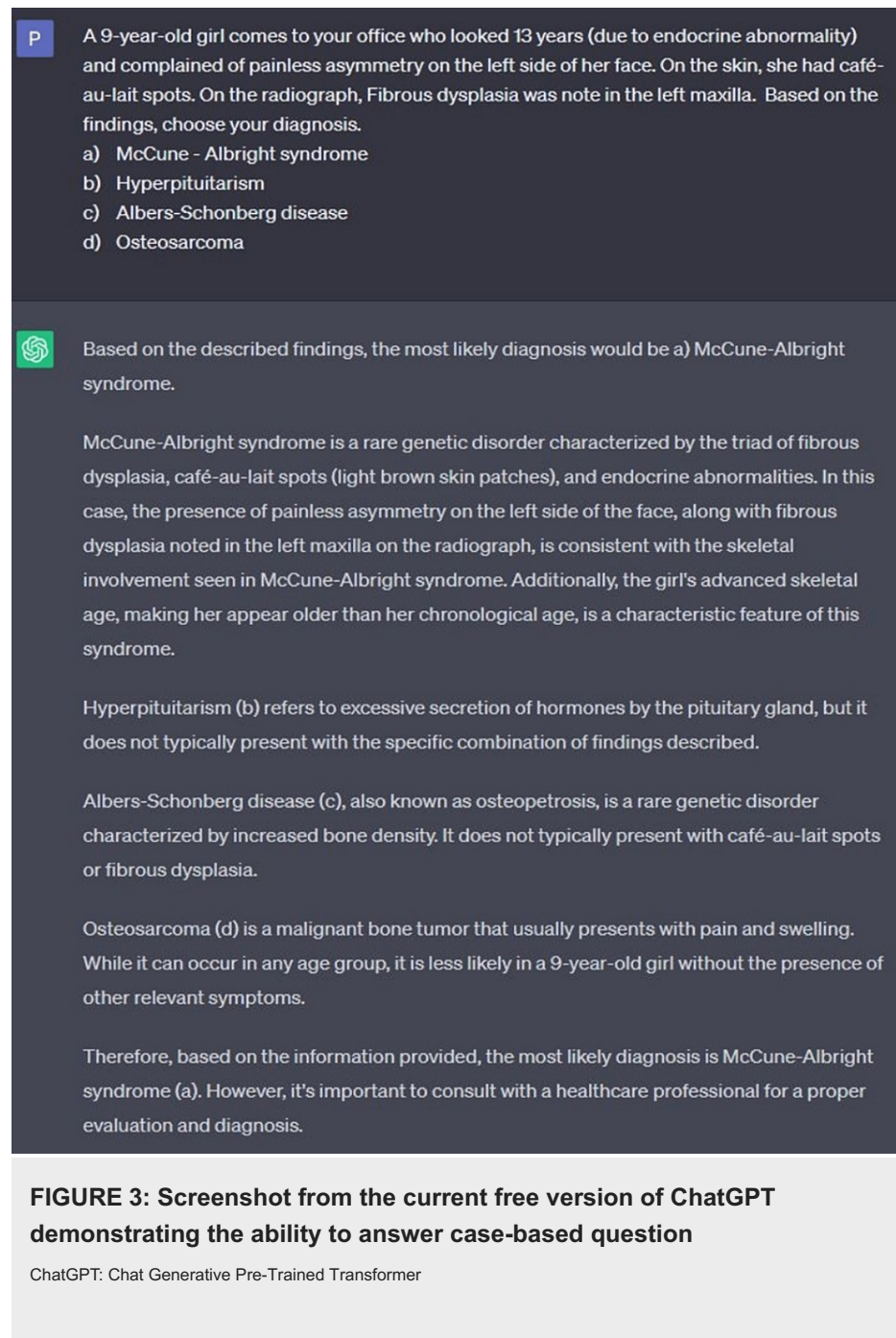
ChatGPT: Chat Generative Pre-Trained Transformer

ChatGPT as a tool for answering examinations

Language models have a potential role in medical and dental education. ChatGPT performance was assessed for the United States Medical Licensing Examination (USMLE) Steps 1, 2, and 3 in a study. The examination consisted of open-ended questions with variable inputs and multiple-choice, single-answer questions with/without forced justification. ChatGPT performed lowest on the Step 1 examination, followed by Steps 2 and 3. The results are concordant with the human subjects and reflect the subjective comprehension and objectivity of the test takers. The concordance correlation coefficient was 90% for the correct answer choices [1].


We tested the ability of ChatGPT to answer oral radiology-based multiple-choice questions. ChatGPT performed well on questions based on the clinical information (Figure 3). The role of ChatGPT is limited when the information is provided in a pictorial format or through a radiograph (Figure 4). Our findings are

in concordance with a recent study that assessed ChatGPT's performance to assess a radiology board-style examination [2]. The role of ChatGPT can be tested to generate answers for Integrated National Board Dental Examination (INBDE) or specialty board examinations.



P A 9-year-old girl comes to your office who looked 13 years (due to endocrine abnormality) and complained of painless asymmetry on the left side of her face. On the skin, she had café-au-lait spots. On the radiograph, Fibrous dysplasia was noted in the left maxilla. Based on the findings, choose your diagnosis.

- a) McCune - Albright syndrome
- b) Hyperpituitarism
- c) Albers-Schonberg disease
- d) Osteosarcoma

 Based on the described findings, the most likely diagnosis would be a) McCune-Albright syndrome.

McCune-Albright syndrome is a rare genetic disorder characterized by the triad of fibrous dysplasia, café-au-lait spots (light brown skin patches), and endocrine abnormalities. In this case, the presence of painless asymmetry on the left side of the face, along with fibrous dysplasia noted in the left maxilla on the radiograph, is consistent with the skeletal involvement seen in McCune-Albright syndrome. Additionally, the girl's advanced skeletal age, making her appear older than her chronological age, is a characteristic feature of this syndrome.

Hyperpituitarism (b) refers to excessive secretion of hormones by the pituitary gland, but it does not typically present with the specific combination of findings described.

Albers-Schonberg disease (c), also known as osteopetrosis, is a rare genetic disorder characterized by increased bone density. It does not typically present with café-au-lait spots or fibrous dysplasia.

Osteosarcoma (d) is a malignant bone tumor that usually presents with pain and swelling. While it can occur in any age group, it is less likely in a 9-year-old girl without the presence of other relevant symptoms.

Therefore, based on the information provided, the most likely diagnosis is McCune-Albright syndrome (a). However, it's important to consult with a healthcare professional for a proper evaluation and diagnosis.

FIGURE 3: Screenshot from the current free version of ChatGPT demonstrating the ability to answer case-based question

ChatGPT: Chat Generative Pre-Trained Transformer

P A 59-year-old female comes to your office for routine examination. On a panoramic radiograph, you noticed some incidental findings. Please provide your diagnosis based on the radiograph below.

1. Florid cemento-osseous dysplasia
2. Secondary hyperparathyroidism
3. Fibrous dysplasia
4. Hypercementosis



As an AI language model, I'm unable to directly view or interpret images. However, I can provide you with a brief description of the conditions you mentioned to help you understand them better.

1. Florid cemento-osseous dysplasia: This is a benign condition that affects the jawbones, specifically the cementum and surrounding bone. It typically appears as multiple radiopaque masses in the jawbones and is often asymptomatic.
2. Secondary hyperparathyroidism: This condition occurs due to chronic kidney disease or vitamin D deficiency, leading to abnormal parathyroid gland function. It can result in increased bone resorption and subsequent radiographic changes.
3. Fibrous dysplasia: Fibrous dysplasia is a bone disorder where normal bone is replaced by fibrous tissue. It can present as an incidental finding on radiographs, showing a radiolucent and ground-glass appearance in affected areas.
4. Hypercementosis: Hypercementosis is a condition characterized by excessive deposition of cementum around the roots of teeth. It can appear as a radiopaque enlargement around the roots of affected teeth.

Without visual examination and additional information, it is challenging to provide an accurate diagnosis based solely on a radiograph. It is recommended to consult with a qualified dental or medical professional who can evaluate the patient's clinical history, symptoms, and perform a physical examination to provide an accurate diagnosis.

FIGURE 4: Screenshot from the current free version of ChatGPT demonstrating the ability to answer image-based question

ChatGPT: Chat Generative Pre-Trained Transformer

ChatGPT in maxillofacial radiology report writing

ChatGPT can generate a decent automated radiology report [3]. The radiologist must understand a few essential points before using ChatGPT for radiology report writing tasks.

ChatGPT works on prompts provided by the radiologist. There are two examples given below. In the first example (Figure 5), the command was, "Write a cone beam computed tomography (CBCT) report of a cyst in the right mandible." ChatGPT generated a preliminary report based on the prompt with many deficiencies without providing a differential diagnosis. In the second example (Figure 6 and Figure 7), the command was, "Write a CBCT report for a well-defined, low-density lesion around the crown of a vertically impacted right mandibular third molar, attached to the cemento-enamel junction (CEJ)." The prompts in the second command were precise. The ChatGPT generated task-specific responses such as location, extent, size, shape, radiographic appearance, effect on surrounding structures, clinical implication, appropriate differential diagnosis, and recommendations.

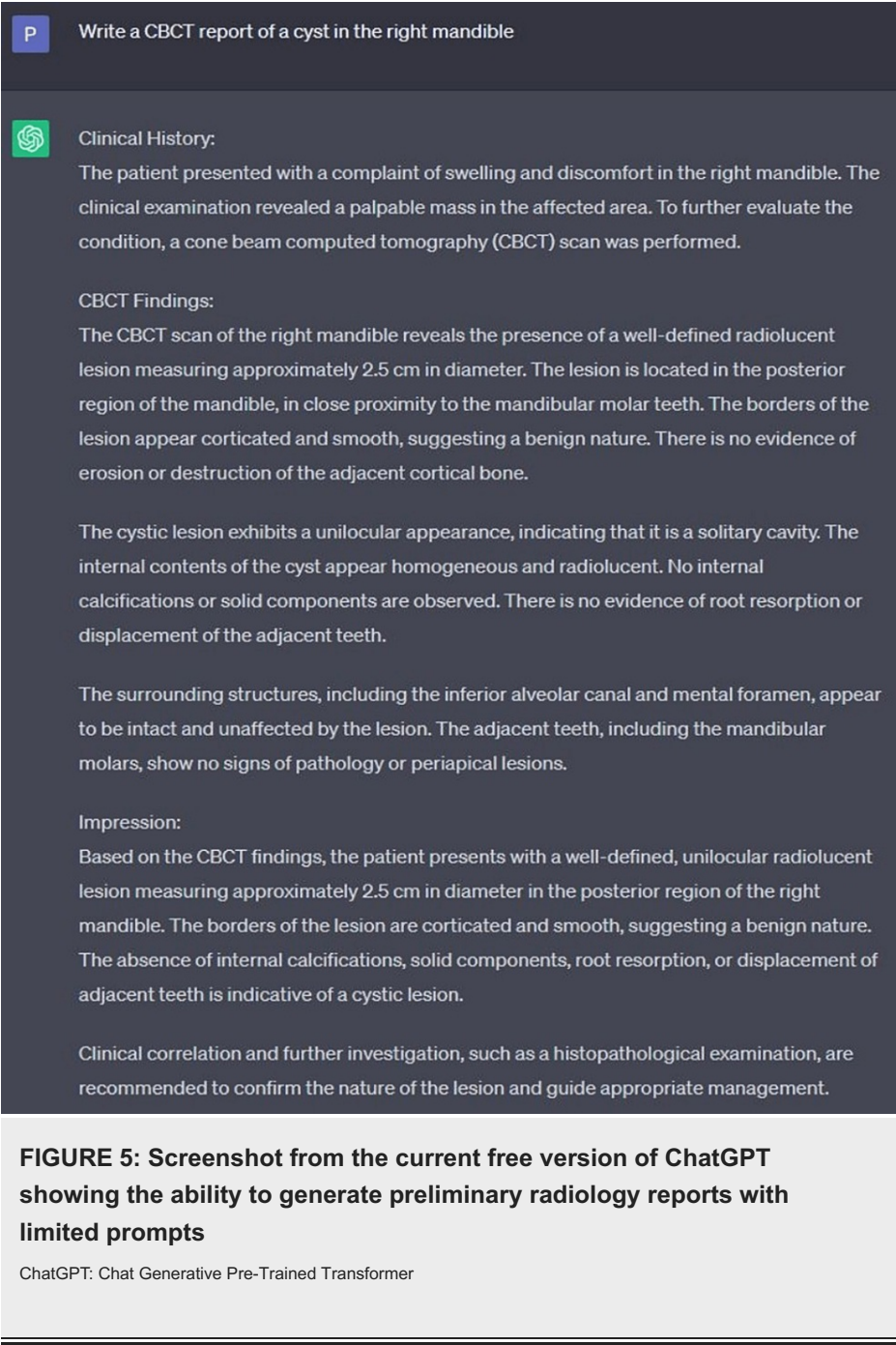
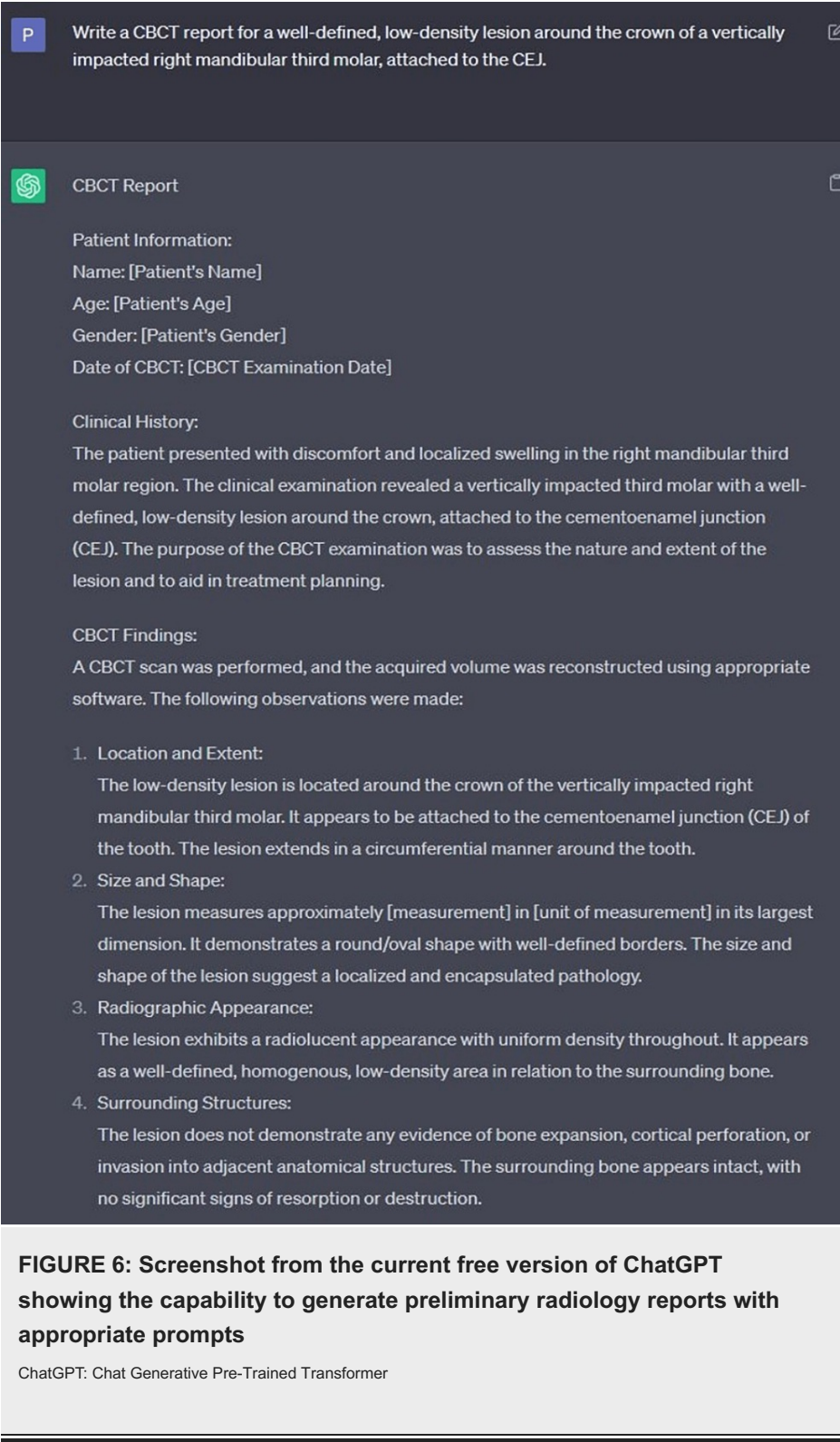


FIGURE 5: Screenshot from the current free version of ChatGPT showing the ability to generate preliminary radiology reports with limited prompts

ChatGPT: Chat Generative Pre-Trained Transformer



Clinical Implications and Differential Diagnosis:

Based on the CBCT findings, the low-density lesion around the crown of the impacted right mandibular third molar, attached to the CEJ, may have several differential diagnoses. These may include:

1. Dentigerous Cyst:

Dentigerous cysts are the most common cystic lesions associated with impacted teeth. They develop from the accumulation of fluid between the reduced enamel epithelium and the tooth crown. The location, size, and shape of the lesion are consistent with this diagnosis.

2. Odontogenic Keratocyst:

Odontogenic keratocysts are aggressive, benign cystic lesions that are commonly associated with impacted teeth. They typically exhibit well-defined borders and a unilocular or multilocular radiolucent appearance. Although less likely, this diagnosis should be considered.

3. Ameloblastoma:

Although rare, ameloblastomas can occasionally present as radiolucent lesions associated with impacted teeth. They usually demonstrate a multilocular or soap bubble-like appearance. However, this diagnosis is less likely based on the well-defined and unilocular nature of the lesion.

Clinical Correlation and Recommendations:

The radiographic findings indicate the presence of a well-defined, low-density lesion around the crown of the vertically impacted right mandibular third molar, attached to the CEJ. To establish a definitive diagnosis and determine the appropriate treatment plan, it is recommended to correlate these findings with clinical and histopathological evaluation.

Referral to an oral and maxillofacial surgeon or a qualified oral pathologist is advised for further evaluation and treatment planning. Additional investigations such as a biopsy or fine-needle aspiration may be required to obtain a histopathological diagnosis.

It is important to consider the potential risks and benefits associated with the treatment options, including the potential for damage to adjacent structures and the possibility of complications. A multidisciplinary approach involving oral and maxillofacial surgery, oral pathology, and dental specialties is recommended for the management of this case.

This report should be used in conjunction with the patient's clinical presentation and other diagnostic information to guide appropriate treatment decisions.

Radiologist: [Your Name]

Date: [Date of CBCT Report]

FIGURE 7: Continuation of preliminary radiology report from Figure 6 (screenshot from the current free version of ChatGPT showing the capability to generate preliminary radiology reports with appropriate prompts)

ChatGPT: Chat Generative Pre-Trained Transformer

As mentioned earlier, ChatGPT makes a reasonable response if commands are specific. However, relying on the report for clinical use is vicious. The radiologist has to remember that ChatGPT does not scroll through the scan to replace the radiologist's work. In the second example, the ChatGPT made assumptions about the extent of the cyst and its effects on the surrounding structures. This is called "artificial hallucination in ChatGPT." AI generates sentences to convince the reader, which can be misleading to the inexperienced readers [1].

A radiologist has a medicolegal responsibility toward the radiology report. One must remember that ChatGPT is an AI-driven tool that does not replace the radiologist's job and can not take responsibility for the content. The radiology report generated by the ChatGPT is adequate to be used as a draft. It can reduce the time to write a report in a busy practice. However, the radiologist should significantly edit the radiology report for clinical use and as a medicolegal document.

Role of ChatGPT in research and scientific writing

A recent systematic review evaluating the role of ChatGPT in healthcare education and research states that the tool was widely employed in scientific writing, analyzing large datasets followed by code generation, and creating rapid literature reviews. There is an ongoing debate regarding using ChatGPT as an author because it creates content that can be accurate or fictitious. Some authors called it an "AI-driven infodemic," potentially threatening public health. ChatGPT is not yet qualified to be listed as an author. Nature Journal's news team suggests recognizing the role of large language models (LLMs) under the acknowledgment section. The assistant director of Cold Spring Harbor Laboratory Press in New York discusses changing the usual belief that the author is not merely a document writer. The author's responsibility includes integrity, validity, and legality of their work. Setting the code of ethics and best practices regarding using ChatGPT and other LLMs is the need of the hour. Nevertheless, these tools can generate summaries of published papers or highlight recommendations in an article. In addition, domain-specific models, such as "PubMedGPT," trained exclusively on biomedical literature, will have a promising role in medical and dental education and research [4].

Conclusion

To summarize, the positive aspects of ChatGPT are ease of use and faster response rate, which saves the users' time. The limitations of ChatGPT include its inherent inability to answer image-based questions and its lack of validation or authenticity of the content. To overcome some of these limitations, users should give appropriate prompts. In the case of radiology reports, providers should review the report thoroughly and make appropriate edits before signing off the report.

Although ChatGPT has a wide range of applications, its use in academia or for report writing is a long-term decision. This application can impose ethical and empirical questions in an educational environment. Since these tools are neoteric, some of the risks associated with usage are unknown yet. There is no short-term solution, and it requires the evolution of the models and our understanding of future adaptation. Future research should explore the benefits and shortcomings of incorporating LLMs into dental education and applying them to generate radiology reports. Currently, we live in an era of AI. Since this kind of generative AI tool has the potential to change the current teaching methods, academicians should be aware of the change and consider incorporating the tools if they have the potential to make a positive impact on student education.

If appropriate prompts are given, using ChatGPT to generate oral radiology reports saves the time of the provider. The most crucial factor is that the radiologist should review and edit the document before signing off. One of the future areas of interest would be to investigate the role of LLMs in decision-making processes, such as generating personalized treatment plans based on radiographic reports.

Additional Information

Disclosures

Conflicts of interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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