

ChatGPT Guided Diagnosis of Ameloblastic Fibro-Odontoma: A Case Report with Eventful Healing

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ABSTRACT

Ameloblastic Fibro-Odontoma (AFO) defined by the World Health Organization as a mixed odontogenic tumor. It's rare and representing 1% to 3% of odontogenic tumors. Due to AFO's rarity and poorly understood etiopathology, clinicians and pathologists may face difficulties in its differential diagnosis. This case report explores the diagnosis and treatment of this uncommon maxillofacial condition in a juvenile patient, also showcasing ChatGPT's potential to assist clinicians by providing diagnosis and recommendations. In parallel to the treatment processes, an external researcher described the case and simulated possible diagnostic and treatment scenarios using ChatGPT 3.5. Although the diagnosis and recommendations obtained are not taken into account in the evaluation of the case, the aim is to draw attention to these tools, which depict a scenario similar to clinical reality. The use of Artificial Intelligence in healthcare, including ChatGPT, is still evolving, and more research is needed to understand its full potential in analyzing clinical information, providing diagnoses, and recommending treatments.

Keywords: Ameloblastic Fibro-Odontoma, Odontogenic Neoplasm, ChatGPT

INTRODUCTION

The use of artificial intelligence (AI) in medicine has shown promising results in improving diagnostic accuracy and streamlining the decision-making process [1]. One of them, Chat Generative Pre-Trained Transformer (ChatGPT), released to the public on November 30, 2022, is the largest artificial intelligence language model and a prototype developed by OpenAI, specializing in dialogue [2]. ChatGPT uses machine learning on extensive human-generated data to generate text responses [3]. The main advantages are that it reduces human error, provides assistance and guidance to doctors and other healthcare professionals, and is always accessible for patient services [4]. This tool holds the potential to function as a valuable

aid and guide for clinicians, particularly in rare conditions [1].

Ameloblastic Fibro-Odontoma (AFO) is a uncommon benign odontogenic tumor, sharing similar histologic features with Ameloblastic Fibroma (AF) [5]. Histologically, it also includes enamel and dentin components [5]. AFO's typically occur in the posterior regions of the mandible and maxilla and usually present as painless, slow-growing swellings accompanied by tooth eruption failure [6]. Its higher prevalence is particularly observed in the pediatric population [6]. AFO exhibits less aggressive behavior than AF although numerous case reports have documented locally aggressive involvement of AFO [7-9]. Treatment varies from only the removal of the tumor to the

removal of the tumor, curettage, and extraction of the associated teeth [8]. Most recurrences reported in the literature are the result of inadequate removal, therefore surgical planning is critical [8].

In this case report, we investigated a scenario where the direct assessment from diagnosis to treatment was considered complicated and evaluated the suggestions of artificial intelligence during these stages. This exemplified the utility of ChatGPT in detailing the diagnosis, treatment, and follow-up process of a rare tumoral case. At this point, an external researcher described the scenario of our case and asked ChatGPT 3.5 for appropriate prompts and possible diagnoses. The appropriate prompts were selected based on the study of Khurana and Vaddi [10]. The diagnoses and recommendations obtained were not taken into consideration in the evaluation of the case. However, it is intended to draw attention to these tools, which are quite relevant to clinical reality.

CASE REPORT

An 8-year-old girl with no history of systemic disease presented to our clinic with pain and swelling in the region of the right lower premolar. Clinical examination revealed a lesion in the premolar region of the right mandible, extending from tooth number 42 to tooth number 85, characterized by a painful, mild swelling of the vestibular mucosa and erythematous appearance of the adherent gingiva in the relevant region. Radiological examination revealed the presence of a radiopaque and radiolucent mixed lesion in the premolar region, localized into the bone, causing displacement of the erupting permanent teeth. A 3D cone

beam tomography examination revealed that the lesion was bicompartimentalized, separated from the surrounding tissue by a soft tissue capsule and contained tooth-like hard tissues (Figure 1). Histologic examination of the lesion by excisional biopsy was planned. Written consent has been obtained from the family. After receiving parental consent, the hard tissue lesion measuring approximately 1.5 x 2.5 cm (horizontal x vertical) was surgically excised under general anesthesia with the aid of local anesthesia, by osteotomy and odontectomy with surgical motor and burs. Tooth number 42, which was located into the lesion without any bone support, and tooth number 43, which was displaced excessively towards the base of the mandible by the lesion and had no chance of eruption, were extracted. The mental nerve, which emerged from the foramen, was identified, and its continuity was preserved. Care was taken to avoid any damage to teeth 44 and 41, which were in close anatomical proximity to the lesion. After the lesion enucleation was completed, the cavity was curetted and the retentive areas were removed (Figs. 2,3). Bleeding was controlled and the area was closed primary tension-free. Standard medication was prescribed to control postoperative infections after the surgery with antibiotics (Augmentin BID; 625 mg, 2x1, GS, London, UK), analgesics for pain control (Parol; 500 mg, 2x1, Atabay, Türkiye), and an antibacterial mouthwash (Oroheks Plus %0.15, 3x1, Tripharma, Istanbul, Türkiye). At the end of the first postoperative week, unsatisfactory healing of the erythematous and edematous vestibular gingiva was observed in the wound area. The patient was instructed on proper oral hygiene procedures with wound site care and was scheduled for a follow-up visit the subsequent week. During the follow-up visit, it was observed that local infection findings such as edema and erythema increased in the vestibular flap and that it was traumatized by the contralateral occlusion (Figure 4). Due to the presence of purulent fluid in the cavity, tooth 83 was extracted and the cavity drained through the socket. Antibiotic therapy using a combination of Augmentin-BID 625 mg (2x1, GSK, London, UK) and Flagyl 250 mg tablets (2x1, Sanofi, Paris, France) was initiated. Irrigation of the socket was maintained every three days using saline and povidone iodine. The subsequent week showed a resolution of the local infection and the appearance of normal tissues in the wound area (Figure 5). AFO diagnosed according to pathology report (Figure 6). The wound area has healed as intended, and the patient is currently being monitored for the potential recurrence of lesions and correct eruption of the teeth. Orthodontic consultation was also obtained to rehabilitate the patient's further occlusion.

Main Points:

- Ameloblastic Fibro-Odontoma (AFO) is a rare odontogenic tumor representing 1% to 3% of odontogenic tumors.
- The diagnosis and treatment of AFO in a pediatric patient illustrates the unique challenges and considerations dentists may face in rare tumor cases.
- At the same time, it aims to highlight the clinical utility of ChatGPT as a tool for diagnostic assistance and guidance in rare pathological conditions, underscoring the potential of AI to assist dentists in decision-making.
- The integration of AI in dentistry increases diagnostic accuracy and improves clinicopathologic correlation, representing a significant advancement in the field

Simultaneously with the procedures, another researcher used ChatGPT 3.5 to make the queries. The medical history and clinical findings of the patient were used to generate a case scenario; then, a diagnosis and treatment recommendations were made on October 25, 2023 (Figure 7). The diagnostic and treatment procedures were monitored by an external observer and compared to the promised scenario and treatment management of ChatGPT.

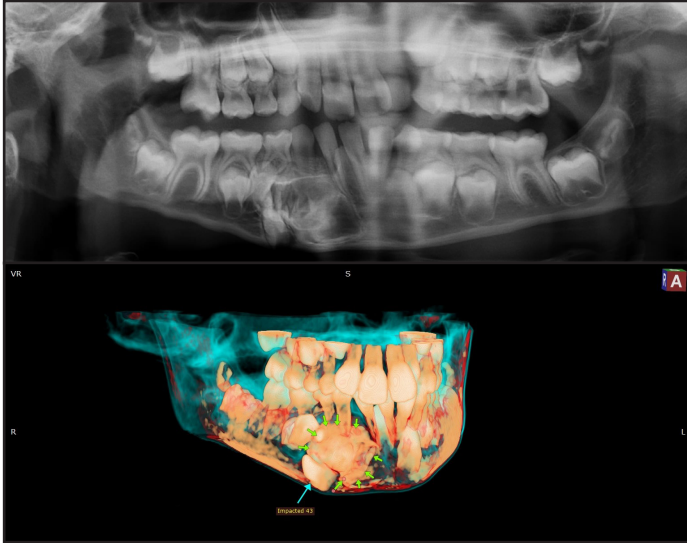


Figure 1. a. Preoperative view on panoramic radiography, b: 3D reconstruction of the lesion (Green arrows)

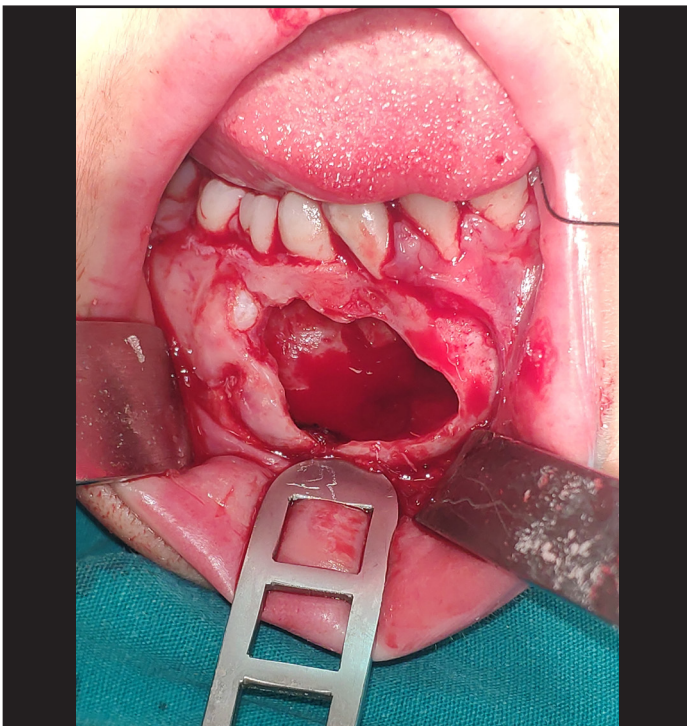


Figure 2. Viewing the cavity after the lesion is enucleated

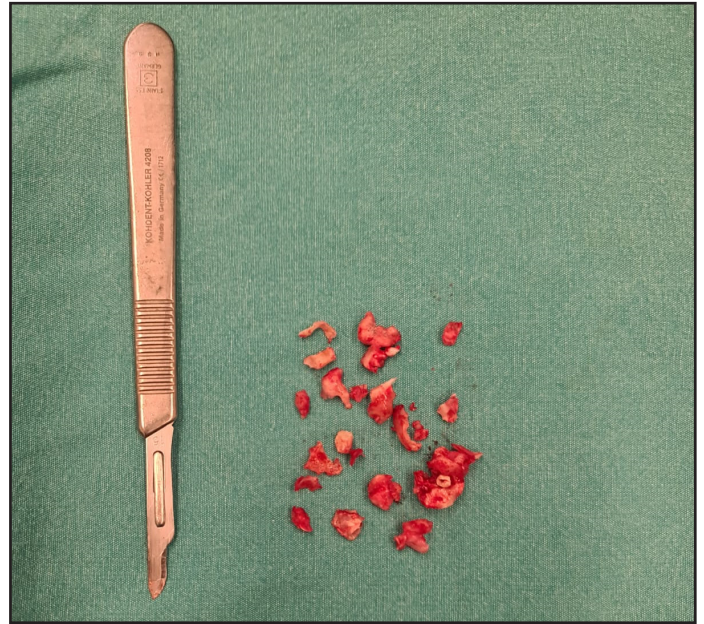


Figure 3. Fragmented hard tissue specimens



Figure 4. Secondary infection at the site of the wound



Figure 5. Ensuring complete recovery after the resolution of local infection findings.

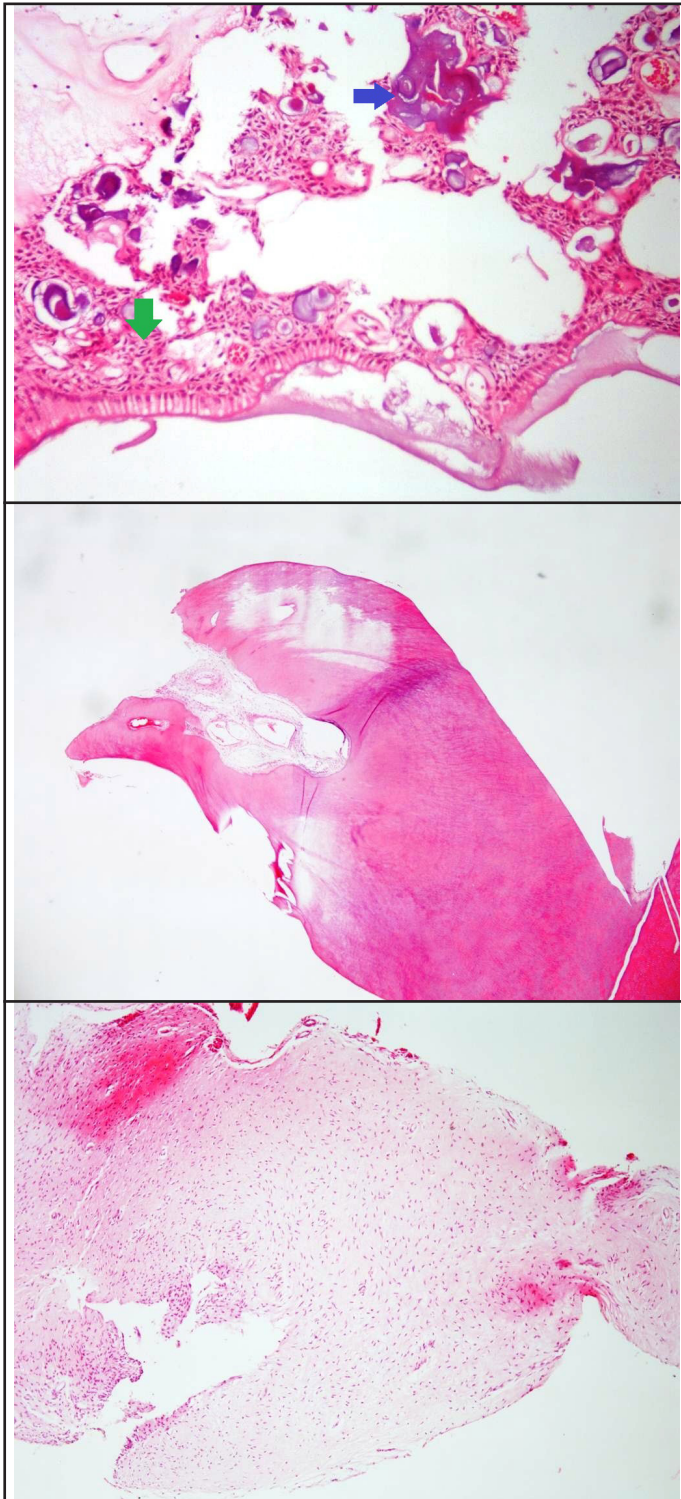


Figure 6. a. In histopathological examination of decalcified tissue samples, both mineralized-calcified foci (blue arrow) and odontogenic epithelium (green arrow) are observed. (Hematoxylin&Eosinx100), **b:** In histopathological sections, enamel-dentin structures and pulp tissue were observed. (Hematoxylin&Eosinx40), and **c:** In this photomicrograph, there is primitive ectomesenchyme that resembled the dental papilla. (Hematoxylin&Eosinx100)

DR write your diagnosis by following clinical scenerio " a 8 year old girl comes to clinic with the lack of teeth in her left mandible premolar region, she hasnt any complain and in radiography the incisors and premolars are impacted due to radiopac and radiolucent mix lesion"

ChatGPT Based on the clinical scenario provided, the diagnosis for the 8-year-old girl with a lack of teeth in her left mandibular premolar region, along with impacted incisors and premolars in the same region associated with a radiopaque and radiolucent mixed lesion, could be indicative of a condition known as "Ameloblastic Fibro-Odontoma" or simply "Ameloblastic Fibroma."

Diagnosis: Ameloblastic Fibro-Odontoma (AFO)

Explanation:
Ameloblastic fibro-odontoma is a rare, benign odontogenic tumor that primarily affects children and adolescents. It is characterized by the presence of both radiopaque (dense) and radiolucent (less dense) areas on radiographic images, which correspond to the mix of dental tissues within the lesion.

In this case, the clinical features and radiographic findings align with the typical presentation of AFO:

- Lack of Teeth in Left Mandibular Premolar Region:** This corresponds to the absence of premolar teeth, which can occur due to the presence of the tumor.
- Impacted Incisors and Premolars:** The impacted incisors and premolars suggest that the tumor is causing crowding and preventing the normal eruption of these teeth.
- Radiopaque and Radiolucent Mixed Lesion:** The radiographic characteristics of mixed radiopacity and radiolucency within the lesion are indicative of the presence of dental tissues such as enamel, dentin, and pulp in various stages of development.

It's important to note that Ameloblastic Fibro-Odontoma is benign and typically asymptomatic. Treatment usually involves surgical removal of the lesion to prevent further dental complications and ensure proper eruption of impacted teeth. Additionally, close follow-up care and monitoring of dental development may be necessary.

However, a definitive diagnosis and treatment plan should be established by a qualified oral and maxillofacial surgeon or oral pathologist after a thorough clinical examination, imaging studies, and histopathological evaluation of the lesion. This response is for informational purposes only and should not replace professional medical advice.

Figure 7. a. Diagnostic prompt with ChatGPT 3.5

You Individualize the treatment plan for this scenario described above

ChatGPT Certainly, considering the specific scenario of an 8-year-old girl with an Ameloblastic Fibro-Odontoma (AFO), here's an individualized treatment plan:

- Biopsy and Histopathological Examination:**
 - Procedure:** Perform a biopsy to confirm the diagnosis through histopathology examination.
 - Timing:** This should be done promptly to establish a definitive diagnosis.
- Pain Management and Symptomatic Relief:**
 - Analgesics:** Prescribe age-appropriate analgesics to alleviate pain and discomfort.
 - Anti-inflammatory Medications:** Consider anti-inflammatory medications to reduce swelling.
- Consultation with Pediatric Oral and Maxillofacial Surgeon:**
 - Purpose:** Collaborate with a specialist experienced in pediatric oral surgery.
 - Timing:** Arrange a consultation promptly for a comprehensive assessment.
- Orthodontic Consultation:**
 - Purpose:** Collaborate with an orthodontist to assess the impact on erupting permanent teeth and plan orthodontic interventions if necessary.
 - Timing:** Early orthodontic consultation to address tooth displacement.

5. **Surgical Excision:**

- **Procedure:** Plan for surgical excision of the AFO lesion.
- **Timing:** Perform the surgery as soon as feasible after confirming the diagnosis.

6. **Reconstructive Considerations:**

- **Bone Grafting:** Assess the need for bone grafting to address any resulting jaw defects, considering the age and growth factors.
- **Timing:** Coordinate with the oral and maxillofacial surgeon to determine the optimal timing for reconstructive procedures.

7. **Postoperative Care:**

- **Regular Follow-Up Appointments:** Schedule frequent follow-up visits to monitor healing, assess for any complications, and adjust the treatment plan as needed.
- **Radiographic Surveillance:** Conduct periodic CBCT scans to monitor bone regeneration and rule out recurrence.

8. **Pediatric Dentistry Involvement:**

- **Preventive Oral Care:** Collaborate with a pediatric dentist to emphasize preventive oral care practices for the patient.
- **Monitoring Permanent Tooth Eruption:** Regularly monitor the eruption and alignment of permanent teeth affected by the AFO.

9. **Psychosocial Support:**

- **Patient and Family Education:** Provide age-appropriate information to the patient and family about the condition, treatment, and expected outcomes.
- **Addressing Anxiety:** Consider involving a child psychologist to address any anxiety or psychological concerns related to the diagnosis and treatment.

10. **Long-Term Monitoring:**

- **Transition to Adult Care:** Plan for a smooth transition to adult oral health care as the patient grows.

This individualized treatment plan takes into account the age-specific considerations, the need for collaboration with pediatric specialists, and the importance of addressing the impact on erupting permanent teeth in an 8-year-old patient with Ameloblastic Fibro-Odontoma.

Figure 7. b. Treatment prompt with ChatGPT 3.5

DISCUSSION

AFO is a rare, benign odontogenic tumor with a disputed etiopathogenesis [9]. The proper classification, specifically the differentiation between hamartoma and neoplasm, is still a controversial subject [9]. According to the World Health Organization (WHO), ameloblastic fibro-odontoma (AFO) is recognized as a mixed odontogenic tumor [11]. AFO is composed of odontogenic epithelium and ectomesenchyme, which demonstrate hard tissue formation. It is characterized by ectomesenchyme resembling dental papilla, dental lamina, epithelial strands and nests that resemble the enamel organ, and the presence of both enamel and dentin [11]. Histopathological features of AFO may overlap with those of an immature complex odontoma [9]. Additionally, studies suggest a close relationship between AF, AFO, and odontoma (both compound and complex), suggesting that they may represent different stages of the same lesion [9]. Some propose that AF and AFO may be precursor stages of odontoma [12]. AFO's diagnostic challenges arise from its similarity to Adenomatoid Odontogenic Tumor

(AOT) and AF [13]. Distinguishing between AFO and AF relies on the presence of tooth germ differentiation elements (enamel or dentin), with AFO showing evidence and AF lacking such features [13]. Adenomatoid odontogenic tumors, which are benign growths, can present as a “snowflake” opacity on imaging [5]. It is typically located in the anterior part of the maxilla that may help exclude with AFO [5]. Despite its rare incidence, AFO should be considered in the differential diagnosis of intraoral radiolucencies containing radiopaque material, especially in young patients. However, considering that AFO is a rare condition, representing 1% to 3% of odontogenic tumors [6], it should be noted that there is a lack of evidence in the literature regarding the tumor's prognosis post-excision and the necessity of long-term follow-up for potential malignant transformation. Although malignant transformation of AFO is rare, there are cases reported in the literature [14, 15].

For practitioners, especially in busy clinical settings diagnostic uncertainty is common and challenging [16]. At this point, the AI evaluating these pathological conditions has major advantages over the human evaluators. For instance, the human brain, limited in data storage, tends to perceive rare medical conditions and treatments as more challenging [1]. AI has no such limitations and can instantly access countless data sources, such as articles and reviews, deriving conclusions from their content [3]. It is not sensitive to factors present in human evaluators, such as fatigue, sleep deprivation, cognitive overload, noise, or psychological conditions [17]. It also eliminates the effects of cognitive biases, minimizing human error, which is important for diagnosis and treatment [18, 19]. However, the use of ChatGPT and similar language models for direct diagnosis and patient management raises ethical issues. These concerns arise when using ChatGPT, including potential issues of trustworthiness, intellectual property infringement, copyright violations, and bias. It is critical to conduct a careful evaluation and address any limitations or ethical dilemmas before integrating ChatGPT into practice [20]. According to the study by Balel, the use of ChatGPT as a patient information tool in oral and maxillofacial surgery is safe [21]. In addition, there are studies in the literature that suggest that its use in medical education or practice is questionable [2, 4].

One of the conclusions drawn from this case presentation is to exemplify that ChatGPT can serve as an auxiliary tool in complex scenarios, albeit not suitable for forming a preliminary diagnosis. Physicians can use artificial intelligence to prioritize

or generate diagnostic hypotheses previously unexplored [22]. Another conclusion to highlight in this section is that the initial diagnosis by the surgeon on the specimens for histological examination significantly reflects the patient's medical history, clinical, radiological, and laboratory findings. This pre-diagnosis acts as a connection between the clinician and pathologist. In this context, ChatGPT may show promise in enhancing clinicopathologic correlation.

The responsibility lies with clinicians to accurately and thoroughly identify the lesion, possess sufficient knowledge of it, and differentiate between normal and pathologic conditions. The pathologist's role is significantly facilitated when the specimen is described in the appropriate medical jargon. In a study by Mehnen comparing the diagnostic abilities of ChatGPT and physicians, ChatGPT proved successful in 90% of presented scenarios, establishing it as a valuable assistant tool [23]. In the literature, ChatGPT has been very successful in scenario- and diagnosis-based studies in the fields of psychiatry, ophthalmology, and otolaryngology, achieving high levels of physician agreement [1, 24, 25].

However, there are still concerns regarding the clinical reliability due to its several limitations [4]. It tends to hallucinate, generating responses that may lack a factual basis [26, 27]. The model's knowledge cut-off in September 2021 poses a risk of outdated information [28]. Inconsistency in responses over time and the potential for false references further challenge the reliability of the information provided [28]. Users must approach ChatGPT with caution, verifying information independently and acknowledging its constraints in handling complex, dynamic, and controversial topics. For ChatGPT or similar language models to be routinely used in maxillofacial surgery, clinical reliability, accurate referencing of the information it provides, appropriate guidelines and a framework of practice are required [29]. It should be noted that ChatGPT's questioning on the case scenario was not considered in the surgical planning and was done separately. The required biopsy was taken as planned without any alteration to the excision margins. Given that pathologists are now striving to digitize their data, workflows, and interpretations, AI will definitely be able to assist the development of clinicopathologic correlation strategies [30].

CONCLUSION

In conclusion, this study sheds light on the pediatric presentation of ameloblastic fibro odontoma (AFO) through the case of an

8-year-old girl and emphasizes its relevance for dentists faced with uncommon conditions in young patients. The diagnostic challenges encountered in pediatric cases, particularly in rare tumoral instances like AFO, underscore the distinctive obstacles and considerations faced by clinicians. Furthermore, the study introduces a noteworthy aspect by exploring the potential of AI, specifically ChatGPT, as a valuable diagnostic aid in dentistry. The use of ChatGPT to provide support and guidance in the diagnosis and treatment decision-making process for rare pediatric conditions demonstrates the promising role of artificial intelligence in assisting pediatric dentists in their clinical endeavors. The integration of AI in dentistry has the potential to increase diagnostic accuracy and contribute to improved patient care, marking a significant step forward in the field.

Ethical Approval

The patient provided informed consent to receive the treatment and for the publication of the data in this report.

Conflict of interest

The authors have no conflicts of interest to declare.

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Author Contributions

Ömer Uranbey was involved in the conception, management of case, management of complications, and writing of the manuscript.

Ferhat Ayrancı was involved in the conception, management of case, management of complications, and writing of the manuscript.

Büşra Erşan Erdem was involved in the examination of the specimen and writing the final manuscript.

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