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CASE REPORT

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A conservative treatment of an involved molar tooth associated with dentigerous cyst: a case report and literature review

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Abstract

Background Dentigerous cysts (DCs) are among the most frequently odontogenic cysts in young and middle-aged individuals. Marsupialization and enucleation are the main treatment options in clinical practice. However, there are few reports on preserving molars severely involved by the cyst.

Case presentation A 35-year-old male patient with a large odontogenic cyst that was successfully treated using a multidisciplinary approach. The patient's chief complaint was discomfort during mastication in the lower left molar region for a month. Clinical examination revealed that teeth 36 and 37 were intact without pain upon percussion, while tooth 38 was unerupted. The radiology examination illustrated a typical well-defined oval radiolucent lesion surrounding the crown of unerupted tooth 38, extending to the distal root of tooth 37. The treatment was divided into two parts: removal of the cyst and the impacted third molar, followed by filling with collagen bone particles; and preserving the tooth 37 via hemisection, root canal treatment and crown restoration. Pathological examination indicated a dentigerous cyst. After 18 months of treatment, the bone defect completely recovered and tooth 37 functioned well following the hemisection.

Conclusions Hemisection effectively preserves the cyst-associated molars and maintains oral function. This article underscores the significance of collaboration among various departments in the treatment of odontogenic cysts, ultimately aiming to achieve minimally invasive and functional surgery.

Keywords Dentigerous cyst, Enucleation, Tooth hemisection, Guided bone regeneration

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Background

Dentigerous cysts, namely follicular cysts, occur when fluid accumulates between the enamel and reduced dental epithelium after the formation of teeth. The third mandibular molar is the region where cysts are involved most [1]. These cysts are characterized by a well-defined, oval, unilocular radiolucency image that surrounds an unerupted tooth. It has been reported that dentigerous cysts account for about 33% of all odontogenic cysts in the jaw [1]. As one of the most commonly found benign odontogenic cysts in clinical practice, the incidence of dentigerous cysts is more frequently found in males than

females, by a ratio of about 1.6 ~ 1.8:1 [2, 3]. With the enlargement of the lesion, the surrounding bone and the adjacent teeth will be affected. Treatment of dentigerous cysts includes marsupialization or complete surgical enucleation [4]. Both have been applied in clinical practice for many years. After enucleation, the residual bone cavity can be left for spontaneous healing or filled with bone grafts depending on the size of the defect. Generally, cyst-involved teeth can be preserved through root canal treatment (RCT) or orthodontics to maintain normal biting and chewing function. However, if the involved teeth become loose or the periodontal tissue is extensively damaged, the prognosis for the teeth will be negative and extraction is recommended [5].

This case report presents a surgical enucleation to manage a large cyst in the mandible. The procedure involved the extraction of a wisdom tooth and the preservation of the cyst-associated tooth via hemisection. The results of a short-term follow-up have been documented.

Case representation

A 35-year-old male patient visited our department with a chief complaint about continuous, slight chewing discomfort in his lower left molar region, along with occasional gingival bleeding, for a month. Clinical examination showed the face configuration was symmetric with no evident distension. Intraoral examination revealed teeth 36 and 37 were stable and intact without tenderness to percussion, while tooth 38 was unerupted. Palpation of the buccal side of the alveolar showed no fluctuation. During the periodontal examination, a deep, bottomless pocket was discovered distal to tooth 37, with brown liquid spilling out from the pocket. The electrical pulp vitality test scores for teeth 36 and 37 were 9 and 12, respectively. A panoramic radiograph illustrated a well-defined oval radiolucent defect surrounding the crown of an unerupted tooth 38. The defect extended to the distal root of tooth 37, with the root apex exposed to the lesion but no root resorption was observed (Fig. 1). The size of the defect was approximately 23 mm by 27 mm in the sagittal plane and 15 mm by 29 mm in the coronal plane as seen in the cone beam computed tomography (CBCT) examination. The lingual and coronal sides of the alveolar bone were completely resorbed. The lesion had close contact with the inferior alveolar nerve canal, but no numbness of the left lower lip was observed. Clinical manifestations and typical radiographic presentation indicated a dentigerous cyst derived from the unerupted tooth 38. After carefully evaluating the clinical data and discussing the relevant condition, treatment strategies, risks, and fares with the patient, complete enucleation was selected to handle the dentigerous cyst. The patient opted to preserve tooth 37 through hemisection instead of opting for a dental implant.

All operations were performed with informed consent and under painless conditions. The first step involved enucleating the cyst, extracting the unerupted tooth 38, and hemisecting tooth 37. After administering a 2% lidocaine block anesthesia and local infiltration anesthesia with articaine, a full-thickness flap from tooth 36 to the distal of tooth 37 was elevated to expose the buccal lining bone of the cyst. Tooth 37 was hemisected by a high-speed handpiece with a fissure bur, and the distal part of the tooth was extracted (Fig. 2a). A piezoelectric surgical

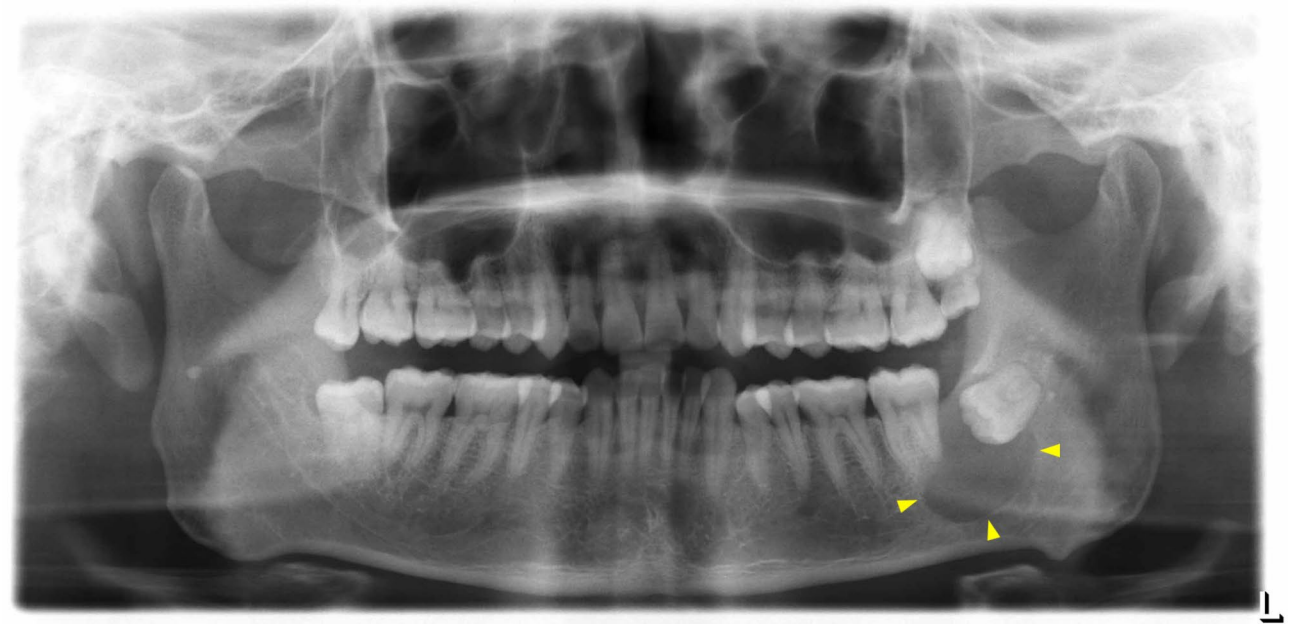

Fig. 1 Preoperative radiological examination

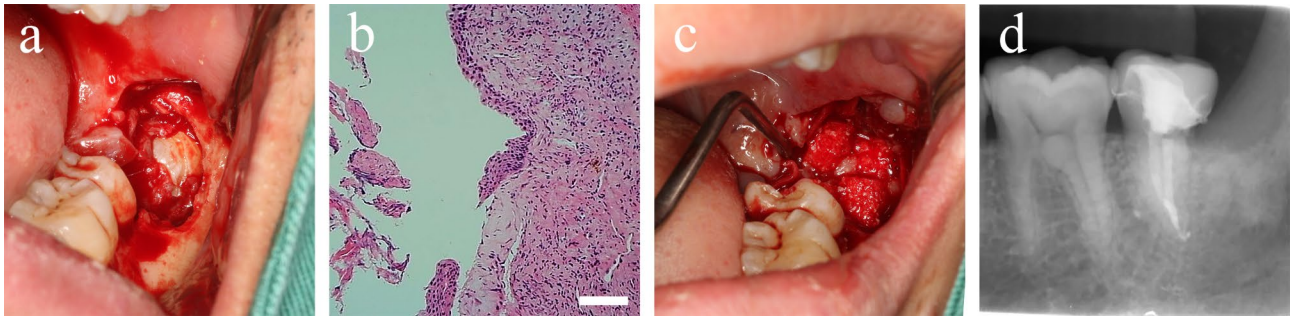

Fig. 2 Surgery Photos. (**a**) Removal of the cyst and the third molar, followed by hemisection of tooth 37. (**b**) Pathological results: the cyst wall composed of connective tissue, lined by a layer of thin, nonkeratinized, flat, stratified squamous epithelial cells (Bar: 100 μm). (**c**) Guided bone regeneration after cyst enucleation. (**d**) Tooth 37 prepared and restored with a full ceramic crown after RCT

device was utilized to remove the overlying bone and expose the cyst. Subsequently, both the cyst and tooth 38 were completely removed. After thorough irrigation with saline, the bone defect was filled with an iodoform sponge, which was removed one week later. Pathological examination implied a dentigerous cyst in the left mandible (Fig. 2b).

The RCT and crown restoration of tooth 37 were performed by a senior doctor of the Department of Endodontics. Paraformaldehyde was used to eliminate any remaining vital pulp tissue of the mesial root of tooth 37 one week after surgery. Three weeks after cyst nucleation, a second-stage surgery was conducted, filling the bone defect with the mixture of Geistlich Bio-Oss® Collagen bone particles (approximately 600 mg in total, Geistlich Pharma AG, Zürich, Switzerland) and platelet-rich fibrin (PRF) membranes (Fig. 2c). To accelerate bone healing, and reduce postoperative pain and swelling, two collagenous membranes (25 mm × 25 mm, Bio-Gide®, Geistlich Pharma AG, Zürich, Switzerland) and additional PRF membranes were used to cover the bone grafts. The patient received intravenous drip therapy for 3 days (Cefuroxime Sodium, 750 mg, TID; Dexamethasone Sodium Phosphate, 5 mg, QD) to prevent infection and swelling. One month later, a follow-up visit showed satisfactory healing after guided bone regeneration (GBR). The mesial root canal of tooth 37 was obturated with hot gutta-percha. Finally, an E.max full ceramic crown (Ivoclar Vivadent, Schaan, Liechtenstein) was placed to restore tooth 37 upon completion of all treatments (Fig. 2d).

Six months after the surgery, tooth 37 was functioning well, and a radiological examination confirmed an increase in the bone density of the affected cavity. The patients did not report any discomfort during this period. During the 18-month follow-up visit, there was no discomfort in tooth 37 (Fig. 3a, b), and the bone density in the previously affected area had been completely restored (Fig. 3c).

Discussion and conclusions

Most odontogenic cysts develop without evident symptoms and expand slowly in the alveolar bone until significant tooth movement or alteration in facial configuration is observed. They are often incidentally discovered through radiographic examinations once the bone has largely been displaced by cysts [1]. In this case, the dentigerous cyst originated from the unerupted third molar, which presented a typical image after the radiological examination. By the time the patient noticed symptoms, the cysts had already encroached on a large peripheral area. There are two approaches for treating dentigerous cysts, enucleation and marsupialization, depending on the size of the cyst and its peripheral anatomical structure. By suturing the epithelium of the cyst directly with the lining of the oral mucosa, marsupialization is a conservative treatment especially recommended for teenagers [6]. However, a downside of this treatment is the potential for residual pathological tissue, which may evolve into ameloblastoma or mucoepidermoid carcinomas, left in situ [7]. Decompression, or marsupialization may require second stage of surgery once the size of the cyst decreases. Enucleation, on the other hand, eliminates this risk by completely removing the cysts' tissue.

Several factors influence bone regeneration after cyst enucleation. One of the most significant factors is the defect size, which plays a crucial role in neo-bone formation [8]. Defects that exceed critical size defects do not restore spontaneously without the assistance of bone grafts, as confirmed by animal experiments as well [9]. Some researchers suggested that bone materials are necessary if the defect length goes beyond 1–2 cm and greater than 50% loss of the perimeter of the bone [10]. The configuration of the defect also impacts bone formation. If the buccal and lingual bone was resorbed by a cyst or removed during surgery, the cavity will not completely recover but fill with fibrous tissue [11, 12]. Other factors include the preservation of periosteum, age, gender, etc. On the contrary, some studies argue that it is unnecessary to place bone grafts due to the strong regeneration

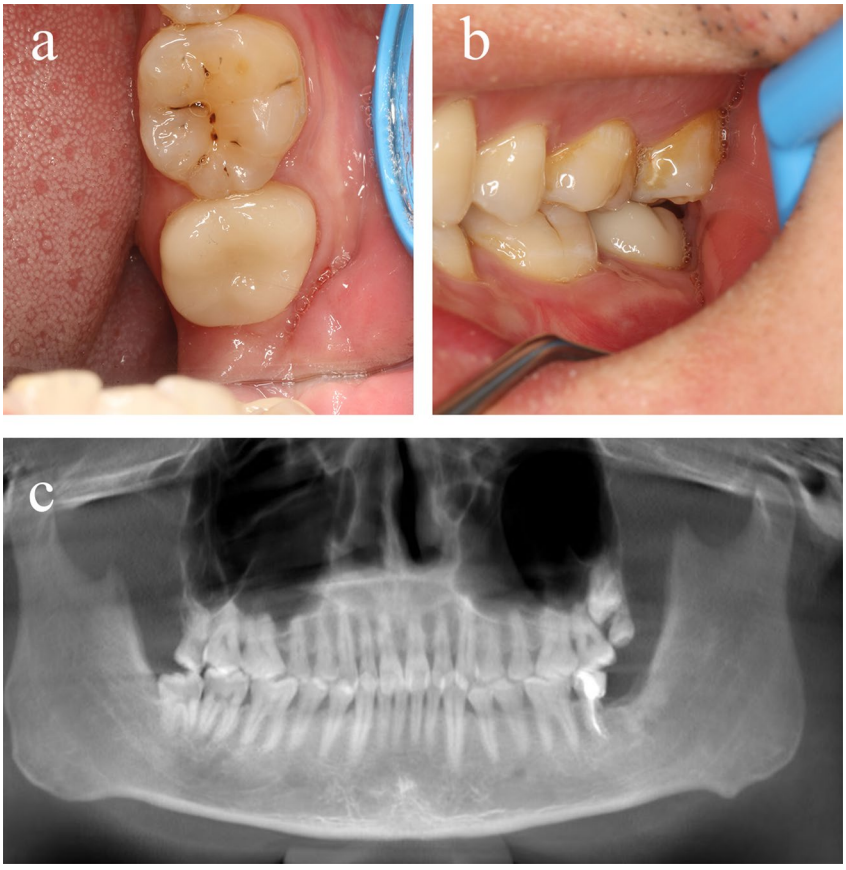

Fig. 3 (**a**, **b**) 18 months follow-up showing tooth 37 functions well. (**c**) Post-surgery radiological examination at 18 months

capacity of alveolar bone. Complications such as infection and bone fracture after cyst nucleation are quite rare [13]. For instance, Chacko's research traced 44 large-size jaw cysts (more than 4 cm) for 2 years, finding that the average reduction of lesion size reached 81.03% at 1 year and 100% after 2 years [14].

Various materials have been employed to accelerate the restoration of bone defects, including autologous grafts, allogenous grafts, xenografts, etc., all of which can significantly enhance bone density during the healing procedure [15]. Autologous bone is deemed the 'gold standard' for bone materials due to its three guaranteed regeneration characteristics: osteoinduction, osteogenesis and osteoconduction [16]. The iliac crests are the most frequent donor sites for their adequate quality and satisfactory quantity of cancellous bone [17]. Kiyokawa introduced a novel method to treat jaw cyst defects by grafting iliac cancellous bone with cyst-involved teeth reimplantation [18]. In addition, xenogenic bone materials, such as deproteinized bovine bone mineral (DBBM, Bio-Oss®) are widely used in GBR and sinus floor augmentations. Shi et al. investigated the bone volume alteration of GBR filling with DBBM in the bone defect after jaw cyst enucleation [19]. The results showed that better bone regeneration was observed in the GBR group, with a larger shrinkage area 6 months after cyst surgery compared to the control group. Compared to other cyst enucleation surgeries without bone grafting, completely spontaneous bone healing may take 1 to 2 years, depending on the defect size [13, 15]. In our case, we mixed the DBBM with PRF to construct bioactive bone grafts, which are proven to enhance bone formation both in animal and human experiment [20, 21]. Radiological examination indicated that the bone density of the defect resembled that of the surrounding area within six months, and the configuration of lingual bone was also restored. To prevent inflammation, an iodoform sponge was placed in the defect prior to the GBR surgery.

The removal of the cyst-associated impacted third molars depends on their position and surrounding anatomical position. Orthodontic extrusion can be used to lift third molars from close contact with the inferior alveolar nerve, thus reduce the risk of associated with extraction [22]. Coronectomy of unerupted teeth is also an effective method to reduce nerve injury and bone fracture [23]. Cyst-involved teeth can be preserved via orthodontics or RCT if feasible. It was possible to keep tooth 37 intact in this case. To achieve this goal, tooth 38 could have been extracted, and marsupialization performed on the cysts at the crest of the alveolar ridge, avoiding

damage to tooth 37. However, due to significant vertical bone loss distal to tooth 37, it would have been difficult to spontaneously regenerate original periodontal attachment and bone level, leaving a deep pocket and a poor prognosis for tooth 37. Significant periodontal breakdown, including increased probing depth, attachment loss and radiographic alveolar bone loss, has been reported in the distal sites of the second molar following the extraction of mandible third molars [24, 25]. Therefore, we chose to remove the cyst-associated distal root of tooth 37 and retain its mesial root. The prognosis of this treatment is predictable since the bone wall surrounding the mesial root is intact. To achieve a more conservative and micro-traumatic treatment, tooth 37 was preserved through hemisection rather than being replaced with a dental implant. Tooth hemisection is a common treatment, particularly for molars with furcation involvement. The median estimated survival rate of the resected molars is 73 months, and teeth with more than 75% bone volume have significantly longer survival periods compared to those with less than 50% [26]. Even if tooth 37 needs to be removed in the future due to complications, the restored alveolar bone will be ready for dental implantation. Filling the empty socket of the extracted root with biomaterials can not only reduce bone resorption of the remaining root but also preserve bone volume for prospective implant surgery [27]. After 18 months post-surgery, tooth 37 continues to function perfectly for mastication.

The present case report demonstrated how a multidisciplinary approach, involving maxillofacial surgery, endodontics, and periodontology, can collaborate to provide patients with satisfactory and minimally traumatic treatment. The dentigerous cyst and unerupted third molar were removed through microsurgical enucleation, and the bone defect was restored through GBR. The key innovation in this case is the preservation and functionality of the cyst-involved tooth through hemisection. Therefore, this case presents a comprehensive approach to the treatment of odontogenic cysts. Admittedly, this case has certain limitations. The main limitation is the small sample size, as hemisection was performed on only this individual patient. The results would be more compelling if additional cases were reported and analyzed. Moreover, an extended follow-up period is necessary to more accurately evaluate the long-term prognosis of the hemisected tooth.

Abbreviations

DCs	Dentigerous cysts
RCT	Root canal treatment
CBCT	Cone beam computed tomography
PRF	Platelet-rich fibrin
GBR	Guided bone regeneration

Author contributions

Libin Zhou performed the surgery. Yuting Zhu handled the root canal treatment and crown restoration. Zhibin Wei collected, analyzed, and organized the medical records and wrote the manuscript.

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Data availability

The authors confirm that all data generated or analyzed during this case report are included within the manuscript or supplementary information files.

Declarations

Ethical approval

This study was approved by the Ethics and Scientific Committee of Affiliated Stomatology Hospital of Guangzhou Medical University with approval number LCYJ2023025. Written informed consent was obtained from the individual for the publication of any potentially identifiable images or data included in this article.

Consent for publication

Consent was signed by the patient for all the images, other personal and clinical details. Written informed consent was obtained from the individual for the publication of any potentially identifiable images or data included in this article.

Competing interests

The authors declare no competing interests.

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