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Conservative Surgical Management of a Large Mandibular Dentigerous Cyst in a Pediatric Patient: A Case Report

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Abstract

Dentigerous cysts are developmental odontogenic lesions commonly associated with unerupted teeth and are often asymptomatic, particularly in pediatric patients. Management of large mandibular cysts in children requires a conservative approach to preserve developing teeth and mandibular growth. We report the case of a 10-year-old male who presented with a painless, slowly progressive swelling of the left mandible and delayed eruption of the premolar teeth. Radiographic examination revealed a large, well-defined unilocular radiolucency involving the left mandibular body, associated with an unerupted second premolar. The lesion was managed by marsupialization and curettage under general anesthesia. Histopathological examination confirmed the diagnosis of a non-neoplastic dentigerous cyst.

Keywords: Mandibular dentigerous cyst; Marsupialization; Pediatric mandible; Odontogenic cyst; Ameloblastoma

Introduction

Dentigerous cysts, also known as follicular cysts, are developmental odontogenic lesions that arise from fluid accumulation between the reduced enamel epithelium and the crown of an unerupted tooth [1,2]. Accurate diagnosis is essential due to differences in biological behavior and treatment strategies compared to other odontogenic lesions [1]. These cysts represent the second most common odontogenic cyst after radicular cysts and are most frequently associated with mandibular third molars, followed by maxillary canines [2,3]. Although dentigerous cysts may occur across a wide age range, their prevalence in pediatric patients is relatively low, with peak incidence typically observed during the second and third decades of life [4-6]. Several studies have reported a male predilection for dentigerous cysts, and they frequently arise in mixed dentition during the early second decade of life [5,7,8].

Most dentigerous cysts remain asymptomatic and are often detected incidentally during routine radiographic examination [2,3]. Panoramic radiography is commonly used as the initial imaging modality for diagnosis, typically revealing well-defined unilocular radiolucencies surrounding the crown of an unerupted tooth [3,9]. A follicular space exceeding 5 mm may suggest the presence of a dentigerous cyst [10]. Cone-beam computed tomography provides additional information regarding lesion extent and anatomical relationships when needed [11]. However, when left untreated, these cysts may enlarge progressively, leading to cortical bone expansion, displacement of adjacent teeth, facial asymmetry, and in advanced cases, pathological fracture of the mandible [4,12,13]. In advanced cases, jaw weakening may develop, emphasizing the importance of early intervention [12,13].

Treatment planning for dentigerous cysts requires careful consideration of multiple factors, including cyst size and location, patient age, stage of dentition, and proximity to vital anatomical structures [1,2,10]. Enucleation is commonly performed for small to moderate-sized lesions [3]. However, marsupialization is often preferred for large cysts, particularly in pediatric patients, as it reduces intracystic pressure, preserves developing tooth germs, minimizes surgical morbidity, and allows spontaneous bone regeneration and tooth eruption [9,14]. Residual bone defects following cyst removal may heal spontaneously or require bone grafting procedures [10]. Autogenous graft materials have demonstrated favorable outcomes in bone regeneration [11].

Although dentigerous cysts are generally benign with low recurrence rates, histopathological examination remains essential to confirm the diagnosis and exclude other odontogenic lesions with similar radiographic features, such as odontogenic keratocyst or unicystic ameloblastoma [6,15]. Histologically, dentigerous cysts are lined by nonkeratinized stratified squamous epithelium, with mucous, ciliated, or sebaceous cells occasionally observed within the epithelial lining [15,16]. Chronic inflammation is commonly present and may alter the histopathological appearance, and has been considered a possible contributing factor to malignant transformation, although such transformation remains rare

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[6,15]. Long-term follow-up is therefore recommended after surgical management [16]. This case report presents the clinical, radiographic, and therapeutic aspects of a large mandibular dentigerous cyst in a 10-year-old male patient, successfully managed by marsupialization with emphasis on conservative surgical approach and favorable long-term outcomes [7,8].

Case Presentation

History and clinical examination

A 10-year-old male patient presented with a slowly progressive swelling localized to the left side of the mandible, which had been present for approximately two years. The swelling was asymptomatic in nature, with no associated pain, redness, or other signs suggestive of inflammation, and there was no evidence of cervical lymph node enlargement upon palpation. Intraoral examination revealed delayed eruption of the premolar teeth in the affected region, while the patient exhibited no signs of systemic involvement and had no history or clinical findings indicative of other related pathological conditions affecting the head and neck region.

Investigations

Radiographic evaluation using a panoramic X-ray demonstrated the presence of a well-defined radiolucent cavity located within the body of the left mandible. Notably, the lesion lacked the characteristic features typically associated with Ameloblastoma, particularly the absence of the classic root resorption or sharply defined "knife-edge" appearance of the adjacent tooth roots, thereby suggesting a different pathological entity (Figure 1) (cyst boundaries indicated by orange arrow, tooth buds by red arrow, and involved tooth roots by blue arrow).

Surgical management

Following the induction of general anesthesia with nasotracheal intubation, a surgical approach was initiated to address the lesion.

Cyst size and Anatomical location: Intraoperative assessment confirmed the presence of a large cystic cavity occupying the body of the left mandible. The lesion measured approximately 6 cm × 8 cm × 8 cm in its maximum dimensions, extending from the region of the left mandibular lateral incisor posteriorly to the first permanent molar, with significant buccal and lingual cortical expansion.

Teeth involved: The cyst was intimately associated with the following teeth:

- Unerupted teeth: Left mandibular canine and second premolar
- Erupted teeth: Left mandibular lateral incisor, first premolar, and first permanent molar

The roots of the erupted lateral incisor, first premolar, and first molar were observed to be projecting into the cystic cavity, while the developing tooth buds of the canine and second premolar were completely enveloped by the cystic lining.

Incision and Exposure: A surgical approach was initiated by making a full-thickness mucoperiosteal flap incision in the gingival tissue to gain adequate access to the underlying lesion. The incision was designed with a crevicular approach extending from the left mandibular central incisor to the distal aspect of the first permanent molar, with a releasing incision placed in the buccal vestibule. The flap was carefully reflected to expose the thin, expanded bony cortex overlying the lesion.

Marsupialization technique: This was followed by careful opening of the cavity wall through creation of a bony window measuring approximately 2 cm × 2 cm using a round bur under copious irrigation. Upon entry, straw-colored cystic fluid was evacuated. A representative biopsy specimen measuring 1.5 cm × 1 cm was harvested from the cavity wall and submitted for histopathological examination to establish a definitive diagnosis. Marsupialization of the lesion was performed by excising a portion of the exposed cystic wall and suturing its edges to the surrounding oral mucosa using 4-0 absorbable sutures (Vicryl), thereby creating a permanent opening to decompress the cavity and promote healing.

Curettage: Following marsupialization, thorough curettage of the remaining cystic lining was carried out to remove the pathological contents using small bone curettes. Particular care was taken around:

- The roots of the erupted lateral incisor, first premolar, and first molar
- The developing tooth buds of the canine and second premolar
- The neurovascular bundle in the vicinity of the mandibular canal

All visible pathological tissue was removed while preserving vital structures and maintaining the integrity of the developing teeth.

Closure and Postoperative care: Upon completion of the procedure, the surgical site was irrigated thoroughly with sterile saline. The mucoperiosteal flap was repositioned and secured with interrupted 4-0 absorbable sutures, and the surgical site was closed primarily without the placement of surgical drains.

Postoperatively, the patient was prescribed:

- Antibiotics: Amoxicillin 250 mg three times daily for 7 days
- Analgesics: Ibuprofen 200 mg as needed for pain
- Mouthwash: Chlorhexidine 0.12% rinses twice daily for 7 days to maintain oral hygiene and prevent secondary infection of the marsupialized cavity

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The patient and parents were instructed to maintain a soft diet for two weeks and to perform gentle irrigation of the marsupialized cavity with warm saline using a syringe after each meal. Regular follow-up appointments were scheduled at 2 weeks, 2 months, 4 months, and 12 months postoperatively to monitor healing and tooth eruption.

Histopathological findings

Histopathological examination of the biopsy specimen obtained from the cystic wall was performed to establish a definitive diagnosis. Microscopic evaluation revealed a cystic lesion lined by thin, non-keratinized stratified squamous epithelium, typically 2 to 4 cell layers in thickness, with a flat epithelial-connective tissue interface, consistent with reduced enamel epithelium (Figure 2A). No evidence of rete ridge formation or epithelial dysplasia was observed.

The connective tissue wall was composed of dense, mature fibrous tissue with areas of loose myxoid stroma. A mild to moderate chronic inflammatory cell infiltrate, predominantly lymphocytes and plasma cells, was observed in focal subepithelial regions. Scattered aggregates of foamy macrophages were also noted in areas adjacent to cholesterol cleft formations, indicative of previous hemorrhage and tissue breakdown. No evidence of Rushton bodies, mucous cells, ciliated cells, or sebaceous differentiation was identified within the epithelial lining.

Immunohistochemical staining demonstrated weak cytoplasmic expression of SOX2 in the epithelial lining (Figure 2B), with moderate nuclear and cytoplasmic immunoreactivity in focal areas (Figure 2C). These SOX2 expression patterns are consistent with previously reported immunohistochemical profiles of dentigerous cysts.

Importantly, there were no features suggestive of odontogenic keratocyst, such as parakeratinized stratified squamous epithelium with palisaded basal cell layer, nor were there any histological hallmarks of unicystic ameloblastoma, including stellate reticulum-like appearance or reverse polarization of basal cells. The absence of cellular atypia, mitotic activity, or invasive growth patterns excluded malignant transformation.

The H&E appearance confirmed the diagnosis of a non-neoplastic dentigerous cyst, while the SOX2 expression patterns further support this diagnosis and help exclude other odontogenic pathologies.

Follow-up and outcome

The patient was followed clinically and radiographically at regular intervals postoperatively. At 2 months following surgery, clinical examination revealed complete soft tissue healing with no signs of infection, dehiscence, or recurrence. Radiographic evaluation demonstrated early evidence of callus formation within the previous cystic cavity, indicating active bone regeneration (Figure 3).

At 4-months postoperatively, follow-up panoramic radiography showed progressive bone fill with near-complete obliteration of the previous radiolucent defect. The developing tooth bud of the left mandibular second premolar remained viable and was observed to be migrating normally within the regenerating bone, while the roots of the adjacent erupted teeth exhibited stable lamina dura and no evidence of resorption or pathological displacement (Figure 4).

At 12-months follow-up, the patient remained asymptomatic with no clinical or radiographic evidence of recurrence. Spontaneous eruption of the previously unerupted second premolar was observed, achieving normal occlusal relationship without orthodontic intervention. The mandibular contour was restored, and there was no facial asymmetry, sensory disturbance, or masticatory dysfunction.

Discussion

Dentigerous cysts are developmental odontogenic lesions commonly associated with impacted teeth and are frequently detected incidentally due to their asymptomatic nature. These cysts may enlarge silently until they cause significant bone expansion, facial swelling, or displacement of adjacent teeth. The pathogenesis of dentigerous cysts involves fluid accumulation between the enamel epithelium and the crown, driven by pressure from erupting teeth and venous obstruction. Cyst enlargement is further attributed to increased intraluminal osmotic pressure and sustained hydrostatic forces acting on the surrounding bone. In pediatric patients, treatment planning must consider the stage of dentition, cyst size, and proximity to vital anatomical structures. Conservative techniques such as decompression are preferred in mixed dentition to preserve permanent tooth germs and minimize surgical morbidity.

In the present case, the cyst measured approximately 6 cm × 8 cm × 8 cm and extensively involved the body of the left mandible, extending from the lateral incisor to the first permanent molar. The lesion was intimately associated with multiple teeth, including the unerupted canine and second premolar, as well as the roots of the erupted lateral incisor, first premolar, and first molar. Given the patient's age (10 years), the stage of mixed dentition, and the risk of damage to developing tooth buds and vital structures, marsupialization was selected over enucleation. This approach successfully reduced intracystic pressure, preserved all involved teeth, and allowed spontaneous eruption of the second premolar within 12 months postoperatively, with complete bone regeneration observed radiographically. These findings are consistent with reports by Berberi et al. [14] and Wei et al. [11], who similarly documented favorable outcomes following decompression of large dentigerous cysts in pediatric patients, including spontaneous tooth eruption and satisfactory bone healing without recurrence.

Decompression reduces intracystic pressure, facilitating gradual bone regeneration and allowing spontaneous eruption of involved teeth. Radiographic follow-up using computed tomography is valuable for evaluating bone healing and anatomical relationships in extensive lesions. Histopathological examination remains essential to confirm the diagnosis and exclude more aggressive odontogenic pathologies. Long-term follow-up demonstrates that decompression is a reliable treatment option for large dentigerous cysts in children, with low recurrence rates [16]. Surgical removal of large dentigerous cysts may result in extensive alveolar bone loss and disruption of occlusion, creating rehabilitative challenges. In growing patients, orthodontic tooth movement can be used as an alternative to bone grafting to reconstruct edentulous areas.

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Orthodontic movement into cyst-related defects promotes bone formation on the tension side of the moved tooth. This biologic response can provide sufficient alveolar width to allow further restorative or surgical interventions. Autotransplantation is a potential treatment option but requires careful consideration of root development and pulp healing capacity. Teeth with complete root formation demonstrate a significantly lower rate of pulp healing following transplantation. To prevent inflammatory complications, endodontic treatment may be required after autotransplantation in such cases. Continuous orthodontic forces, particularly with superelastic coil springs, may increase the risk of lateral root resorption. Careful force control and patient age are critical factors influencing the extent of root resorption during tooth movement. With appropriate orthodontic reshaping and torque control, functional occlusion and acceptable esthetics can be successfully achieved after cyst-related tooth loss [17].

Conclusion

Dentigerous cysts represent a common developmental odontogenic pathology that primarily affects unerupted teeth of the mandible, particularly third molars. Despite their benign nature, these cysts have the potential to cause significant bone destruction if left untreated. Their frequent asymptomatic presentation emphasizes the importance of routine radiographic examination for early detection.

Panoramic radiography and cone-beam computed tomography play a crucial role in accurate diagnosis and treatment planning. Histopathological evaluation remains essential to confirm the diagnosis and to exclude other odontogenic lesions with similar radiographic features. Management strategies for dentigerous cysts should be individualized based on lesion size, patient age, and anatomical considerations. Enucleation remains an effective treatment option for small to moderate lesions with a low risk of recurrence. Marsupialization offers a conservative alternative for large cysts, particularly in young patients, allowing preservation of adjacent teeth and vital structures. Adequate bone healing may occur spontaneously following cyst removal, although larger defects may require grafting procedures. Regenerative techniques and autogenous bone grafts have demonstrated favorable outcomes in restoring mandibular integrity. Although recurrence is rare, long-term follow-up is recommended to monitor bone regeneration and detect potential complications. Malignant transformation of dentigerous cysts is uncommon but highlights the necessity of thorough histopathological assessment. Early diagnosis enables less invasive treatment approaches and reduces the risk of functional and esthetic impairment. Timely intervention minimizes complications such as tooth displacement, facial asymmetry, and pathological fracture. A multidisciplinary approach can enhance treatment outcomes, especially in extensive or complex cases. Comprehensive case documentation contributes valuable information to the existing body of literature. Case reports remain essential for illustrating uncommon presentations and evaluating therapeutic strategies. The present case underscores the importance of correlating clinical, radiographic, and histological findings. Appropriate management of mandibular dentigerous cysts generally results in an excellent prognosis. Continued research and reporting are necessary to further refine diagnostic and treatment protocols.

Ethical Approval

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

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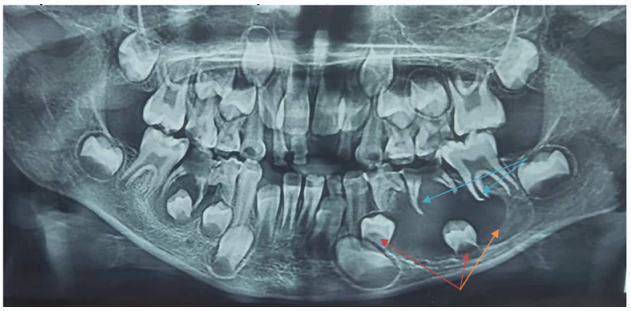

Figure 1: Preoperative Panorama. Inside the cyst boundaries [Orange arrow]. Tooth buds are presented [Red arrow] and erupted tooth roots are located also in cyst [Blue arrow].

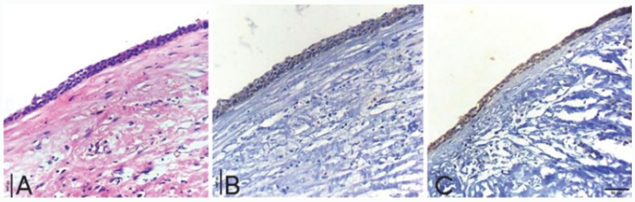

Figure 2: Photomicrographs of the cystic lesion. (A) Dentigerous cyst with thin odontogenic epithelium of 2–4 cell thickness with flat epithelial connective tissue interface (H&E ×200). (B) Dentigerous cyst with weak cytoplasmic expression of SOX2 in epithelial lining (ABC-DAB ×200). (C) Moderate nuclear and cytoplasmic immunoreactivity for SOX2 in dentigerous cyst epithelial lining (ABC-DAB ×200). The H&E appearance (A) confirms the diagnosis of a non-neoplastic dentigerous cyst, while SOX2 expression patterns (B, C) are consistent with previously reported immunohistochemical profiles of dentigerous cysts.

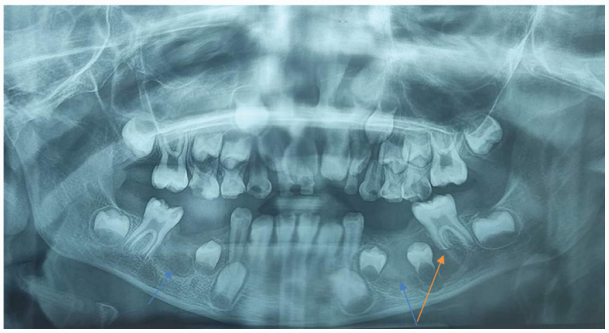

Figure 3: Postoperative panorama after 2 months, the cyst had been filled with callus tissue [Blue arrow] and the teeth roots [Orange arrow] are located in healing bone.

Figure 4: Postoperative panorama after 4 months, the treated area contains tooth bud [Black arrows] and root of erupted tooth [Red arrow] and bone is healed spaces are filled [Green arrow].

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