Orthodontically guided eruption of mandibular second premolar following enucleation of an inflammatory cyst: case report

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This case study describes the surgical management of an inflammatory cyst combined with the orthodontically assisted eruption of an impacted mandibular second premolar.
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INTRODUCTION

Cysts, as occurrences in the jaws, manifest as epithelium-lined sacs filled with fluid or soft material. The dentigerous cyst or follicular cyst, is an odontogenic cyst associated with the crown of an impacted, embedded, unerupted, or developing tooth. The cyst enclosing the crown of the unerupted tooth is attached to the cervical region of the tooth.[1,7]

Regezi and Sciubba cite the highest incidence of dentigerous cysts during the second and third decades, while Takagi and Koyama report most dentigerous cysts in patients younger than 20 years of age.[1,2] Patients are often adolescents in the mixed dentition stage and males are reported to develop dentigerous cysts more often than females.[1,6]

Dentigerous cysts occur predominantly in the third molar regions of the mandible, the maxillary canine region, and the third molar region of the maxilla.[2,6] This is not surprising, as these teeth are the most frequently impacted.[1,5] Maxillary and mandibular premolars have also been associated with dentigerous cysts.[2,7,14] Kaban explains that follicular cysts have a predilection for the mandibular premolar region in children, and the third molar region in teenagers and adults.[3]

The prevalence of dentigerous cyst development in the mandible near the region of the second primary molars has been linked to the observations that second primary mandibular molars are associated with greater caries susceptibility and more treatment. The close physical relationship between a second primary mandibular molar and the follicle of the successor has been associated with a facilitated spread of infection.[10]

Formation of dentigerous cysts can result in two histopathologically distinct variants, noninflamed or inflamed, which are the result of two distinct etiologies, developmental or inflammatory.[6,7] Regezi and Sciubba describe the process of cyst development due to a proliferation of the enamel organ remnant or reduced enamel epithelium.[1] The accumulation of fluid between the remnants of the enamel organ and the subjacent tooth crown occurs shortly after complete formation of the crown.[7] The inflammatory mode of dentigerous cyst development is the result of intrafollicular spread of periapical inflammation from an overlying infected primary tooth. Persistent and prolonged inflammation causes chronic irritation to the unerupted tooth's dental sac, inducing or hastening epithelial proliferation of follicular tissues and cystic transformation.[7]

Expansion of dentigerous cysts is related to epithelial proliferation, release of bone-resorbing factors, and a secondary increase in cyst fluid osmolality resulting from passage of inflammatory cells and desquamated epithelial cells into the cystic lumen.[1,6,7] Dentigerous cysts can achieve significant size and are frequently associated with cortical bone expansion and erosion.[1,6] Tooth displacement, malocclusion, and facial asymmetry are also associated with the lesion.[5,6]

Patients are generally asymptomatic. According to Ziccardi *et al*., dentigerous cysts are often discovered as an "incidental radiographic finding or when acute inflammation or infection develop."[6] Delayed eruption of permanent teeth can be an indication of odontogenic cyst formation.[1,3] When a child presents with teeth that have not erupted appropriately according to schedule, a panoramic radiograph is the most useful tool for detecting cysts associated with impacted teeth.[3] Zic-

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cardi *et al.* explain, that since dentigerous cysts often are asymptomatic, the potential exists for the surrounding structures to suffer damage before the cyst is detected.[6]

Radiographically, a dentigerous cyst can be identified as a well defined, unilocular radiolucency in association with the crown of a frequently displaced, unerupted tooth. Generally there is a distinct, dense periphery of reactive bone (condensing osteitis) with a radiolucent center.[13] These cysts can also manifest as multilocular entites.[1] Occasionally, dentigerous cysts are associated with resorption of the roots of adjacent erupted teeth.[1]

Differential diagnosis of such a pericoronal radiolucency includes odontogenic keratocyst, unicystic ameloblastoma and other odontogenic tumors, adenomatiod odontogenic tumor (anterior jaw), ameloblastic fibroma (posterior jaw young patient).[1] Dentigerous cysts have the potential for metaplastic or neoplastic change, and the clinician must always be aware of the possibility for the transformation of the epithelial lining of the cyst to more aggressive pathology, which includes ameloblastoma, mucoepidermoid carcinoma, squamous cell carcinoma, and odontogenic keratocyst.[1,6]

Generally, dentigerous cysts are treated by surgical removal. Simple, nonagressive inflammatory cysts are conventionally managed with the following surgical techniques: enucleation, marsupialization, a staged combination of the two procedures, and enucleation with curettage.[13] Regezi and Sciubba state that removal of the associated tooth and enucleation of the soft tissue component is definitive therapy in most cases.[1]

Ziccardi *et al*. state, that treatment modalities range from enucleation to marsupialization, and are based on the premise that the pathological process can be controlled locally with minimal injury to the adjacent host structures. In a child, however, loss of permanent tooth buds in the management of a large dentigerous cyst can be devastating.[6]

The goal for treatment of dentigerous cysts is complete elimination of the pathology and maintenance of dentition with minimal surgical intervention.[6] It is imperative that the clinician utilize a conservative approach to treatment of dentigerous cysts that does not involve sacrifice of the unerupted permanent tooth whenever possible. However, thorough eradication of the cyst should never be compromised for the potential orthodontic benefit of saving the permanent tooth.[3]

It has been stated that enucleation is the shelling out of the entire cystic lesion without rupture.[13] It has been described as the removal of an entire structure without rupture, as one shells the kernel of a nut. Every attempt must be made to remove the cyst from the bony housing without fragmentation, thus ensuring complete removal and limiting the chances for recurrence. Kaban outlines basic treatment to consist of enucleation of the cyst and removal of the impacted tooth.[3] Enucleation effectively eradicates the lesion, however developing tooth buds could be lost, necessitating replantation.[6]

In cases of inflammatory dentigerous cysts, marsupialization is combined with extraction of the causative infected primary tooth as a treatment choice. Tuzum explains that if a dentigerous cyst contains one or more teeth at the stage of eruption, and if the patient is younger than 20 years of age, marsupialization will permit eruption of such teeth into the arch.[9] Murakami agrees that marsupialization is the best way to conserve a tooth affected by a dentigerous cyst and to permit its eruption, especially in a young person.[7] Marsupialization of cysts to the oral mucosa is utilized to eradicate large cysts that involve serious loss of bone, or in situations in which the bone present is so thin that enucleation of the lesion would likely result in gross perforation of the buccal and lingual cortex. Marsupialization is a minimally invasive technique that avoids marked bone defects and paresthesia.[2] The procedure is generally combined with the placement of a wire to allow for drainage and decompression of the cyst.[6] Takagi and Koyama explain that marsupialization decreases intracystic pressure and promotes shrinkage of the cyst as well as bone fill.[2] These authors report a successful transformation of the cystic epithelial lining into normal oral mucous membrane. The major disadvantage of marsupialization is persistence of the lesion or recurrence.[2]

Marsupialization requires the surgeon to make an opening at the lowest point of the cystic cavity, a technique that is impossible in the mandible. In addition, maintaining patency is difficult in bony lesions.[6,8] Ziccardi states that a lateral window could drive the developing permanent dentition toward ectopic eruption, resulting in malocclusion and creating a potential need for further interceptive orthodontics.[6]

Ziccardi *et al*. describe the technique of fenestration, which removes the cystic entity and preserves the developing dentition.[6] In this procedure, the cyst is effectively decompressed through an opening made along the crest, and guided eruption drives the permanent teeth toward the correct eruption paths.[6] Ziccardi *et al*. explain this simplified surgical technique combining fenestration, a drain fashioned out of IV tubing, and the utilization of a space maintainer that aids in the correct development and eruption of the permanent dentition.[6]

Our case study describes the surgical management of an inflammatory cyst combined with the orthodontically assisted eruption of an impacted mandibular second premolar.

CASE STUDY

MM, an eight year, seven month old female patient in general good health presents to the Nova Southeastern University College of Dental Medicine Pediatric Dentistry Clinic on 10-18-99 on an emergency basis. The father relates a fifteen-day history of a swelling associated with the left mandible of the child and a four day

Figure 1. Panoramic radiograph showing post-operative panoramic radiograph shows tooth #20 in normal alignment in the mandibular arch.

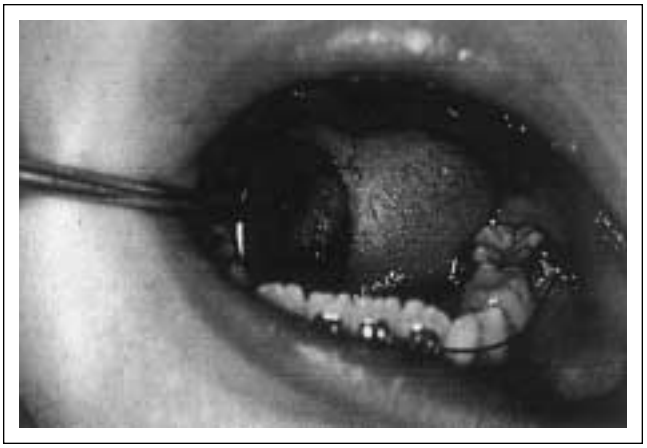

Figure 2. Clinical view of tooth #20 erupted in the mandibular arch.

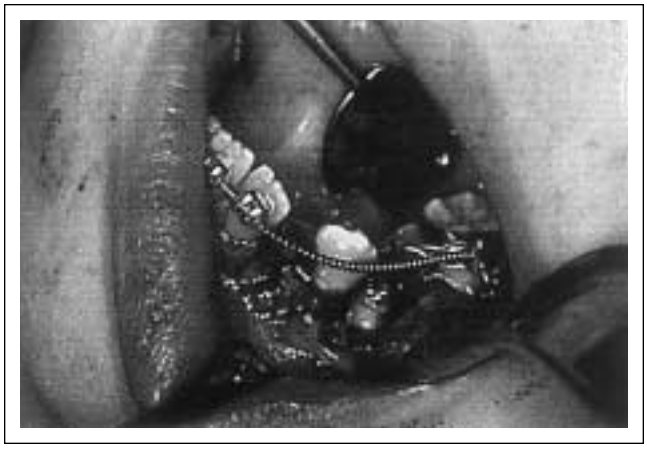

Figure 3. Intra-operative view of tooth #20 exposed with orthodontic bracket attached.

Figure 4. Periapical radiograph showing tooth #K with a periapical radiolucency surrounding the crown of unerupted tooth #20.

history of a recent cold. Minor pain is elicited through palpation of the area in question. The father describes an attempt to treat the swelling with antibiotics (Amoxicillin) without success before consulting with a dentist.

Patient MM has a positive medical history for asthsma, yet no contraindications to dental treatment exist.

The extra-oral examination revealed a TMJ with normal opening, and absence of clicks or crepitus. Patient MM was positive for tenderness in the left submandibular area. She presented positive bilateral lymphadenopathy.

The intraoral examination showed positive tooth mobility tooth #K (left mandibular primary second molar), and a buccal cortical plate expansion adjacent to tooth #K. This swelling displayed no fluctuance. The floor of the mouth was soft and non-elevated, within normal limits.

After completion of a comprehensive clinical and radiographic exam, it is evident that she has a previous dental history of composite restorations on teeth #A (right maxillary primary second molar), #I (left maxillary primary first molar), #J (left maxillary primary second molar), #K, #S (right mandibular primary first molar), and #T (right mandibular primary second molar). A pulpectomy was preformed on #K. All of the previous dental work was completed outside of the USA. Patient MM presents with an intraoral swelling on her lower left side. This buccal mandibular swelling was not associated with pain or discomfort, however tooth #K was slightly tender to percussion.

Examination revealed an approximately 3 cm x 2 cm x 2 cm mass of the left mandible. The mass was bound anteriorly, posteriorly, and laterally by the buccal gingiva, and medially by the body of the mandible. The lesion was firm to palpation with minor pain / discomfort manifest upon palpation. The mass is placed lateral and apical to the clinical crowns of teeth #K, #21, and #M (left mandibular primary canine). Tooth #K contained a large composite restoration and displayed one mm mobility. Tooth #M displayed 2-3 mm mobility.

Figure 5. Pre-operative panograph shows the extent of the radiolucency and root development of tooth #20.

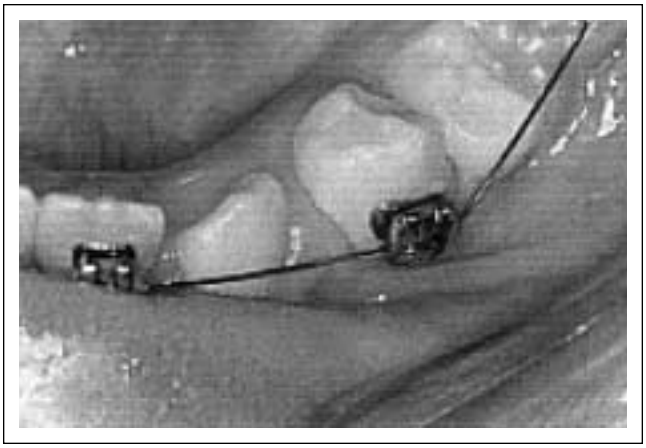

Figure 6. Clinical view of tooth #20 erupted into the mandibular arch.

Figure 7. Intra-operative view of tooth #20 exposed following enucleation of the cyst.

Both panoramic and periapical radiographs reveal a well-circumscribed radiolucency involving the roots of tooth #K. The radiolucency projects from and includes the anatomic crown of tooth #20, which is horizontally impacted with its occlusal surface facing towards the distal. A foreign body, possibly a particle of root canal filling material used in pulpectomy of #K appears on the lingual aspect of #21. The clinical diagnosis of this radiolucency was consistent with dentigerous cyst.

SURGICAL/ORTHODONTIC TREATMENT

Enucleation was the treatment of choice as the cyst in this case was small (approximately 3 cm) and prognosis for spontaneous bone regeneration was very good.

As stated by Miyawaki *et al*., the optimal timing to initiate surgical treatment of a cyst-associated-tooth is when the tooth has the ability to erupt. Radiographic analysis of the roots and apex of these teeth should show at least 2/3 root formation with an open apex.[11] Although optimal timing correlates with 2/3 root development, in this case the roots showed approximately 1/2 of root development. The decision was made to initiate treatment on the premise that the patient was currently symptomatic.

Evaluation of the distance and angulation between the crown of the impacted tooth and the crest of the alveolar bone should also be completed pre-operatively. In this case there was approximately one mm from the crown of the impacted second premolar to the crest of alveolar bone. The premolar displayed distolingual angulation, which allowed for beneficial access and placement of orthodontic brackets on the crown of the tooth.

A description of the combined orthodontic-surgical treatment of patient MM is as follows: Molar bands with buccal tubes were cemented preoperatively to teeth #19 and #30. Brackets were bonded on teeth #23, #24, #25, and #26. A flap with vertical release incisions was made anterior to tooth #23 with the aid of local anesthesia achieved with two and one half carpules (90 mg) of 2% Lidocaine with 1:100,000 Epinephrine. A full-thickness mucoperiosteal flap was elevated between teeth #19 to #23. Deciduous teeth #M and #K were extracted. Enucleation of the cyst was performed. The crown of tooth #20 was clearly visible immediately after enucleation. An orthodontic bracket was bonded to the buccal cusp of tooth #20. Ligature wire was used to ligate tooth #20 to the molar tube on tooth #19. The flap was closed with 4-0 chromic gut sutures. A coil-spring was placed around the 0.12 light round wire in addition to a stop bend mesial to the molar tube of tooth #19 to prevent mesialization and maintain space for the guided eruption of tooth #20.

Amoxicillin 250mg TID for seven days and Tylenol #2 elixir prn for pain, were prescribed to the patient.

The diagnosis according to the post-enucleation pathology report was consistent with a chronically inflamed cyst.

On follow-up appointments, healing was noticed and a panoramic radiograph revealed evidence of osteogenesis. The 0.12 wire was replaced by a 0.16 wire and a

bracket was bonded to tooth #21 subsequently until eruption of tooth #20 into the oral cavity was imminent. Healing was uneventful, and tooth #20 was found to be in occlusion one year postoperatively. Orthodontic treatment continues for the final alignment of teeth.

The technique used here of surgical enucleation combined with orthodontic treatment allows for guided eruption of the mandibular second premolar in the direction of the alveolar bone crest. The mandibular second premolar was directed toward the correct eruption path, and the post-interceptive position in the arch was sound, both occlusally and functionally.

REFERENCES

1. Regezi JA, Sciubba JJ. Cysts of the oral region, in oral pathology: clinical pathologic correlations. 3rd ed. Philadelphia, PA, W.B. Saunders Company, p 288-321, 1999.
2. Takagi S, Koyama S. Guided eruption of an impacted second premolar associated with a dentigerous cyst in the maxillary sinus of a 6-year-old child. J Oral Maxillofac Surg 56: 237, 1998.
2. Kaban LB. Dentoalveolar surgery, in Kaban LB (ed): Pediatric oral and maxillofacial surgery. Philadelphia, PA, Saunders, p 117, 1990.
3. Martinez-Perez D, Varela-Morales M. Conservative treatment of dentigerous cysts in children: a report of 4 cases. J Oral Maxillofac Surg 59: 331, 2001.
4. Sain DR, Hollis WA, Togrye AR. Correction of a superiorly displaced canine due to a large dentigerous cyst. Am J Dentofac Orthop 102: 270, 1992.
5. Ziccardi VB, Eggleston TI, Schneider RE. Using a fenestration technique to treat a large dentigerous cyst. J A D A 128: 201, 1997.
6. Murakami A, Kawabata K, Suzuki A, Murakami S, Ooshima T. Eruption of an impacted second premolar after marsupialization of a large dentigerous cyst: case report. Pediatr Dent 17: 372-74, 1995.
7. Clauser C, Zuccati G, Barone R, Villano A. Simplified Surgical orthodontic treatment of a dentigerous cyst. J Clin Orthod 28: 103, 1994.
8. Tuzum MS: Marsupialization of a cyst lesion to allow tooth eruption: a case report. Quintessence Internat 28: 283-84, 1997.
9. Lustig JP, Schwartz-Arad D, Shapira A. Odontogenic cysts related to pulpotomized deciduous molars. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 87: 499-503, 1999.
10. Miyawaki S, Hyomoto M, Tsubouchi J, Kirita T, Sugimura M. Eruption speed and rate of angulation change of a cyst-associated mandibular second premolar after marsupialization of a dentigerous cyst. Am J Orthod Dentofacial Orthop 116: 578-84, 1999.
11. Chiapasco M, Rossi A, Motta JJ, Crescentini M. Spontaneous bone regeneration after enucleation of large mandibular cysts: a radiographic computed analysis of 27 consecutive cases. J Oral Maxillofac Surg 58: 942, 2000.
12. Peterson LJ, Ellis EE, Hupp JR, Tucker MR. Contemporary oral and maxillofacial surgery. 3rd ed. Mosby, St. Louis, 1998.
13. Azaz B, Shteyer A. Dentigerous cysts associated with second mandibular bicuspids in children: report of five cases. J Dent Child 40: 29-31, 1973.