Eruption of a Severely Displaced Second Permanent Molar Following Surgical Removal of an Odontoma

Ari Kupietzky, DMD, MSc Catherine M. Flaitz, DDS, MS Rephael Zeltser, DMD, DipOdont

Dr. Kupietzky is in private practice, Jerusalem, Israel, and a diplomate of the American Board of Pediatric Dentistry; Dr. Flaitz is professor, Oral and Maxillofacial Pathology and Pediatric Dentistry, Department of Diagnostic Sciences, University of Texas Dental Branch Health Science Center, Houston, Tex; Dr. Zeltser is senior lecturer and head, Department of Oral and Maxillofacial Surgery, Hebrew University–Hadassah Faculty of Dental Medicine, Jerusalem, Israel. Correspond with Dr. Kupietzky at drkup@netvision.net.il

Abstract

The process of tooth eruption is very complex, and many of its factors remain unknown. Although radiographic features can provide clues into the eruptive potential of a tooth, underlying factors that affect tooth development and eruption are not as well defined, ranging from local disturbances to systemic disease. In addition, it is difficult to predict which teeth will require treatment and when the optimal time is to intervene. The purpose of this report is to illustrate the eruption potential of an impacted molar following the removal of a developing odontoma, despite its unfavorable position in the bone, complete root development, and orthodontic attachment loss. (*Pediatr Dent*. 2003; 25:378-382)

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The process of tooth eruption is very complex, and many of its factors remain unknown. The etiology of unerupted teeth may be attributed to local and systemic factors. Radiographic signs indicating the loss of eruption potential of an unerupted tooth are complete root development with apexification of the root and loss of the periodontal ligament space with fusion of the root to the alveolar bone. Other factors that affect tooth eruption include disturbances within the dental follicle, the skeletal and dental age of the patient, specific systemic diseases, crowding due to developmental disorders, and iatrogenic factors such as therapeutic radiation and previous trauma. Although many of these predisposing factors are well known, it is difficult to predict which teeth will require intervention. In addition, it is not clear how long a clinician should observe an unerupted tooth before initiating surgery with or without orthodontic treatment or recommending extraction of the tooth.

The purpose of this report is to illustrate the eruption potential of an impacted molar following the removal of an odontogenic lesion, despite its unfavorable position in the bone, complete root development, and orthodontic attachment loss.

Diagnosis and treatment planning

One of the first steps in examining a pediatric patient of any age–primary, mixed, or permanent dentition–is to determine the presence or absence of unerupted teeth.[1]

The optimal diagnostic tool for this purpose is the periapical or panoramic radiograph. The American Academy of Pediatric Dentistry guidelines for prescribing radiographs indicate that a child in transitional dentition (following eruption of the first permanent tooth) have, in addition to bite-wing radiographs, a routine panoramic examination or periapical/occlusal views to properly assess dental diseases and growth and development.[2] The patient's age, medical and family history, dental development, and clinical and radiographic analyses are all necessary to complete a diagnosis.[3] After a diagnosis of eruption failure is made, it becomes important to determine the cause.

The etiology of an unerupted tooth may be divided into 3 main groups:[4]

1. Mechanical obstruction (overretained, submerged, and/or ankylosed primary tooth, supernumerary teeth, odontogenic cysts, and neoplasms);
2. Failure of normal eruption and resorption of overlying bone with the absence of any physical

Table 1. The Diagnosis and Treatment of Unerupted Permanent Teeth

	Group 1	Group 2	Group 3
Obstruction present	Yes	No	No
Systemic condition	No	Yes	No
Enlarged crypt	No	No	Yes
Treatment	Surgical exposure, patent channel of eruption, orthodontic traction if needed	Surgical exposure and orthodontic traction	Extraction, orthodontic traction contraindicated

obstructions. This condition may be the result of various systemic conditions (such as hypopituitarism and hypothyroidism) or syndromes such as cleidocranial dysplasia.[3] Children who were born prematurely with very low birth weight may also exhibit a delay in overall eruption.[5]

3. Primary failure of the eruption mechanism.[4] The best evidence for this diagnosis is failure of the tooth to erupt despite the absence of any apparent obstruction or systemic condition.[4] Patients with primary failure of eruption may have an enlarged dental follicle around the crown of the tooth, which may be indicative of the specific etiology of the problem. The dental follicle–the loose connective tissue sac that surrounds each unerupted tooth–is required for eruption. The dental follicle releases many chemical mediators that are essential for the initiation of the eruption process.[6,7] In these cases, bone resorption occurs (in contrast to group 2) but tooth movement does not, resulting in an enlarged bony crypt above the crown of the tooth.[4] This condition is probably also related to a periodontal ligament defect. Treatment depends on the cause of failure to erupt (Table 1).

Group 1

Treatment of cases with mechanical interference should be surgical by removing the obstacle and observing the unerupted tooth over the next few months. If the impacted tooth has eruptive potential, it should begin to erupt. If it begins to erupt, even though it does not quite reach the normal location on its own, the periodontal ligament and eruption mechanism are normal and the tooth will respond to orthodontic treatment.[4] The prognosis is based on the extent of displacement and the surgical trauma required for exposure. Traditionally, a tooth with full root development and completion and apical closure was believed to have lost its eruption potential. Kaban and others determined the limiting factor of spontaneous eruption following surgical exposure to be apical closure.[8] Success was related to teeth whose roots were at least one-third formed, but whose apices were not yet closed. Other factors included orientation of the tooth and root dilaceration.

Rotated or poorly angulated teeth may not erupt spontaneously following surgical removal of the obstruction and of the bone and overlying soft tissue. Dilaceration, which is defined as a distorted root form with curvature, may result from mechanical interference with eruption. If distortion is severe, it may be impossible for the crown to reach its proper position, and it was suggested that it may be necessary to extract a severely dilacerated impacted tooth.

The surgical procedure consists of removal of the obstruction and excision of all the soft and hard tissues including the dental sac and any existing pathosis followed by the maintenance of a patent channel between the crown and the normal eruptive path into the oral cavity.[9] A surgical pack may be placed for this purpose, although other techniques have also been described.[9]

Group 2

Treatment of group 2 cases, unerupted teeth without any obstructions with the presence of a systemic cause, includes both surgery and orthodontic treatment. The underlying problem is the failure of the bone above the unerupted tooth to resorb. Surgical treatment is needed to expose and remove the bone and soft tissue and allow orthodontic access. Surgery is not sufficient on its own, and adjunctive orthodontic treatment is necessary. An orthodontic attachment should be placed during the surgical procedure, and orthodontic traction should commence immediately after surgery. Another possible treatment mode is surgical repositioning.

Group 3

Treatment of patients with primary failure of eruption is more problematic. It has been suggested that the treatment of choice is extraction.[4] Orthodontic treatment is contraindicated because the presence of mechanical forces on the unerupted tooth usually results in ankylosis and subsequent intrusion of adjacent anchor teeth.

Case report

A 13-year-old white male was seen by his pediatric dentist for a routine biannual recall examination. Bite-wing radiographs were exposed to evaluate for evidence of proximal caries. The patient's right permanent second mandibular molar had recently erupted and a fissure sealant was placed. It was noted that the left second permanent mandibular molar had not erupted. At the next recall examination, it was noted that the maxillary right molar had erupted, but both of the second molars on the left side were not present.

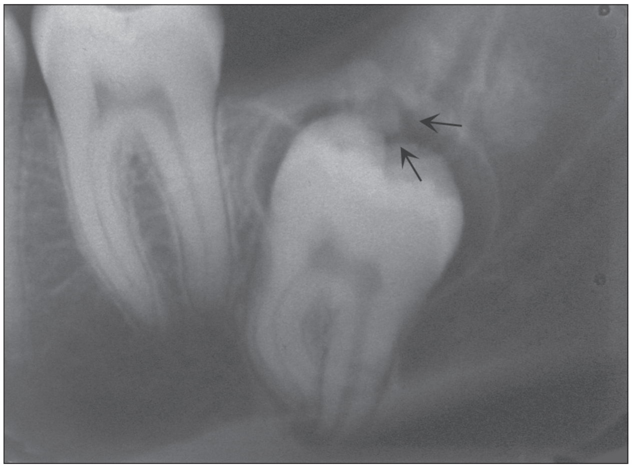

Figure 1. In the periapical view, 2 discrete globular opacities can be observed pericoronally, within the follicular space. The roots of the tooth are fully developed and dilacerated with apparent closure of the root apices.

Because there was no soft tissue or bony expansion overlying these unerupted molars, the delayed eruption was considered to represent a unilateral but idiopathic anomaly.

Two-and-a-half years later, the patient returned for a recall examination at age 15 years. The maxillary right second molar had erupted, but there was no sign of the left mandibular second molar. Bite-wing radiographs were exposed, and the occlusal mesial aspect of the unerupted tooth was seen. Due to the findings, a periapical film (Figure 1) and panoramic radiograph were taken (Figure 2). The radiographs showed an unerupted inferiorly displaced mandibular second molar. The tooth appeared to be in close proximity to the inferior border of the mandible and had a distal angulation. Its roots were fully developed and dilacerated with apparent closure of the root apices (Figure 1). Pericoronally, 2 discrete globular opacities were found within the follicular space. The dental follicle was well defined and surrounded by a thin sclerotic margin.

Figure 2. The panoramic radiograph shows an unerupted, inferiorly displaced mandibular second molar.

The working diagnosis of the radiographic findings was a complex odontoma; however, a calcifying odontogenic cyst and an early ameloblastic fibro-odontoma were included as possibilities based on the age of the patient and radiographic presentation. Based on the differential diagnosis, the patient was referred to an oral and maxillofacial surgeon and orthodontist for consultation and treatment. It was decided to remove the radiopaque lesion overlying the tooth, expose the crown, and begin orthodontic traction. The decision to include orthodontic traction was due to the assumed poor prognosis of spontaneous eruption of the tooth. This was based on the premise that a distal angulated, displaced, impacted tooth with fully developed, dilacerated roots, would not spontaneously erupt without orthodontic traction.

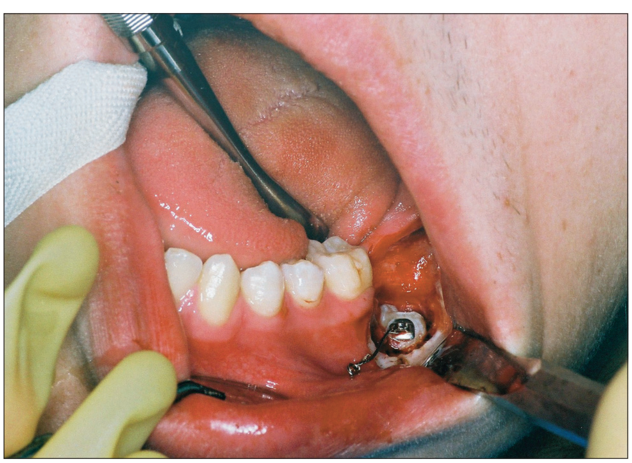

Figure 3. An attachment was bonded to the tooth during surgery to allow orthodontic traction and forced eruption of the impacted tooth.

Under local anesthesia (Octacaine100–Lidocaine 2% with Epinephrine 1:100,000, Novocol Pharmaceutical, Canada), a semitrapezoid mucoperiosteal flap was raised distal to the first permanent molar, leaving part of the underlying occlusal mucosa attached to the crestal bone. The exposed crestal alveolar bone was intact. The occlusal bone covering the lesion was removed. Enucleation of an encapsulated lesion, which was composed of a soft tissue envelope containing hard tissue fragments, was achieved. The enucleation of the lesion overlying the unerupted molar and the removal of the occluso-buccal dental sac exposed the crown of the tooth. An attachment was bonded to the tooth dur-

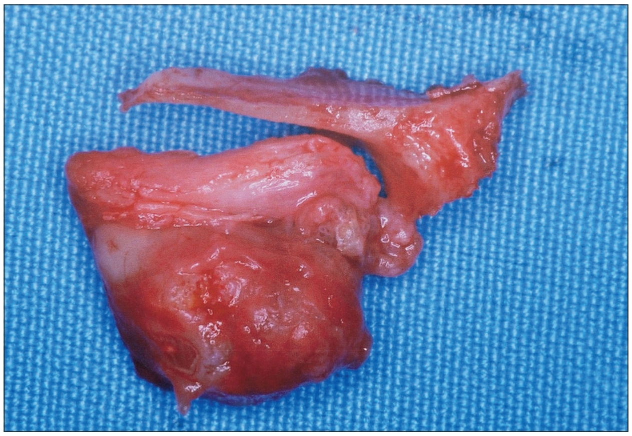

Figure 4. Macroscopic view of the lesion: oral mucosa, with underlying alveolar bone and the lesion overlying the tooth.

Figure 5. A periapical radiograph taken the day after surgery confirmed the clinical impression of failure of the bonded orthodontic attachment.

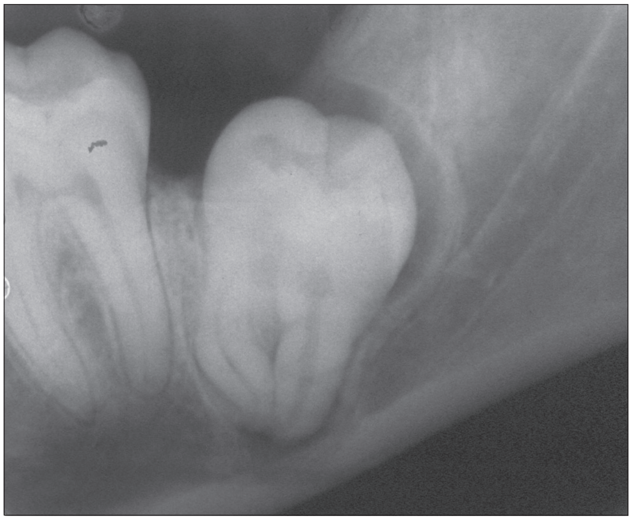

Figure 6. A periapical radiograph exposed 3 months following surgery shows partial eruption of the second molar.

ing surgery to allow future orthodontic traction and forced eruption of the impacted tooth (Figure 3). The overlying mucosa was sutured with 4/0 Vicryl suture (Ethicon Johnson & Johnson, New Brunswick, NJ). Due to penicillin allergy, the patient was prescribed with Clindamycin 900 mg/day for the next 5 days.

The lesion with the overlying bone and part of the surface mucosa was submitted for routine histopathologic examination following decalcification of the specimen (Figure 4). The microscopic findings of the histopathological evaluation revealed decalcified tissue, a disorganized mass of dentin with strands of enamel matrix, pulpal tissue, and cords of odontogenic epithelium. Based on these findings, a diagnosis of a developing complex odontoma was made.

The day following the surgery, the patient reported that the ligature wire attached to the bracket felt loose. A periapical radiograph confirmed the clinical impression of failure of the bonded orthodontic attachment (Figure 5). To prevent physiological healing of the hard and soft tissues overlying the impacted tooth and keep a patent passage for possible spontaneous eruption, an iodoform gauze (Nu Gauze, Johnson & Johnson, New Brunswick, NJ) soaked with White Heads varnish (Hadassah Medical Center, Jerusalem, Israel) was placed in the surgical site. The dressing was changed every 2 weeks for 3 months.

To prevent overeruption of the opposing left maxillary molar during the expected prolonged period of tooth eruption, a bonded sectional orthodontic arch wire extending between the first and second molars was placed. After a period of 3 months, a follow-up examination and radiograph showed partial eruption of the second molar (Figure 6). Fourteen months after surgery, the tooth partially appeared in the oral cavity. Nineteen months after surgery, the bite-wing radiograph showed that the tooth was in occlusion and there was no need for further intervention (Figures 7 and 8).

Discussion

Tooth eruption is a multifactorial and complex process involving an eruption force and bone remodeling.[10] Potential causes of failure to erupt interfere with either components of the process. For example, a systemic disease inhibiting bone resorption can prevent a tooth from erupting. A physical obstruction can prevent a tooth from erupting even though both components–eruption force and bone remodeling–are normal. Typically, removal of the obstacle will allow for spontaneous eruption. Other factors that may affect eruption force and bone remodeling include nutritional, hormonal, cellular, molecular, and physiochemical factors, and age.[3] All may modify the rate and direction of the eruption process.

The biology of eruption is governed by chemical mediators, which begin a cascade of monocyte infiltration and osteoclastic activity.[11] The absence of any of these factors may cause the eruption mechanism to fail. A genetic component may also play a role.

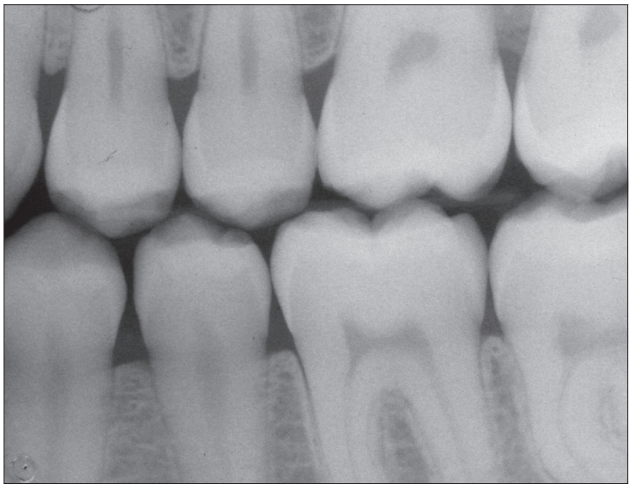

Figure 7. A bite-wing exposed 19 months later, showing the tooth fully erupted.

Figure 8. Clinical view of the tooth fully erupted without any further intervention.

Clinical signs related to the loss of tooth eruption potential are lacking. Previous theories that root elongation and development are essential for tooth eruption through the proliferation of Hertwig's epithelial sheath or continued dentinogenesis have been refuted. Teeth without the presence of a pulp or epithelial root sheath have erupted, proving that tooth development and eruption are separate processes. Indeed, Marks and Cahill showed that if an inert object were substituted for the tooth prior to eruption, the object would still erupt, confirming that the presence of the tooth itself is not essential for the eruption process.[12] On the other hand, surgical removal of the dental follicle from a tooth prior to the onset of eruption prevents its eruption, proving that the dental follicle is the key tissue required for eruption.[11]

One of the main tasks of the follicle is the preparation of an eruption pathway through the activation of osteoclasts. Once an eruption pathway is formed, teeth begin to erupt. Another classic study by Cahill showed that teeth that were experimentally restrained from erupting did not prevent an eruption pathway from forming.[13] When the wires restraining the unerupted teeth were removed, the teeth rapidly erupted. Similarly, as depicted in the case presented, it would seem that once an eruption pathway was made (surgically) and maintained, the impacted tooth erupted through it, regardless of its state of development.

Conclusions

Clinicians should not underestimate the eruption potential of an impacted tooth. Previous assumptions on the relationship between tooth formation and eruption potential need to be revisited. Understanding the cause of an impacted tooth is essential for correct choice of treatment.

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