

Diagnosis and treatment planning for unerupted premolars

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Abstract

Premolars rank third in frequency after third molars and maxillary canines in impacted or unerupted teeth. Failure to detect and analyze the problem may lead to unnecessary space loss, crowding, or collapse of the dental arch. A diagnostic scheme is presented to facilitate diagnosing and treating unerupted premolars. Important observations include:

- *Diagnosing congenitally missing permanent teeth*
- *Whether the condition is generalized or localized*
- *Whether the succedaneous tooth has a viable form, eruptive potential, and viable orientation*
- *Whether the delayed eruption is due to over-retained primary molars such as ankylosis and incomplete root resorption*
- *The amount of space available for the succedaneous tooth to erupt*
- *The presence of overlying soft tissue or bone.*

Space management and proper management of primary molars will frequently facilitate uneventful eruption of premolars. Orthodontic guidance of eruption is rarely indicated if problems can be detected early and managed properly. Four case reports elucidate the recommended treatment methods for these commonly occurring unerupted premolars. (Pediatr Dent 16: 89-95, 1994)

Introduction

One of the first steps in examining a pediatric dental patient with a mixed dentition is to determine the presence or absence of unerupted permanent teeth. Impacted or unerupted premolars rank third in frequency after third molars and maxillary canines.¹ Most of the literature focuses on the sequelae of the submergence, ankylosis, or early loss of the primary molars.²⁻¹¹ Few articles report the developmental course of unerupted premolars, with or without early interventions.

Etiological factors associated with unerupted premolars may include arch length deficiency, mechanical blockage, ectopic positioning, malformed teeth, ankylosis of the premolar, over-retention of primary teeth or ankylosed primary teeth, trauma, and systemic diseases.¹²⁻¹⁴

Ankylosis of primary teeth

The presence of ankylosed primary molar teeth may complicate eruption and development of the succedaneous permanent dentition. Typically, exfoliation of affected teeth is delayed¹⁵ with subsequent complications such as:

- Deflected eruption paths for adjacent or opposing teeth¹⁶
- Impaction of succedaneous premolars^{16,17}
- Localized or generalized loss of needed arch length¹⁵
- Tipping of adjacent teeth over the ankylosed primary molar or supraeruption of opposing teeth.^{15,17-18}

These sequelae usually cause malocclusion.

Conservative approaches in treating ankylosed primary molars have been advocated after longitudinal study of such cases.⁴⁻⁶ One study found that extracting ankylosed primary molars resulted in a gradual space loss in 14 of the 15 children.⁵ Three approaches were recommended: observation, extraction, and restoration to occlusion. According to Messer and Cline,⁴ the treatment recommendations should be based on the molar type, clinical pattern, and the severity of infraocclusion. For example, ankylosed mandibular second primary molars tend to become more severely infraoccluded as compared with mandibular first molars over time. Mesial tipping of the adjacent first permanent molar over the occlusal surface of the ankylosed tooth may occur, causing loss of arch length. The primary molar should be extracted if the tooth becomes moderately infraoccluded and/or mesial tipping of the mandibular first permanent molar is imminent. On the other hand, restoring solitary ankylosed primary mandibular molars showing only slight infraocclusion with restorations or stainless steel crowns to restore occlusion appears to be a useful interim treatment during the mixed dentition period. When the primary molar is ankylosed and the permanent premolar is congenitally absent, early orthodontic and prosthodontic consultations should be sought concerning long-term treatment of the dentition. A recent case report demonstrated an ectopically impacted premolar with radiolucent evidence of a defect in the crown.¹⁹ Treating this problem may require immediate surgical exposure and restoration.

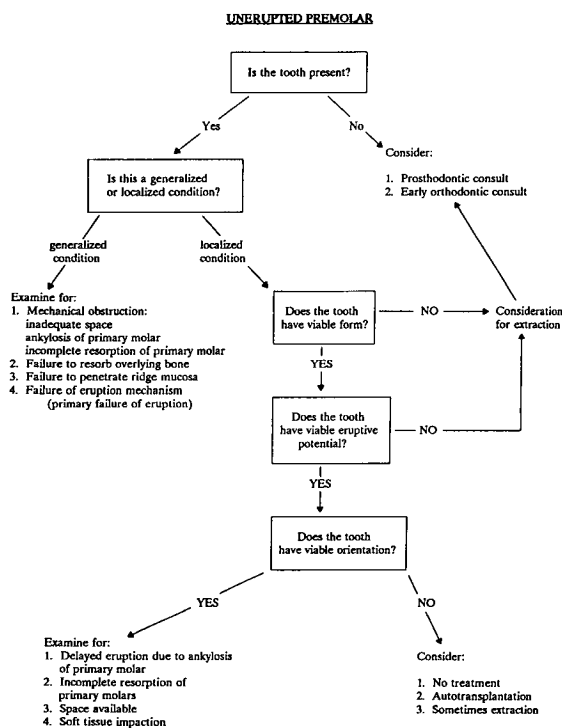


Fig 1. Diagnostic and treatment scheme for unerupted premolars.

Unerupted premolars

Unerupted teeth can be treated by either extraction or exteriorization of the crown of the impeded permanent tooth.¹³ Three techniques of exteriorization include surgical exposure, repositioning, and orthodontic traction.

Surgical exposure is indicated if the tooth is in a normal eruptive position but retarded in its eruption after development of 3/4 of its root length. The procedure involves removing overlying bone and soft tissue and exposing the full occlusal surface of the impacted tooth. The impacted tooth is then allowed to erupt unaided by maintaining a patent channel from the crown to the oral cavity along the normal eruptive path. Various techniques have been used to ensure this patency including cementing a celluloid crown²⁰ or packing gutta percha material, zinc oxide eugenol,²¹ or a surgical pack.²²

Surgical repositioning or autotransplantation may be indicated if a tooth is in an abnormal axial inclination or, if once exposed, it does not erupt.^{23, 24} The surgical technique was refined by Northway,²⁵ and various articles in the literature reported a high success rate of autotransplantation.^{26, 27} Long-term studies of autotransplanted premolars by Andreasen^{28, 29} demonstrated successful periodontal healing and continued root growth of the premolar, depending on the amount of damage to Hertwig's epithelial root sheath.

Finally, orthodontic traction may be used to guide

eruption of the malpositioned and unerupted tooth with direct bonded attachments,³⁰ and applying a guidance force. Complications of orthodontic traction have been reported.¹³ Reparative dentin has formed with varying degrees of pulpal obliteration, and dwarfed roots have formed making the tooth unresponsive to vitalometer stimulation.¹³

Diagnosis and treatment scheme for unerupted premolars

A number of critical observations help select the proper treatment approach for a specific patient. These include:

- Diagnosing missing succedaneous teeth
- Whether the condition is generalized or localized
- Whether the succedaneous teeth have viable form, eruptive potential, and viable orientation
- Whether the delayed eruption is related to over-retained primary molars such as ankylosis and incomplete root resorption
- The amount of space available
- The presence of overlying soft tissue or bone.

The objectives of this paper are to direct the clinician through a diagnostic sequence of recognition and decision making in planning treatment for an unerupted premolar. Four case reports elucidate some recommended treatment methods for commonly occurring unerupted premolar conditions.

Fig 1 shows a diagnostic scheme to determine the problems and develop a treatment plan for the unerupting premolar. The first question is whether all the succedaneous teeth are present. The answer usually comes from routine clinical examination with a good dental history and appropriate radiographs such as panoramic, bite-wing, or periapical views. An unerupted premolar is usually detected from a routine bite-wing radiograph while its absence generally is confirmed by a routine panoramic radiograph. If present, its position is determined by comparing it with corresponding premolars in other quadrants. If the succedaneous premolars were missing in one or more quadrants, early orthodontic and prosthodontic consultations should be sought to determine the long-term treatment.

The second question is whether the condition is generalized or localized. If it is generalized, consider mechanical interferences with the eruptive process, such as an ankylosed primary molar, a supernumerary tooth, unresorbed root of a primary molar, or lack of available space. The usual mode of treatment will be to remove the mechanical obstruction, regain lost space, and observe the unerupted tooth over the next few months. Other possible problems are failure of overlying bone to resorb properly or failure of the tooth to penetrate the masticatory ridge mucosa. These situations require surgical exposure. Teeth may erupt independently, or

orthodontic treatment may be required to move the involved teeth into position. If the involved teeth fail to respond to direct orthodontic force, such as that provided by vertical elastics, the possibility of primary failure of eruption should be considered. This is a failure of the eruption mechanism, probably related to a periodontal ligament defect.³¹ The treatment of choice would be surgical repositioning, possibly with autotransplantation^{28,29} or bone grafting.³¹

If the problem is localized, the next question is whether the tooth has a viable form. Teeth that are not viable should be considered for extraction with orthodontic and prosthodontic consultations regarding future space management and prosthetic replacement. On the other hand, teeth that are viable should be evaluated for their eruptive potential. Teeth with poor root morphology or ankylosis do not have good eruptive potential. If teeth cannot be brought into function with orthodontic therapy, a restoration may be indicated to establish occlusal contact. If restoration is contraindicated, extraction followed by orthodontic management of the resulting space may be required for space closure or prosthetic replacement.

The next question has to do with the orientation of the tooth. Rotated or poorly angulated premolars usually indicate a failure in normal root resorption of the primary molar. A tooth directed horizontally or apically will not erupt into occlusion without guidance. One should consider orthodontic traction³⁰ or autotransplantation.^{28,29} A decision to monitor — not to treat immediately — should be considered if further root development may improve the crown position.

A delay in eruption of a succedaneous tooth may be related to the condition of the primary teeth, such as ankylosis or an incomplete resorptive pattern of the primary tooth. Both may indicate a need to extract the primary tooth — or a more conservative approach — to wait for the exfoliation of the primary tooth. Ankylosis or infraocclusion of a primary molar is frequently due to fusion of the primary tooth root to the surrounding bone or due to other causes such as:

- Disturbed local metabolism
- Gaps in the periodontal membrane
- Local mechanical trauma
- Localized infection
- Chemical or thermal irritation
- Local failure of bone growth
- Abnormal pressure from the tongue.²⁻⁵

Complications that can result from infraocclusion of primary molars include tipping of the neighboring teeth, loss of space, overeruption of the antagonist or posterior (lateral) openbite.^{9,10,31} In addition, infraoccluded primary molars do not respond to orthodontic forces, so early intervention by extracting the severely infraoccluded primary molar and instituting space-regaining therapy may be indicated.

Frequently, the space may not be adequate for the

succedaneous tooth to erupt. Occasionally, when the primary molar is prematurely lost, space regaining is indicated. Examine the entire malocclusion — not merely the local crowding — or the clinician may proceed with space regaining to realize later the case requires extraction of permanent teeth.

Finally, consider the overlying soft tissue. Delayed eruption may be due to overlying soft tissue. The ridge area masticatory mucosa is dense and may be resistant to penetration.³² Removing soft tissue from the occlusal surface to create a hole approximately the diameter of the unerupted tooth and maintaining patency may allow the tooth to erupt into the oral cavity. Quite frequently, orthodontic traction is required to assist or hasten eruption through the hole. If the unerupted tooth exhibits no physiologic mobility at time of exposure, the tooth will most likely resist orthodontic traction, eruption, or guidance.³¹ In that case, extraction is

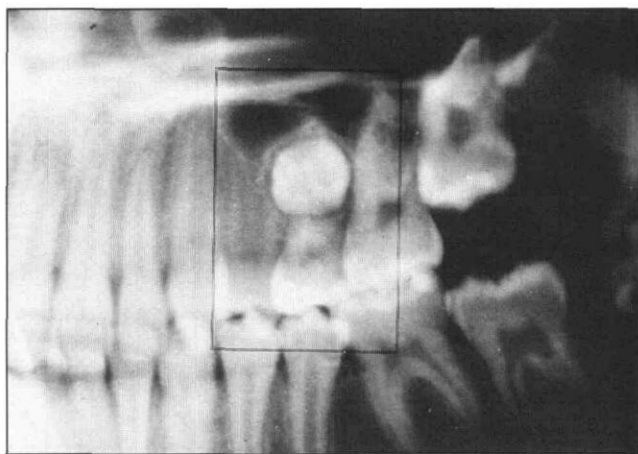


Fig 2A. Picture of the maxillary left second primary molar area taken from a panoramic radiograph of an 11-year 6-month-old patient. The premolar appeared to be angled with the occlusal surface toward the buccal.



Fig 2B. Radiograph of the same area of the same patient 21 months after extraction of the primary molar. The premolar erupted, without any assistance, into occlusion in a 90° rotated position.

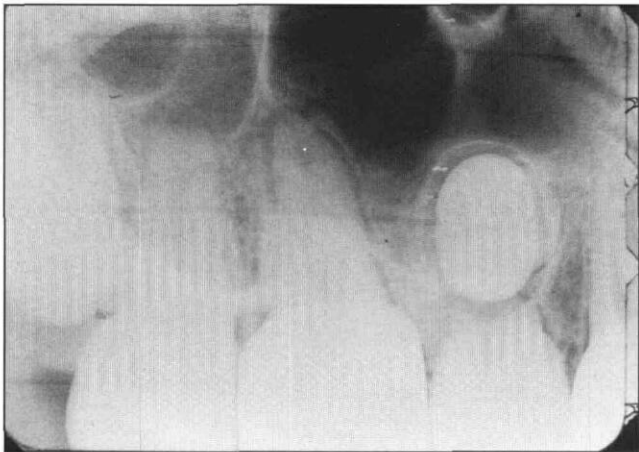


Fig 3A. Radiograph of a left maxillary retained second primary molar with malposed second premolar (6-6-82). Orthodontic appliances are in place.



Fig 3B. Radiograph of same area 18 months later (12-9-83). After extraction of the primary molar the opening was maintained. Premolar was erupting unassisted.



Fig 3C. Radiograph of same area after premolar had erupted into occlusion during the orthodontic retention phase (7-31-84). The maxillary second premolar erupted without any force being applied to it.

indicated since placing a restoration to gain occlusal contact would create an unfavorable crown-to-root ratio, undesirable coronal form, and periodontal relationship.

Case reports

Case 1

An 11-year 6-month-old female seen for a dental recall appointment had a retained maxillary left second primary molar in a Class I dental occlusion. The unerupted premolar appeared to be positioned in such a way that the occlusal surface was directed perpendicularly buccally (Fig 2A). The primary molar was extracted approximately two weeks later. The socket was curetted well and the opening was maintained with iodofomed gauze. No space gaining was needed, and orthodontic care was applied. The premolar erupted into occlusion, but in a 90° rotated position (Fig 2B).

Case 2

A 12-year-old female presented with a Class II, division 1 malocclusion with crowding in the maxillary arch, a slight deep bite, and retained maxillary left second primary molar (Fig 3A). Apical to the retained primary tooth was a malposed second premolar circumscribed by a well-defined radiolucency (wider than a normal periodontal ligament space) and a well-defined "lamina dura." Further radiographic assessment revealed no root formation. Orthodontic treatment was initiated with fixed appliances. No attachment of appliances was made to the primary tooth. Space was increased as Class II correction was continued. The maxillary left second primary molar was extracted and the socket area packed with sterile orthopedic plaster. Plaster was left in place for approximately 2 weeks. The second premolar tooth was allowed to erupt through the patent area (Fig 3B). No orthodontic attachment was placed on the premolar and no force was applied. Active orthodontic treatment was completed and retainers were placed. Adequate space was developed for the premolar. The premolar was left to continue its independent eruption. Four and a half months later the premolar was in occlusion (Fig 3C).

Case 3

A 9-year-old female was referred to the pediatric dentistry/orthodontic clinic for consultation. Clinical and radiographic examination revealed precocious eruption of the maxillary left second premolar, and a blocked maxillary right second premolar due to premature loss of the second primary molar (Fig 4A). Treatment recommendations included space regaining in the maxillary right quadrant to allow eruption of the second premolar. A removable appliance with finger spring was used to distalize the maxillary right first molar. Four years later, all permanent teeth were in occlusion except the over-retained and submerged

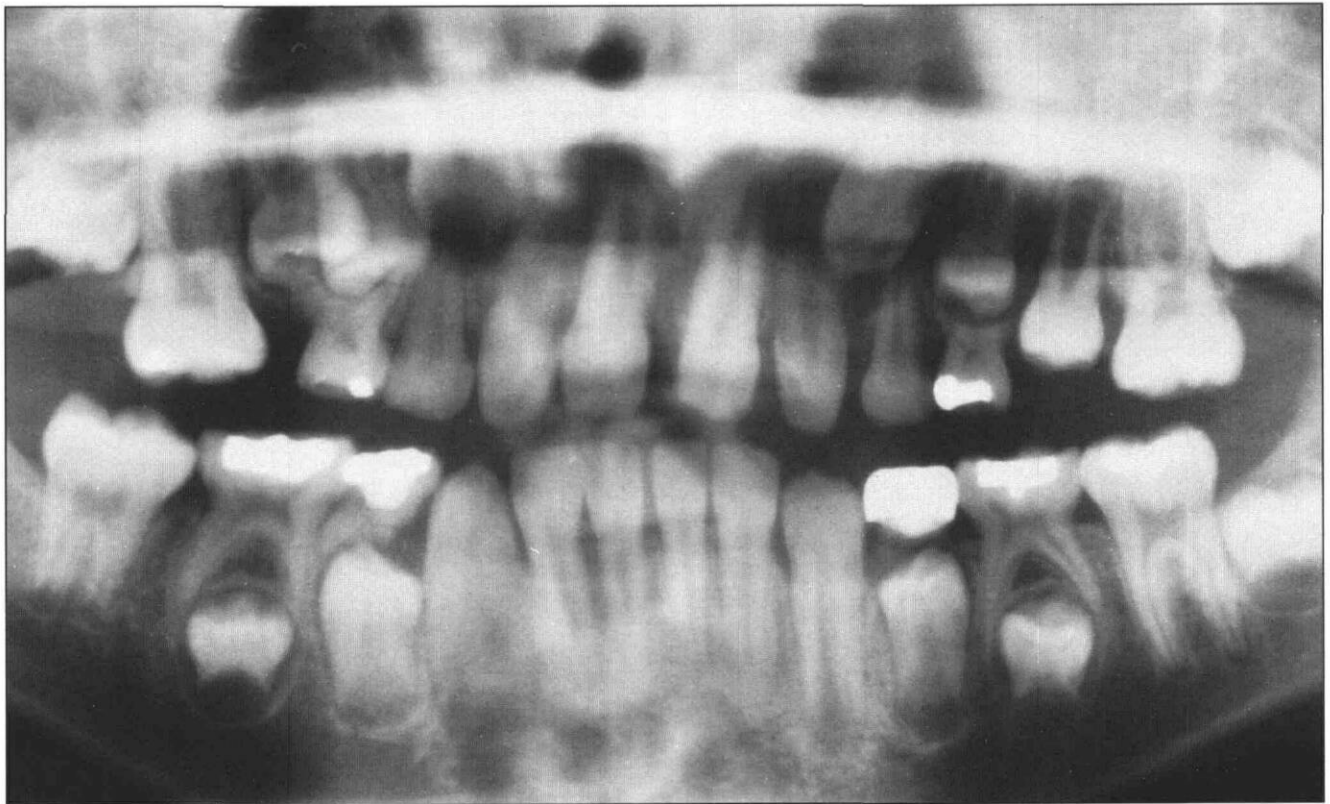


Fig 4A. Panoramic radiograph of a 9-year-old female showing precocious eruption of the maxillary left second premolar and blocked-out maxillary right second premolar due to premature loss of the second primary molar.

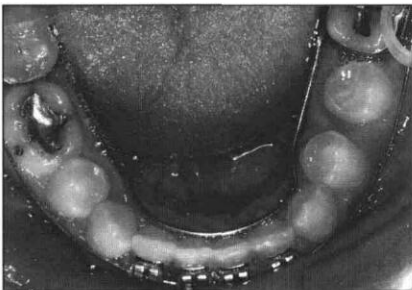


Fig 4B. Occlusal view of the same patient four years later with all permanent teeth in occlusion except the over-retained mandibular right second primary molar.

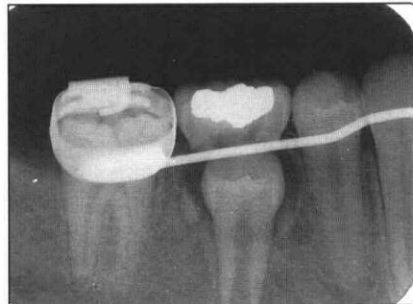


Fig 4C. Periapical radiograph of the same patient showing an unerupted mandibular second premolar with ankylosed primary second molar.

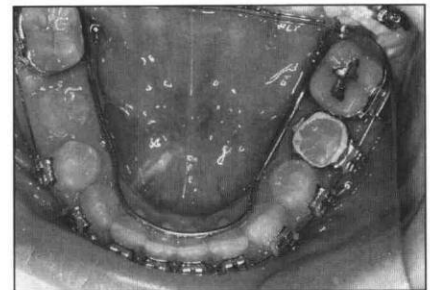


Fig 4D. Occlusal view of the same patient 6 months after extraction of the primary molar showing eruption of the premolar without orthodontic guidance or traction.

mandibular right second primary molar (Fig 4B). A periapical radiograph revealed an unerupted premolar with ankylosed second primary molar (Fig 4C). A lower lingual holding arch was placed as a space maintenance appliance and the patient was referred for extraction of the primary molar. Six months later, the second premolar erupted into occlusion unaided (Fig 4D). Comprehensive orthodontic treatment was completed.

Case 4

A 9-year-old girl presented to the pediatric dentistry/orthodontic clinic with a chief concern of a miss-

ing primary molar. Clinical examination revealed that all primary teeth were present in functional occlusion except for the mandibular right second primary molar (Fig 5A). A panoramic radiograph disclosed the presence of a primary molar in severe infraocclusion with the bud of the second premolar lying close underneath. The root of the succedaneous premolar bud was less than half formed and the crown was tipped distally toward the permanent first molar. The mandibular right permanent first molar was mesially tipped and overlapping the primary second molar.

Treatment recommendations included space regaining, molar uprighting, and distalization of the man-

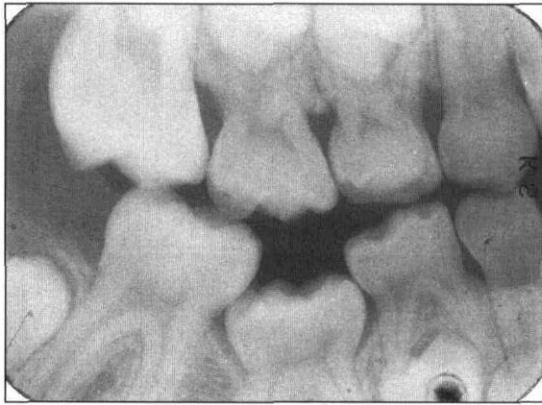


Fig 5A. Bite-wing radiograph of a 9-year-old female showing primary second molar in severe infraocclusion with the bud of the second premolar lying close underneath. The mandibular right permanent first molar was mesially tipped and overlapping the primary second molar.

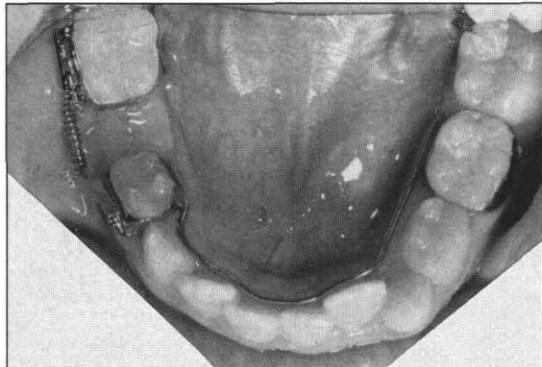


Fig 5C. Occlusal view showing the appliance used to regain space by molar uprighting.

dibular right permanent first molar with a fixed appliance while awaiting development of the succedaneous tooth. Periodic surveillance to determine the need to extract the secondarily retained primary molar was required. The mandibular first permanent molars were banded with buccal tubes and gingival hooks. Mandibular premolar bands with welded brackets were adapted to the primary first molars. A lower lingual holding arch was fabricated from the mandibular right primary first molar to the permanent first molar on the opposite arch. The initial wire was a 0.0175 braided and stopped arch wire. Three weeks later, an 0.016 stopped arch wire was inserted. Six weeks later, a stopped 0.018 wire with compressed coil was placed on the arch wire and inserted between the primary first molar and the permanent first molar. Reactivation was accomplished three times. Total treatment time was 5 months (Fig 5B).

Five months after initiating orthodontic treatment, the second primary molar was removed due to the



Fig 5B. Periapical radiograph of the same patient showing the roots of the succedaneous premolar were less than half formed and the crown was angulated distally towards the permanent first molar.



Fig 5D. Radiograph taken two years later showing the eruption of premolar into occlusion with orthodontic guidance or traction.

poor angulation of the succedaneous premolar. After the surgical site of the ankylosed primary molar healed, all bands and brackets on all teeth were removed, and a lower lingual holding arch space maintenance appliance was placed (Fig 5C). Two years later, the premolar had erupted into occlusion uneventfully without any orthodontic traction or guidance (Fig 5D).

Conclusions

An unerupted premolar is common. Failure to detect and analyze the problem may lead to unnecessary space loss, crowding, or collapse in the dental arch. A diagnostic scheme is presented to facilitate diagnosis of the unerupted premolar condition. Important observations to make in the diagnosis and treatment planning for unerupted premolars are:

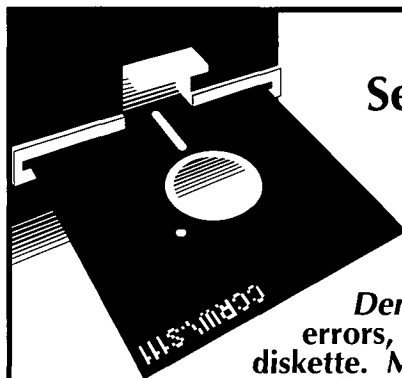
1. Presence of unerupted premolar
2. Space available for its eruption
3. Presence, position, status and condition of primary molar
4. Viability of premolar form, eruptive potential and orientation
5. Presence and status of overlying bone and/or soft ridge musoca.

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