The nuts and bolts of hemisection treatment: Managing congenitally missing mandibular second premolars

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When you treat the congenital absence of mandibular second premolars by extracting the residual deciduous second molar and closing the space, you run the risk of flattening facial fullness, especially in patients with nonextraction features—diminished facial fullness, absence of crowding, and reduced tooth size. This challenge is heightened by the increased likelihood that these features will occur in patients who have agenesis. This article describes a new approach that has been shown to minimize such a loss of anchorage. The technique is called hemisection and involves buccolingual sectioning of the second deciduous molar, followed by removal of its distal half. As necessary, the mesial half is also removed, and space closure can be completed. The advantages, philosophy, and technique are discussed in detail. (Am J Orthod Dentofacial Orthop 2005;127:606-10)

How do you treat a patient with congenitally missing mandibular second premolars? If you extract the residual deciduous second molar and close the space, you run the risk of flattening facial fullness, especially in patients with nonextraction features (diminished facial fullness, absence of crowding, and the reduced tooth-size that often accompanies agenesis). A bold new approach has been shown to minimize this negative impact. The technique is called hemisection and involves faciolingual sectioning of the second deciduous molar and removing its distal half. This allows spontaneous mesial movement of the first permanent molar with the resultant closure of space created by the extraction. Once the mesial movement slows, often because of its approximation to the mesial half of the hemisected tooth, this mesial half (the "bookend") is removed. At this point, it is a good idea to apply orthodontic forces to finish the space closure. If the mechanics are carefully designed and supported, the mandibular molar can be brought forward without anchorage loss. This minimal loss of anchorage has been demonstrated by using the pitchfork analysis in an article that examined 23 consecutively treated patients, each treated with this hemisection approach to manage congenitally missing mandibular second premolars.[1]

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THE SURGICAL TECHNIQUE

The surgery is performed with the patient under profound local anesthesia. A bur of sufficient length is used to cut from the midpoint of the buccal aspect of the second deciduous molar through to the lingual midpoint. This cut should extend through the pulp floor and into the undersurface of the crown. The distal half of the tooth can then be luxated and removed. If ankylosis is suspected, it is a good idea to also make an incision through the tooth from the distal contact point forward to the hemisecting cut. This will allow the distal quarters of the tooth to implode, thus diminishing the chances that removal of any of the thin trabecular bone between the mesial root of the permanent molar and the distal-arching root of a retained mandibular second deciduous molar will occur.

Once this distal portion has been extracted, the pulp tissue should be removed from the pulp chamber of the remaining mesial portion. The nerve will not need to be extirpated from the mesial root in more than a cursory fashion, because this portion will not be kept in the long term. The pulp chamber must then be sealed with calcium hydroxide paste (Fig 1). The remnant root can be removed—if it does not resorb—when the space is closed or as it gets in the way of continued space closure. Only rarely will the mesial portion become infected and need early removal. In the meantime, its presence supports the maintenance of alveolar width in this area. Many patients who lose the entire second deciduous molar experience dramatic alveolar atrophy. It could be that, when the tooth is extracted with less than extreme care, alveolar contour loss occurs. The

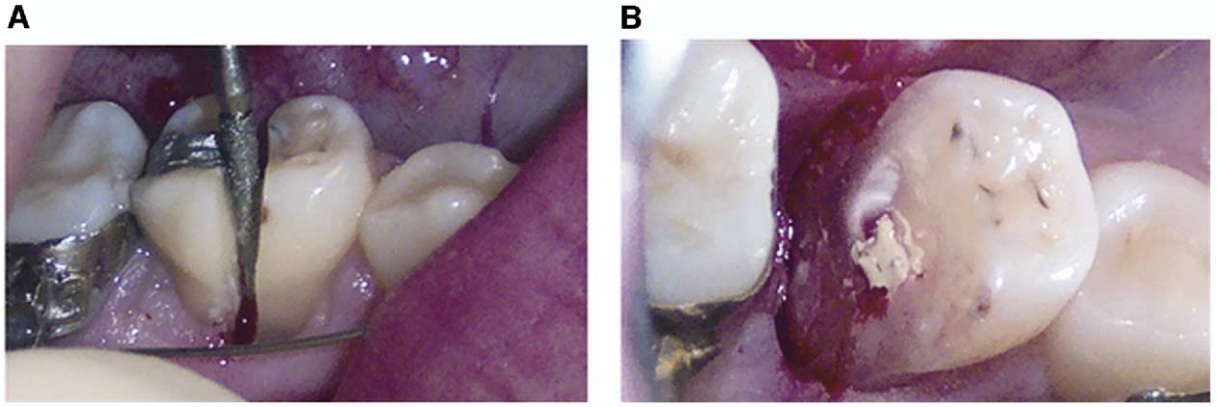

Fig. 1. **A**, Hemisection; **B**, mesial half pulp chamber capped with calcium hydroxide paste.

observant clinician will see many patients in whom, for whatever reason, the alveolar thickness becomes profoundly diminished. The concave shape that is characteristic of such alveolar collapse is lined on both the lingual and the buccal by cortical plate that resists tooth movement.

ANCHORAGE PREPARATION

One might expect that the laws of physics should dictate the direction and degree of anchorage loss in the aftermath of extraction; ie, the teeth on either side of an extraction might move toward each other in equal amounts. However, that is not how teeth respond. Typically, teeth distal to extraction sites in the maxilla move much farther toward the mesial than the more mesial teeth move toward the distal. This phenomenon has been described as "mesial drift." The tendency occurs in the mandible, but not nearly as profoundly as it does in the maxilla. Furthermore, it tends to depend on location and age. Specifically, if the mandibular first permanent molar is removed before the eruption of the second molar and, therefore, before the eruption of the mandibular premolars, there is a tendency toward massive distal movement of the mandibular premolars on eruption. Although Björk and Skieller[2] and Svendsen et al[3] have shown that the path of eruption of a normally developing mandibular posterior tooth tends to be upward and forward, their findings are drawn from subjects who were growing and had no extractions or agenesis.

Hemisection allows the first permanent molar to move forward as soon as the distal half of the tooth is removed. What is peculiar to the patients we have treated by hemisection is the apparent static state of the residual mesial portion of the hemisected deciduous molar. This "bookend" does not migrate to the distal as one might expect. However, when this remnant is removed, the teeth on either side begin to occupy the extraction site: distal movement of the premolar and the canine begins to the extent that the midline can be seen to shift. Furthermore, the mandibular anterior teeth begin to tip toward the lingual, exaggerating the overjet and initiating a loss of lip support.

Once that mesial half is removed, it is important to carefully address anchorage needs. Especially if simple power-chain ties or Class I elastics are applied to the mandibular arch, the laws of physics dictate that the distal teeth will move forward and the more mesial teeth will move backward. If it is desired that the front teeth are kept forward, measures should be taken to prevent anchorage loss. Similarly, if intermaxillary elastics are used, 1 arch will experience a distalizing effect (the maxilla in the case of Class II elastics). This can have a potentially harmful impact in some facial forms.

We have used chincups with traction hooks (Hickham cups) and various facial traction devices (protraction face masks), but patients are typically not enthusiastic about them. We have had tremendous success with tooth-borne functional appliances in conjunction with fixed orthodontic appliances (Fig 2). With such an appliance, like an activator, the protrusive bite causes the patient to hold the mandible forward. Because the muscles of mastication and facial expression cause the mandible, specifically the mandibular teeth, to settle back against the appliance, the teeth begin to experience a force of proclination. When correcting a Class II malocclusion, this is typically not a favorable side effect because of the likelihood of relapse. But when trying to close the space of an extracted or congenitally missing tooth, the protrusive side effect can be a favorable source of anchorage. Patients with maximum reverse anchorage—those whose facial profiles are such that no retraction of the lips and other facial

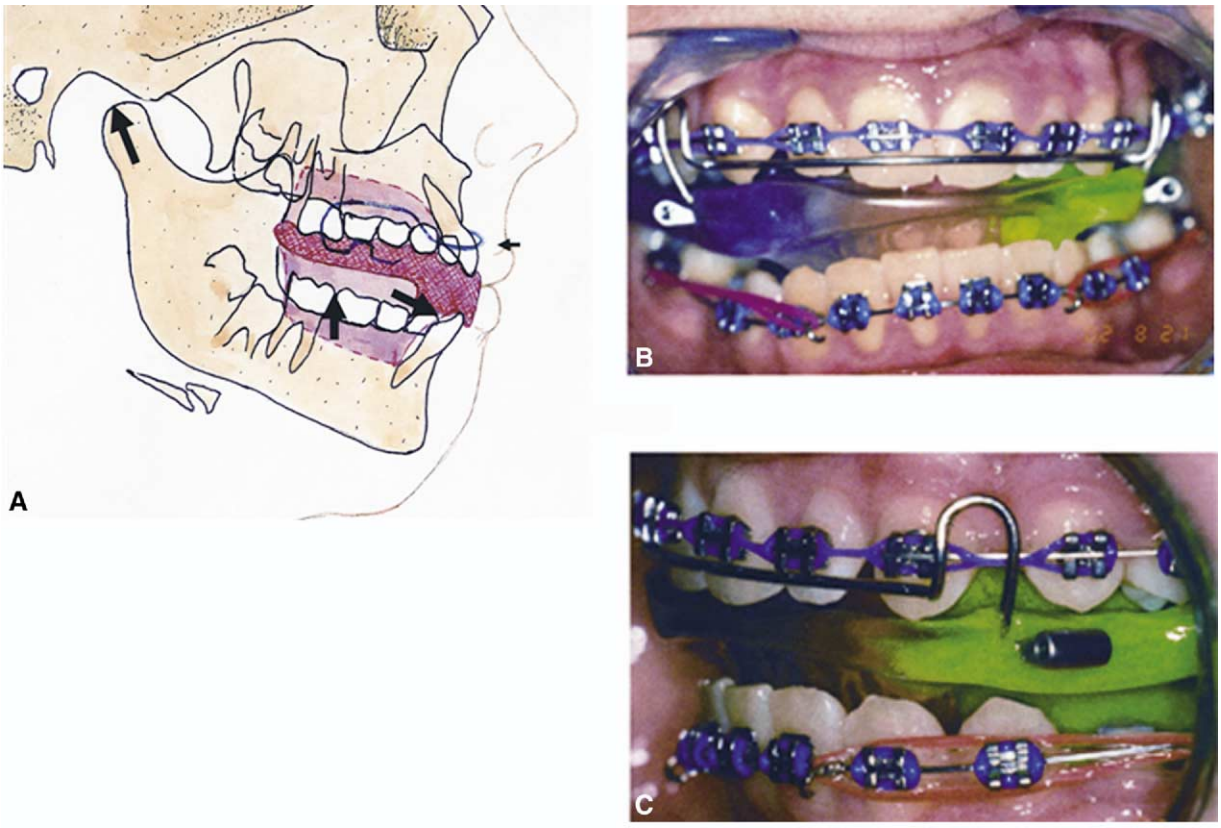

Fig. 2. A, Schematic of functional appliance; **B** and **C**, activator demonstrating potential for arch leveling and anchorage even with unilateral Class I elastics to close extraction site.

features is desirable—can nicely use this auxiliary component of force. If the patient wears Class I elastics in the mandibular arch only when the activator is in place, the effect of retroclination of the incisors can be somewhat balanced by the proclination, and the net effect is that the posterior teeth can be protracted to finish closing the space. Other forms of proclination can also be used: Jasper jumper or modified Herbst, for example.

Caution should be used about the injudicious use of power chain because it will produce a more constant force, and any lapse in cooperation or reduction of the protracting effect on the incisors will result in an immediate loss in anchorage. The mandibular incisors will tip toward the lingual, and lip support will be lost. The patient shown in Figure 3 demonstrates excellent anchorage control. Overbite and overjet have been maintained while the mandibular molar has been brought forward to close the space.

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Frost[4] observed a direct correlation between the degree of injury to bone in localized areas and the intensity of the physiologic healing response—a condition that he called regional acceleratory phenomenon. This, also known as osteopenia, develops in the immediate aftermath of osseous insult (extraction, fracture, cuts, or other forms of trauma to bone) and provides a time period during which teeth can be moved rapidly. This concept is currently being advanced by Wilcko et al[5] (Wilckodontics) and might explain, to some extent, why the mandibular permanent molar moves forward in the aftermath of the hemisection. Anecdotally, we have observed that spontaneous space closure proceeds more rapidly in the initial stages after the extraction than during the subsequent months. To that extent, having only a 4- to 5-mm site to close in the aftermath of the hemisection, followed by another space to close after the extraction of the mesial half, allows teeth to move more vigorously than when the process gets bogged down during the closure of a 10- to 11-mm extraction site. Moreover, we have begun approaching hemisection patients more aggressively, implementing more of a corticotomy-type approach when removing the mesial half of the deciduous molar,

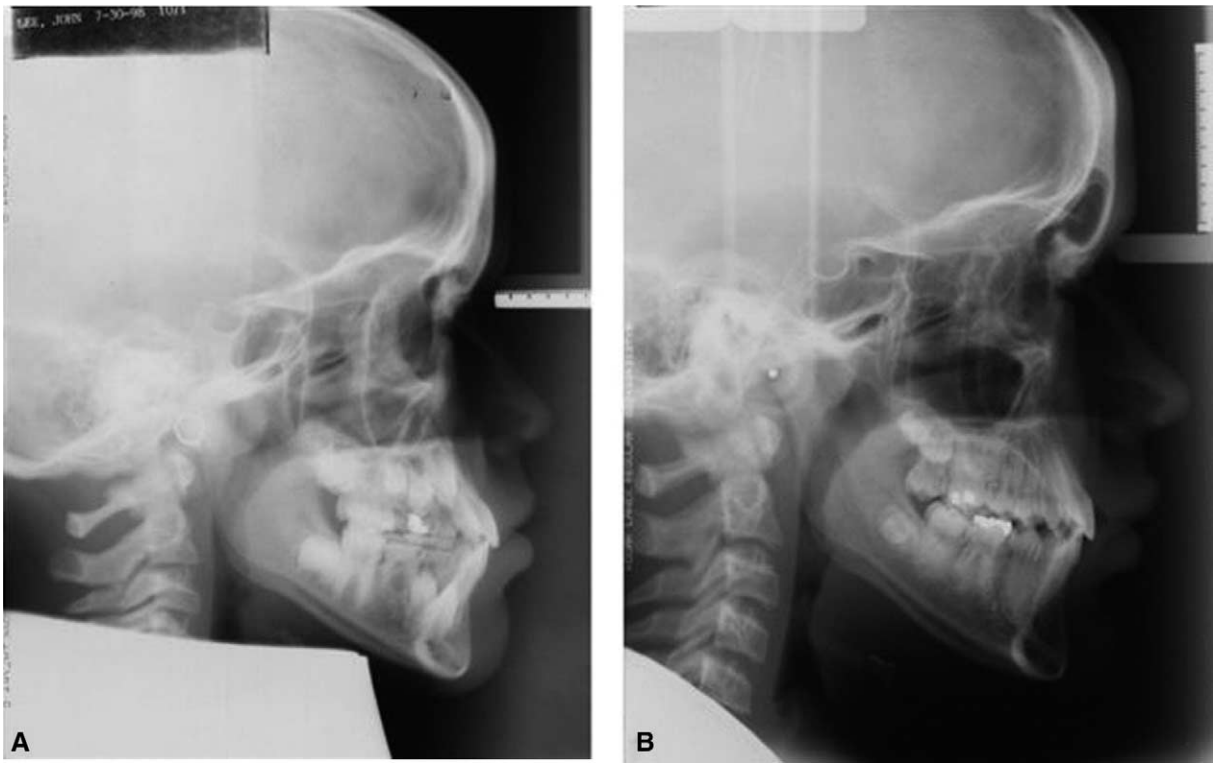

Fig. 3. **A**, Pretreatment lateral cephalogram of patient with bilateral agenesis of mandibular second premolars; **B**, posttreatment view showing space closure and minimal reduction of dental support. Excellent interdigitation and minimal increase of overjet occurred even as removal of maxillary premolars has been obviated.

with the hope of reducing the edentulous site left by congenitally missing mandibular second premolars to normalcy even more rapidly, perhaps in less than 6 months.

It will be interesting to study whether the secondary responses—the subsequent mesial movement of the more distal second and third molars—will continue as favorably as they have with the conventional procedure. We have noted that there is a "drafting" phenomenon that occurs distal to the mesially protracted first molar; the second and third molars move forward, completely closing the spaces distal to the first molar. Perhaps it is simply the effect of interdental fibers, but we look forward to studying the impact of more insult to the alveolus. Specifically, will it modify what has, to this point, appeared to be a beneficial subsequent response?

Sletten et al[6] made a case for keeping the second deciduous molar when the premolar is congenitally missing. They examined 20 subjects who were 20 years old or older and still had healthy mandibular second deciduous molars. Of the 28 teeth that were followed for 12 years, 24 (86%) survived. No numbers are given on how many congenitally missing mandibular second premolars will have deciduous precursors whose roots resorb, how many will ankylose, how many will have arch length discrepancies that will befuddle any chance of appropriate occlusal scheme. Until now, it has been easy to understand the decision to try to maintain the second deciduous molar, especially if there are no indications for orthodontic treatment. But for patients who would benefit from alignment or any other aspect of orthodontic improvement, the ability of the hemisection to reduce the amount of anchorage loss, not to mention the ease of space closure, makes the decision to remove the second deciduous molar and close the space a wise choice, even in patients who do not require significant reduction of crowding or protrusion.

REFERENCES

1. Northway W. Hemisection: one large step toward management of congenitally missing lower second premolars. Angle Orthod 2004;74:790-7.
2. Björk A, Skieller V. Normal and abnormal growth of the mandible. A synthesis of longitudinal cephalometric implant studies over a period of 25 years. Eur J Orthod 1983; 5:1-46.

3. Svendsen H, Malmskov O, Björk A. Prediction of lower third molar impaction from the frontal cephalometric projection. Eur J Orthod 1985; 7:1-16.
4. Frost HA The regional acceleratory phenomena, a review. Henry Ford Hosp Med J 1983;31:3-9.
5. Wilcko WM, Wilcko TM, Bouquot JE, Ferguson DJ. Rapid orthodontics with alveolar reshaping: two case reports of decrowding. Int J Perio Rest Dent 2001;21:9-19.
6. Sletten DW, Smith BM, Southard KA, Casko JS, Southard TS. Retained deciduous mandibular molars in adults: a radiographic study of long-term changes. Am J Orthod Dentofacial Orthop 2003;124:625-30.