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Molar protraction: A challenge

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Abstract
Management of patients with missing mandibular second premolars or extraction of second molars continues to challenge clinicians to find the best treatment options. The Orthodontist must make the proper decision at the appropriate time regarding management of the edentulous space. If space is left for an eventual prosthetic replacement, the clinician should try to create the exact amount of space required and leave the alveolar ridge in an ideal condition for the future restoration. If the space is to be closed orthodontically, detrimental changes to the occlusion and facial profile must be prevented. Therefore, the correct decision must be made at the appropriate time. Which method of molar protraction is best done by anchorage requirement.

Keywords: Molar protraction, challenge, alveolar ridge, orthodontically

Introduction
Many orthodontic patients have posterior spacing due to missing mandibular teeth. Excluding the third molars, the mandibular second premolar is the most common congenitally absent tooth, which is reported to occur in 2.5-5% of the population in the USA and Europe. Such absence ensues bilaterally in 60% of instances. There is an assortment of treatment options if the problem is diagnosed early during the period of mixed dentition. These treatment modalities can be broken down into two main groups based on the decision to keep or extract the primary molars. The Orthodontist must make the proper decision at the appropriate time regarding management of the edentulous space. If space is left for an eventual prosthetic replacement, the clinician should try to create the exact amount of space required and leave the alveolar ridge in an ideal condition for the future restoration. If the space is to be closed orthodontically, molar protraction can be an alternative to restoration with posterior dental implants or fixed partial dentures.

When a mandibular first molar is lost, orthodontic replacement with second and third molars would be an excellent treatment option if success were guaranteed. Stepovich1 presented the possibilities of these methods without severe complications, such as root resorption and tipping of adjacent teeth. At that time, however, the space was closed mostly by reciprocal movement of the anterior and posterior teeth, because no temporary skeletal anchorage devices were available. Roberts *et al*. used endosseous implants placed in the retromolar area to close missing first molar spaces by mesial movement of the mandibular molars. In recent years, orthodontic miniscrews, which are more convenient, simple, and cheaper than endosseous implants, have been used widely. Kyung *et al*. reported a 9-mm mesial movement of mandibular second molars, and Nagaraj *et al*. reported an 8-mm movement using miniscrews to close bilateral missing mandibular first molar spaces. Kravitz and Jolley [6] discussed problems, such as buccal proclination, during mandibular molar protraction with miniscrews.

Treatment is difficult when pure protraction of the second and third molars is required without retraction of the anterior and premolar teeth. In addition, treatment would be more complicated if the patient had an anterior open bite and long edentulous spaces.

Protraction of mandibular molars is challenging because of the high density of mandibular bone. Anterior dental anchorage is often inadequate to protract even a single first molar without reciprocal retraction of the incisors or movement of the dental midline. Furthermore, if the buccal and lingual cortical plates in the edentulous region have collapsed, safe and effective protraction may be impossible.

Intraoral skeletal anchorage (Miniplates, screws) provides absolute anchorage for various tooth

movements without requiring patient cooperation and anchorage preparation and gets predictable treatment results more rapidly. Orthodontic temporary anchorage devices (TADs) can provide skeletal anchorage for mandibular molar protraction, avoiding the problems often encountered with the use of dental anchorage.

Lingual elastic tied to the archwire

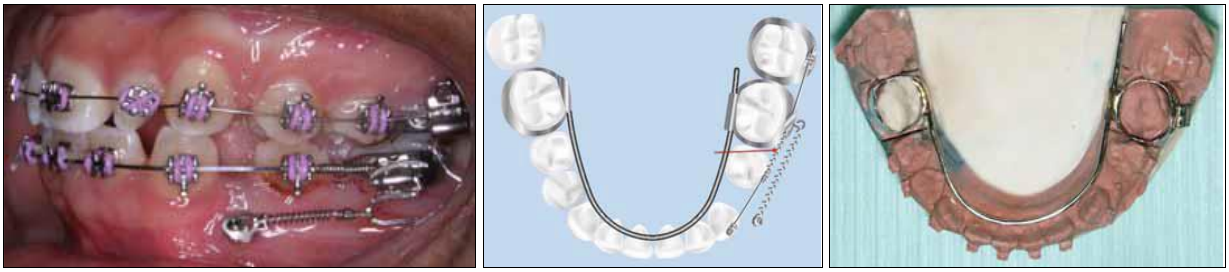
Direct protraction from a miniscrew placed lateral and inferior to the archwire can create posterior crossbite and open bite. To counteract these effects, the following steps should be considered:

1. Protraction with a balancing lingual force, such as an elastic thread tied from the lingual cleat of the molar to the archwire. When tying the lingual elastic to the archwire, the incisors and canines must be ligated to prevent rotation of the anterior teeth.
2. Incorporating the second molar into the archwire to minimize arch expansion.
3. Using a rectangular archwire to prevent the molar from rolling out buccally.
4. Placing an occlusal gable bend (upward V-bend) in the archwire mesial to the edentulous space to counteract molar intrusion. Alternatively, if an auxiliary slot is used, a buccal hook can be fabricated from a wire segment to protract the tooth at its center of resistance.

A. Lingual elastic thread tied to archwire to provide balancing lingual force without sacrificing anterior dental anchorage. First and second molars must be ligated to prevent rotation of anterior teeth.
B. Protraction through atrophic edentulous ridge (moderate Seibert Class I) with lingual elastic thread tied to archwire, producing complete space closure in eight months without loss of pulp vitality.

Sliding band on lingual arch for a lone molar

A balancing lingual force is particularly important when protracting the terminal tooth in the arch, because this molar can quickly swing into crossbite. A lingual arch with a sliding band may provide greater support than lingual elastic thread. The lingual arch consists of an .040" wire soldered to the molar band on the side opposite the lone molar. A sliding band with a headgear tube soldered to its lingual surface is cemented to the lone molar at the same appointment. The lingual arch extends through this tube, acting as a guide rail during protraction. After protraction is complete, the clinician can cut the lingual arch from the soldered band.



A. "Push-pull" technique. Miniscrew is placed in edentulous space (Mild Seibert Class I) and used to pull first molar. Open-coil spring pushes second premolar mesially. Buccal hook for molar band is fabricated at chairside.
B. "Push-pull" technique using sliding band.

Sliding band and bar on Single molar

Each molar band has .036" buccal and lingual tubes, 4-5mm wide. An .032" stainless steel wire is inserted in the tubes on each side and soldered anteriorly to the second-premolar band. Hooks are soldered close to the CR of the molar and premolar for application of elastomeric chain. The premolar band has a slot soldered buccally to engage an .021" × .025" rigid wire for indirect anchorage from a mini-implant between the lower premolars.

The appliance is cemented in place, and a rigid stainless steel power arm is bent from the buccal mini-implant, engaged in the premolar tube, and cinched. The stainless steel segment is splinted over the mini-implant using flow able composite. After stabilization of the appliance, 75g of force is applied on each side with elastomeric chain. The appliance is reactivated every six to eight weeks. The buccal and lingual .032" stainless steel wires increase the rigidity of the appliance and thus prevent arch wire deflection during sliding. Simultaneous buccal and lingual force application helps reduce 1st-order frictional resistance. Because the power arm extends close to the CR of the molar, the point of force application is near the CR, which minimizes mesial tipping of the molar.

Fig a, b, c d.

The "Push-Pull" Technique

Conventionally, a miniscrew is placed mesial to the edentulous space to avoid impeding the molar protraction. As an alternative, the clinician may insert the TAD within the edentulous space and protract from the second tooth back, using an open-coil spring to push the tooth in front of it. The open-coil spring tips the crown enough to provide complete space closure.

The "push-pull" technique has the following advantages over other protraction methods:

- Simplifies miniscrew insertion.
- Minimizes the risk of root perforation.
- Obviates surgical stent fabrication and periapical radiography.
- Ensures adequate bone stock.
- Prevents the auxiliary from crossing the canine eminence.
- Applies two active forces (a nickel titanium coil spring and the open-coil spring) for efficient multitooth protraction.

Regardless of the protraction technique, the best site for miniscrew insertion may be distal to the mandibular canine. A TAD placed mesial to the canine can irritate the lip or cause the nickel titanium coil spring to overextend and rub against the canine eminence.

Many orthodontic patients have posterior spacing due to missing mandibular teeth. Excluding the third molars, the mandibular second premolar is the most common congenitally absent tooth. The mandibular first molar is the most frequently lost tooth in adults. Molar protraction can be an alternative to restoration with posterior dental implants or fixed partial dentures. Avoiding anchorage loss is considerably more challenging in the mandible than in the maxilla, in part because of the structural differences between the two jaws.

The posterior maxilla is composed of uniformly thin cortices interconnected by a network of spacious trabeculae, while the posterior mandible consists of thicker cortical bone with dense, radially oriented trabeculae. In the molar region, the maxilla has an average buccal cortical thickness of 1.5mm, compared with 2mm in the mandible [4, 5]. The rate of molar protraction is inversely related to the radiographic density or cortical thickness of the resisting alveolar bone. Because of the increased thickness of mandibular cortical bone, the rate of mandibular molar translation with skeletal anchorage is nearly half that of maxillary molar translation-approximately .34-.60mm per month.

Potential risks of molar protraction through an atrophic ridge include loss of attachment (particularly in the presence of plaque), dehiscence, mobility, ankylosis, root resorption, devitalization, and tooth morbidity. Although successful molar protraction through atrophic ridges has been reported, no clinical study to date has evaluated the correlation between an atrophic ridge and periodontal response during bodily tooth movement.

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