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MIRACLES WITH EXTRACTION SPACES: MESIALISATION REVIEW

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ABSTRACT
Management of patients with missing teeth keeps on challenging clinicians to find the best treatment options. The Orthodontist must make the proper decision at the suitable time with respect to management of the edentulous space. If space is left for an eventual prosthetic substitution, the clinician should attempt 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 forestalled. Therefore, the right choice must be made at the appropriate time. This article reviews the literature on orthodontic treatment involving extraction space closure by mesialization and highlights many of the clinical contemplations when treating such cases.

KEYWORDS
Mesialisation, V-bend, Lingual elastic, Push-Pull technique

INTRODUCTION
Oral health is one of the most vital facets of public health. Certain frequent dental anomalies require immediate attention as these conditions negatively affect both the aesthetics and function. These conditions include but are not limited to congenital absence of teeth, impacted teeth, extracted teeth due to decay or trauma. Aesthetics is an essential and fundamental aspect of oral well-being. Aesthetic problems may affect patients' self-esteem, confidence, professional dealing and quality of life. Aesthetics has become as significant as function, structure, and biology.
Edentulous space caused by a missing tooth in the arch is a common problem that clinicians see among oral patients. Patients with missing permanent teeth may suffer from complications such as periodontal damage, lack/absence of alveolar bone growth, diminished chewing ability, inappropriate pronunciation, changes in skeletal relationships, and an unfavourable appearance; vast majority of these anomalies need rather costly and challenging multidisciplinary treatments.
It is frequent in orthodontic practice to deal with either adult patients who present with the early loss of permanent molars and require some sort of orthodontic treatment, or the patients with agenesis of lateral incisor or impactions. In some of these cases, the orthodontic repositioning of neighbour teeth in the edentulous area has been proven to be an amazing treatment alternative. Space closure represents a challenge for orthodontists on account of the all-inclusive treatment time, the discomfort created for the patient, tissue tolerance and stability. Moving teeth without any inclination is the objective, which makes vertical control a major concern.
In earlier days, distalization was mainly used for space closure (some of them were heavily dependent upon patient compliance such as extraoral traction, removable appliances with finger springs, Wilson arches, and sliding jigs with Class II intermaxillary elastics); but now the trend has been continuously evolving. Regardless of different distalization treatment modalities, numerous mesialization methods have been illustrated. Orthodontic space closure with the movement of teeth towards the midline can be performed in patients with missing maxillary incisors or with lateral incisor agenesis. The key issue is to provide the patients with a satisfactory aesthetic and functional outcome.
The aim of this comprehensive review is to discuss various treatment modalities available for orthodontic space closure by mesialization technique.

When first molars are extracted?
• Extensively carious first molars.
• Hypoplastic first molars.
• Heavily filled first molars where premolars are perfectly healthy.
• Apical pathoses or root treated first molars
• Crowding at the distal part of the arches and wisdom teeth reasonably positioned
• High maxillary/mandibular planes angle
• Anterior open bite cases

Whether first molars are extracted is dependent on many factors, including the patient's attitude to fixed appliance therapy, the standard of oral hygiene, the amount and site of crowding, and the presence or absence of other permanent teeth. The patient's suitability for this invariably lengthy course of fixed appliance therapy must be considered to ensure that the benefits of treatment far outweigh the potential risks.

Types of molar protraction and appliances:

- V-bend principle for molar protraction.
- Lingual elastic tied to the archwire.
- Sliding band on lingual arch for a lone molar.
- Sliding band and bar on Single molar.
- The "Push-Pull" Technique.

V-bend principle for molar protraction:

V-bend principle is uncomplicated method of protracting the second molar into first molar extraction spaces and it involves wire bending and reforming. V bend has to be incorporated in rectangular stainless-steel wire and it is done when patients reach rectangular stainless-steel wire. Radiusing (roundening of the posterior part of wire) to facilitate the sliding of molar to be done in rectangular stainless-steel wire. Since the wire bending is within the arch form, it did not affect the soft tissue. This "V"- bend technique is advisable for mandibular molar protraction as it is non-invasive and consumes less chairside time and painless. E-chains are given from molar to canine to protract molar into extraction spaces and V-bend is incorporated in extraction space area and care should be taken not to distalize the anterior teeth. With the development of numerous innovative techniques in orthodontics, this technique to protract the mandibular molar is unique and makes the patient more comfortable during orthodontic treatment and it is non-invasive.

Lingual elastic tied to the arch wire:

Direct protraction from a miniscrew placed lateral and inferior to the arch wire 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 arch wire. When tying the lingual elastic to the arch wire, the incisors and canines must be ligated to prevent rotation of the anterior teeth.
2. Incorporating the second molar into the arch wire to minimize arch expansion.
3. Using a rectangular arch wire to prevent the molar from rolling out buccally.
4. Placing an occlusal gable bend (upward V-bend) in the arch wire 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.

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.

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.

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.

It is interesting to note that various techniques have evolved since past, with its own advantages and disadvantages but the best technique to protract molars at present scenario is to use temporary anchorage devices since it does not cause unwanted tooth movement and molars can be moved bodily rather than tipping it. In all the methods discussed above, there are chances of tipping and distalisation of anterior teeth where only molar protraction is indicated, hence temporary anchorage devices serve as a fruitful device in molar protraction.

Discussion:

Previously, Graber stated that clinicians can seldom close molar spaces with limited orthodontic therapy. The large root surfaces of molars make their movement uncertain and simultaneously cause unwanted tooth movements such as lingual tipping of the incisors. However, now with skeletal anchorage, it is possible to solve anchorage problems that could not be addressed previously.

Protraction of molars often requires a considerable amount of Root movement because an untreated missing molar usually causes tipping of the adjacent molars. Thus, the use of proper mechanics and stable anchorage is mandatory for successful protraction of the molars.

As second molar protraction is time-consuming and relatively difficult, this treatment option may be rationalized only when the periodontal health of the protracted second molar is not compromised. Mesial tipping movement has been reported to lead to alveolar bone resorption in the cervical area. Second molars were protracted by bodily movement by using long lever arms and TADs placed mesial to the missing tooth space. Dental implants are strong enough for effecting mesial movement of the mandibular molars without causing lingual tipping of the incisors.

Conclusion:

Mandibular molar protraction can be considered as an alternative treatment to conventional prosthetic treatment for the edentulous area, especially in young adults.

Among all the methods used for space closure / mesialization of mandibular second and third molar, the best one is by using TADS as it will lead to minimum anchor loss with bodily movement of the molars.

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