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ORTHODONTIC MANAGEMENT OF MISSING MOLARS

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ABSTRACT:
Numerous studies have shown that masticatory performance deteriorates as the number of posterior teeth and occlusal surface area decrease. Congenitally missing teeth (CMT), or usually called as hypodontia, is a highly prevalent dental anomaly. Missing molars can also be because of endodontic or periodontal problems. This article reviews the various causes of missing molars and their various treatment options.

Key words: missing molars, space closure, auto transplantation, prosthetic rehabilitation

1. INTRODUCTION:

The reported prevalence rate of maxillary first molar agenesis was 2.9% of the total number of missing teeth in a general population and has been reported to vary from 0.4%2 to 4%[1] in orthodontic patients. According to Butler field theory, the distal most teeth in each field are commonly found to be defective or missing.

Molar absence is generally accompanied with other complicated dental and skeletal problems, which affect treatment planning and outcomes. Loss of permanent molars without any remedy could disturb the developing dentition, generate numerous malocclusions, and affect dental health. It typically leads to occlusal disturbances by pathological migration of neighboring teeth and periodontal lesions as alveolar melting. Masticatory efficiency is also greatly reduced. Often, inter- disciplinary approach is required to obtain good results.

2. ETIOLOGY:

Hypodontia can be because of local/ systemic factors or genetic factors. Multiple genes have been identified as the causative factor for congenitally missing teeth including genes- MSX1, PAX9, WNT10A, AXIN2 and EDA[2]. It has multifactorial etiology. Other than that, molars can also be extracted due to caries or periodontal problems. The early eruption age and complex occlusal anatomay makes the first permanent molars vulnerable to caries. Molar agenesis may be an isolated anomaly or associated with particular syndromes. It is an uncommon clinical condition not well documented in the literature.

3. CLINICAL FEATURES:

Molar extraction results in 10 to 12mm of space which can lead to occlusal and periodontal disturbances. Once a molar is extracted, the teeth distal to it tip mesially and the tooth that opposed the extracted tooth begins to supra-erupt. When this happens, the space available for us to replace is greatly reduced. Apart from these clinical features, radiological changes are observed in the alveolar bone. A reduction in width of the alveolar bone upto almost 50% can be observed. Sinus pneumatization can also be observed following extraction of maxillary molars.

4. TREATMENT OPTIONS:

When considering treatment options for missing molars, the subsequent change in vertical dimension should also be kept in mind.the various treatment options include: implant insertion, autotransplantation, and prosthetic restoration and space closure. Prosthetic bridges offer the advantage of short treatment time but must be accompanied by significant tooth preparation. Dental implants permit conservation of tooth structure but require surgery. Autotransplantation also requires surgery, and successful transplantation cannot be guaranteed. Thilander has shown that both closure and space opening alternatives have their advantages as well as disadvantages, but the evidence base is weak, with currently no randomized trials reporting on the outcome of different interventions.
The amount of crowding, type of malocclusion, facial profile, age of the patient, periodontal conditions, bone volume in alveolar process, vertical or horizontal growth pattern, the number of missing teeth, and the available space should be considered in treatment plan.

Space closure:

The main whole treatment can be finished immediately after completion of orthodontics which is the main advantage with this procedure. This procedure is preferred because of its better long term outcome without other side effects like infraocclusion, blue coloring of the gingiva, or periodontal problems as seen when implant is placed. Reduced financial burden on the patient is one other advantage with this procedure. This procedure is preferred in crowded cases as the space from the missing molar can be utilized to resolve crowding.

Space closure is not indicated in all cases. Like in hypodivergent patients, because of the muscular and cortical anchoring, making it difficult to close extraction space. The aim is to maintain the occlusal relationships and arch symmetry. A compensating extraction is the removal of a permanent molar from the opposing quadrant, while a balancing extraction signifies the extraction of a permanent molar from the opposite side of the same dental arch. Other factors like developmental status of the dentition, the third molars, prognosis of the remaining molars, underlying malocclusion play a role in deciding treatment plan.The age also plays an important role in deciding the treatment plan.

This is a cost-effective alternative to complex restorations which may require replacement over a period of time. Even after cessation of statural growth, vertical growth of the face continues which permits continued teeth eruption late into puberty and could adversely affect the alignment of teeth after orthodontic therapy.
Facial growth in the horizontal plane ends earlier than growth in the vertical plane predominantly in patients with vertical growth patterns. Accordingly, if an implant is placed before growth and eruption completion, it will become in infraocclusion, as it behaves like ankylosed teeth while the adjacent teeth continue to erupt. The magnitude of the vertical changes after age 20 seems to have little clinical importance.

On the other hand, in adults undergoing comprehensive orthodontic therapy, coexisting dental and periodontal problems require multidisciplinary treatment approaches to manage malocclusions often complicated by the migration of adjacent teeth into the extraction sites. Periodontal defects, multiple missing teeth, and atrophic extraction sites make it difficult to close all the extraction spaces, which require remodeling of cortical bone. Also, adults show less bone apposition when moving molars into the

narrowed space, poor maintenance of the closed space, and, in some cases, resorption of the second molar roots when moved in place of first molar. Duration of treatment has to be considered and adapted to patient needs. For these reasons, the placement of an implant may be the treatment of choice for adults with missing molars.

For missing molars, studies have reported that posterior spaces have been closed by protracting posterior teeth, which prevent detrimental effects without reopening of the edentulous spaces or increased pocket depth in the follow-up period. Before any prosthetic rehabilitation succeeding space redevelopment, the practitioner has to upright and to parallelize the adjacent teeth in order to gain sufficient space, even apically at the root level.[2]

Edentulous spacing have been missing teeth for years and therefore exhibit alveolar ridge resorption. The rate of resorption is greatest during the first several months to two years after extraction, but decreases thereafter.The amount of post-extraction resorption is significantly greater on the buccal than on the lingual side in both arches. During the first year after tooth extraction, the amount of resorption in the mandible is twice that in the maxilla—a ratio that increases to 4:1 after seven years.
The simplest way to diagnose edentulous ridge resorption is with the Seibert classification. Seibert Class I is defined as buccolingual loss of hard- and soft-tissue contour with normal apicocoronal height. Seibert Class II is an apicocoronal loss of hard- and soft-tissue contour with normal buccolingual width. Seibert Class III is a combination of Class I and II, with both buccolingual and apicocoronal loss of hard and soft tissue. Allen and colleagues modified and expanded on Seibert's original classification. Allen Type A is an apicocoronal loss of ridge height. Type B is a buccolingual loss of ridge width. Type C is a combination of buccolingual and apicocoronal loss. The ridge is further assessed in terms of the amount of tissue loss: mild, less than 3mm; moderate, 3-6mm; and severe, more than 6mm. Therefore, an edentulous site with a 3-6mm loss of hard and soft tissue in the buccolingual direction may be classified as a moderate Seibert Class I or Allen Type B defect.

Protracting the molars may be advantageous for the patient by increasing alveolar ridge width that had previously been lost in the edentulous space. It should ideally be done before significant vertical bone resorption occurs. 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.

Regardless of the chosen option, the fate of wisdom teeth must be assessed. The final success of the treatment depends on its satisfactory positioning. So, it is important to evaluate angulation, eruption space, root developmental stage, and periodontal status of this tooth before deciding to close molar space. Actually, space reopening is indicated when the wisdom tooth is absent.

Stepovich[3] 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. 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. 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 Orthodontic temporary

anchorage devices (TADs) can provide skeletal anchorage for mandibular molar protraction, avoiding the problems often encountered with the use of dental anchorage.
Avoiding anchorage loss is comparatively more difficult in the mandible than in the maxilla 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,[3] 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] The rate of molar protraction is inversely related to the radiographic density or cortical thickness of the resisting alveolar bone.6 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.[5] Also, the failure rate of TADs is more in the mandible than in the maxilla. The primary biological factors that determine miniscrew stability are bone density (or bone quality), peri-implant soft-tissue health, adequacy of peri-implant bone stock, and operator technique. The greater failure rate of mandibular miniscrews, despite the thicker mandibular cortical bone, is probably due to root proximity (or inadequate peri-implant bone stock) and greater buccal tissue mobility

Roberts et al[9] recommended placing an implant in the retromolar area and using it as an absolute anchorage for closing the space of a missing mandibular first molar. Their study showed that dental implants are strong enough for effective mesialization of the mandibular molars without causing lingual tipping of the incisors.

Recently, the usage of titanium screws has gained wider acceptability; they have several advantages over dental implants, such as simpler placement, lower costs, minimal surgical trauma, and immediate loading. In addition, their small size allows them to be placed in most anatomic locations so that force can be applied in any direction.

Kyung et al [10] reported a 9-mm mesial movement of mandibular second molars and Nagaraj et al[11]reported an 8-mm movement using miniscrews to close bilateral missing mandibular first molar spaces. Kravitz [12]and Jolley discussed problems, such as buccal proclination, during mandibular molar protraction with miniscrews. Sugawara et al [13]reported maxillary molar extrusion occurred simultaneously with mandibular molar intrusion. This problem could complicate tooth movement. It could take more time for orthodontic movement, and the narrow ridge could cause root dehiscence, resorption, or other periodontal problems. The right time to extract is just before mesial traction. Before which leveling and alignment should be done.

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 (Fig. 2). 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 balancing lingual force is particularly important when protracting the terminal tooth in the arch, because this molar can quickly swing into cross bite. A lingual arch with a sliding band may provide greater support than lingual elastic thread.

The lingual arch consists of a .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.

The "Push-Pull" Technique: [13]

A technique was proposed to protract molars using miniscrews. In this technique, a TAD is inserted within the edentulous space and protraction is done from the second tooth back, using an open-coil spring to push the tooth in front of it. The open-coil spring works by tipping the crown enough to provide complete space closure.

The advantages of this technique over other protraction methods include:

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

Ideally, a miniscrew is placed distal to the mandibular canine in order to avoid irritation of the lip. If its placed mesial to canine, it can also cause the nickel titanium coil spring to overextend and rub against the canine eminence.

Studies[3] about the effect of space closure on edentulous mandibular ridge was carried out in the area of first molar. It was concluded that space closure was possible for 10mm or more but the chances of relapse is high. For which, bonded buccal retainers from molar to premolar was recommended.

A fixed prosthesis has always been the preferred option for patients with moderate bone loss. However, prostheses have certain limitations: initial cost, partial destruction of abutment teeth, secondary caries, and mechanical failures.

5. CONCLUSION:

The decision has to be made after considering various factors like pre existing malocclusions, status of the third molar, absence of other teeth, and patient compliance. An orthodontic treatment, planned meticulously considering patients expectations and reasoned biomechanic principles will help in achieving good results.

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