

# MANAGEMENT OF MISSING MAXILLARY LATERAL INCISORS

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**M**issing maxillary lateral incisors present challenging treatment planning and mechanotherapy problems for orthodontists, prosthodontists and general practitioners. Two treatment approaches commonly taken are creating adequate space to replace the missing lateral incisors or closing spaces and reshaping canines to simulate the presence of lateral incisors.<sup>1-11</sup>

In this article, I describe the management of malocclusions resulting from missing maxillary lateral incisors. I also discuss the indications, advantages and disadvantages of the two most common treatment approaches, as well as treatment protocols and problems encountered.

## ORTHODONTIC SPACE OPENING

When maxillary lateral incisors are missing, orthodontic space opening for future restorations is indicated when enough room is available in the maxillary arch. Patients with accentuated dentoalveolar protrusions and soft-tissue convexity

## ABSTRACT

**Background.** Missing maxillary lateral incisors create an esthetic problem with specific orthodontic and prosthetic considerations. The purpose of this article is to describe treatment protocols and problems encountered in the management of this disorder.

**Case Description.** The two common treatment options are orthodontic space opening for future restorations or orthodontic space closure using canines to replace the missing maxillary lateral incisors. The required amount of space opening and the various prosthetic options are discussed. The methods for reshaping canines in orthodontic space closure and building them up to simulate lateral incisors also are described. The indications, advantages and disadvantages of both treatment modalities are outlined to help clinicians make decisions in borderline situations.

**Clinical Implications.** Teamwork between the orthodontist, general practitioner and restorative dentist is important when analyzing factors related to individual patients and establishing overall treatment plans. This also will allow treatment modalities and the various options for replacing missing maxillary lateral incisors in space opening to be discussed between team members and the patient.

are not good candidates for such procedures.<sup>3</sup> However, if upright maxillary incisors need to be protruded, or tipped labially, to help correct anterior crossbites or to gain upper lip support—such as in patients with a cleft lip or palate—orthodontic space opening for one or both missing lateral incisors is indicated even if minimal or no space is available in the maxillary arch (Figure 1).

When orthodontic space opening is indicated, orthodontic treatment will maintain or establish a normal buccal occlusion (Angle Class I), redistribute the available space, close the midline diastema, and retract and upright maxillary canines until adequate lateral incisor spaces are created for future prosthetic replacement (Figure 2). Teeth adjacent to the missing lateral incisor space should have parallel roots, especially if implants are considered.

**Amount of space needed for orthodontic space opening.** The required amount of space needed for replacing missing lateral incisors is de-



**Figure 1. A.** This pretreatment photograph shows a patient with a cleft lip and palate, as well as a missing maxillary left lateral incisor and complete space closure.



**Figure 1. B.** This posttreatment photograph taken after an orthodontic space opening was created shows that the missing maxillary lateral incisor was replaced by a single-tooth implant.

terminated by two factors. The first is the esthetics of mesiodistal width between the anterior teeth. The width relationship between lateral and central incisors should follow the golden proportion: one lateral incisor is equal to two-thirds of a central incisor.<sup>12</sup>

Occlusion is the second factor that affects the amount of space that needs to be created. Achieving good buccal intercuspation with a normal canine relationship, coinciding midlines, and optimal overbite and overjet relationship should provide adequate space for a prosthetic lateral incisor that is esthetically pleasing.<sup>13</sup>

When implants are part of the treatment plan, their size dictates the amount of space that needs to be opened. The standard Brånemark implant, which was designed to support dentures and bridges and was not intended to be used as a single-tooth replacement, is 3.75 millimeters in diameter.<sup>14</sup> The minimum interdental space needed for a 3.75-mm implant that provides optimal gingival health and sufficient bony support is about 6 mm. When the available space is less than 6

mm, placement of such an implant not only is hazardous and not healthy periodontally but sometimes is impossible.<sup>15</sup>

To overcome esthetic and narrow interdental space problems, esthetically oriented prosthetic components are available that either can be screwed on directly to the fixture or on an abutment, or can be cemented on an abutment that has been prepared as a tooth that is to be crowned. These components include smaller-sized fixtures of 2.9-, 3.0- and 3.3-mm width. When the space is adequate and the corresponding implant size is determined, bone thickness should be evaluated. An alveolar bone augmentation procedure—such as an onlay bone graft—at the implant site may be needed in cases in which the alveolar crest is thin, making implant placement a two-step surgical procedure.

**Advantages and disadvantages of orthodontic space opening.** Creating an orthodontic space opening for missing maxillary lateral incisors is reported to be advantageous both functionally and occlusally, as it favors an ideal intercuspation of canines

through first molars.<sup>3,16</sup> In addition, minimal equilibration and reshaping are required on sound teeth.

The major disadvantage of orthodontic space opening is that it commits the patient to a permanent prosthesis in an area of the mouth in which tooth shade, gingival contour and margins are critical and not always easy to control.<sup>2</sup>

**Prosthetic options with orthodontic space opening.** The four prosthodontic options currently available for replacing missing teeth are traditional fixed partial dentures, resin-bonded fixed partial dentures, removable partial dentures and osseointegrated implants.

Primarily described in the literature and used in the early 1900s, traditional pinledge bridges combined with modern porcelain are still one of the most conservative and attractive solutions for restoring teeth or serving as abutments for bridges. This is especially so when they are compared with conventional ceramometal bridgework, which involves substantial destruction of esthetics and sound tooth structure.

With the introduction of com-



**Figure 2. A.** This pretreatment photograph shows a missing maxillary right lateral incisor, peg-shaped left lateral incisor and persistence of the primary left lateral incisor and the primary right canine.



**Figure 2. B.** This posttreatment photograph shows adequate orthodontic space distribution. A pinledge bridge replaced the missing maxillary right lateral incisor and a composite buildup was done on the peg-shaped left lateral incisor.

posite cements, bonding procedures, such as those used with the Maryland bridge, became popular in the early 1980s. Follow-up studies, however, showed that bonded bridges were subject to cementation failure, which prompted preparation modifications to improve their stability.<sup>17-21</sup> One of the limitations of bonded prostheses was the graying effect sometimes caused by the metal wings on thin, transparent, light-shaded abutment teeth. This problem was overcome recently with the introduction of the all-ceramic bridges.

As for removable partial dentures, besides being used as temporary prostheses, they are very seldom accepted as an alternative to replacing teeth or fixed partial dentures because of their bulkiness and movement and for sociological reasons. Nowadays, osseointegrated implants are the most biologically conservative and most commonly used option for replacing missing lateral incisors.

#### **ORTHODONTIC SPACE CLOSURE**

Closing spaces and replacing

missing maxillary lateral incisors by using the canines is indicated in full-lip profiles when anterior teeth are severely protruded, or tipped labially. In such cases, opening spaces for the missing lateral incisors will make anterior teeth protrude even more, thus worsening the patient's profile and compromising the long-term stability of the end result. If the patient has a balanced profile with normally inclined anterior teeth and minimal or no space available in the maxillary arch, orthodontic space closure is indicated. Whenever teeth in the mandibular arch need to be extracted for orthodontic reasons—such as severe crowding or protrusion—orthodontic space closure by using canines to replace missing lateral incisors is indicated in the maxillary arch.

Treatment planning for maxillary lateral incisor orthodontic space closure should include a trial diagnostic setup, which consists of cutting teeth on the plaster model without altering their mesiodistal width and then repositioning them with sticky wax in the desired posi-

tion. This trial diagnostic setup helps identify any tooth-mass problems and the amount of tooth reshaping and interproximal reduction needed for a functional and esthetic result.<sup>2,10</sup>

**Canine lateralization procedure.** For optimal esthetic and functional results in orthodontic space closure, canines need to be transformed to better resemble and function as lateral incisors.<sup>2,22</sup>

To produce a flat incisal edge, there are three possibilities, all of which depend on the gingival level and the overall shape of the canine: flatten the tip of the canine by trimming it, create composite buildups at the mesial and distal angles, or use a combination of both the first and second options.<sup>2,22-24</sup> If the gingival level of the canine initially is apical, it will have to be extruded orthodontically, and extensive cusp-tip trimming will be necessary.<sup>25</sup> The amount of extrusion and occlusal trimming is limited by the inclination of the canine's palatal aspect.

When it occupies the lateral incisor position, the canine's greater labiolingual dimension will interfere with the lower in-

cisors. Therefore, composite buildups, rather than extensive occlusal and palatal trimming, will have to be done, leaving a more apical gingival level on the future lateral incisors in some cases.<sup>13</sup> While this is acceptable if the patient's smile line is low, it can be esthetically unpleasant in gingival smiles.<sup>3</sup>

Reducing canine width through proximal grinding also should be performed. The central incisors' size and the diagnostic setup will dictate the amount of proximal reduction needed. On average, canines are 1.2 mm wider than the lateral incisors they are replacing.<sup>2,26</sup> Therefore, canine proximal reduction generally is not extensive and should be accomplished at the expense of the more bell-shaped distal surface.<sup>27</sup> On the other hand, smaller maxillary first premolars partially offset the width difference between the canines and the lateral incisors they are replacing.<sup>2</sup> Canine proximal reduction can usually be accomplished in a single visit, preferably at the beginning of orthodontic treatment. If canines are in contact with neighboring teeth, canine proximal grinding can be done later through treatment when access to proximal surfaces is easier.<sup>23</sup>

Canine palatal enamel is reduced throughout orthodontic treatment whenever prematurities with the lower incisors are detected. Flattening the canine labial surface is deferred until orthodontic treatment is completed. This allows for better bond strength of the orthodontic bracket during treatment.<sup>10</sup> Canine labial surfaces should be reduced with care, as the procedure can result in a yellower or grayer tooth.<sup>4</sup>

Clinical and histologic human studies have shown that fairly extensive dental grinding can be performed without significant discomfort and with minor or no pulp and dentin reactions.<sup>23</sup> Long-term observations indicate that any unfavorable reactions are temporary.<sup>24</sup> Gentle grinding techniques using diamond burs and abundant cooling water are recommended, followed by paper

***The major advantage of orthodontic space closure is the permanence of the finished result.***

disk and pumice polishing and topical fluoride applications.<sup>23,24</sup>

**Positioning canines and premolars in orthodontic space closure.** When replacing missing lateral incisors by using the canines, mesial rotation of the maxillary first premolars should be done for esthetic reasons. This will favor a better contact point and camouflage the premolars' flat mesial surfaces.<sup>3,25</sup> First premolars should be extruded relative to the adjacent teeth to simulate canines. Grinding of the palatal cusps also is recommended to avoid interferences during lateral movements.<sup>28</sup>

**Advantages and disadvantages of orthodontic space closure.** The major advantage of orthodontic space closure is the permanence of the finished result. The need for removable retainers until the prosthesis is completed and patient dependence on a permanent restoration is avoided.<sup>2,4</sup> At the end of orthodontic treatment, the overall treatment is completed and the result is permanent.

The tendency of the space between the anterior teeth to re-open is the major disadvantage of space closure.<sup>29</sup> This can be overcome with long-term fixed retention using a palatally bonded multistrand wire on the central incisors and canines when occlusion permits.<sup>10,29</sup>

Canine-protected occlusion is not feasible with orthodontic space closure. As a result, the forces generated through canine guidance are placed on the smaller and thinner roots of the first premolar.<sup>15</sup> Some investigators fear loss of periodontal attachment due to the stress placed on the premolars.<sup>27</sup> Long-term periodontal and occlusal studies, however, have shown that space closure is equally sound occlusally and is preferable periodontally to orthodontic space opening.<sup>27</sup>

Orthodontic space closure in unilateral lateral incisor agenesis can pose a matching size or shape problem. The canine replacing the missing lateral incisor will not be in harmony with the existing lateral incisor. Extraction of the existing lateral incisor has been advised for symmetry, especially when it is peg-shaped.<sup>10</sup>

In a few cases, poorly formed or extremely large canines cannot be adequately shaped into lateral incisors. Dark-shaded canines also will be esthetically unpleasant when positioned proximally to central incisors.<sup>11</sup> Reshaping procedures, bleaching, composite buildups, veneers or all-ceramic crowns should be able to compensate in these particular situations.<sup>10</sup>

The importance of the canine prominence also has been investigated. Some authors claim that orthodontic space closure has the disadvantage of ad-



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versely affecting facial and dentoalveolar esthetics, as the canine and its prominence are moved mesially.<sup>30</sup>

**CONCLUSION**

Missing maxillary lateral incisors with any co-existing malocclusion must be managed within an overall treatment plan. Factors relating to the patient; the size, shape, position and color of the teeth; the effect on occlusion; and overall facial and dental esthetics should be considered when deciding on whether to create an orthodontic space opening or space closure. Advantages and disadvantages of both treatment modalities and the various options for prosthetic replacements in an orthodontic space opening should be discussed with the patient.

In the past, creating an orthodontic space closure by replacing missing lateral incisors using the canines was a more common procedure when the main space-opening prosthetic solution was the conventional bridge. The advent of conservative prosthetic alternatives and the nonextraction trend in orthodontics have made orthodontic space opening along with replacing the missing lateral

incisors a more popular treatment option. ■

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