

Congenitally Missing Maxillary Lateral Incisors and Orthodontic Treatment Considerations for the Single-Tooth Implant

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A b s t r a c t

Implant restorations have become a primary treatment option for the replacement of congenitally missing lateral incisors. The central incisor and canine often erupt in less than optimal positions adjacent to the edentulous lateral incisor space, and therefore preprosthetic orthodontic treatment is frequently required. Derotation of the central incisor and canine, space closure and correction of root proximities may be required to create appropriate space in which to place the implant and achieve an esthetic restoration. This paper discusses aspects of preprosthetic orthodontic diagnosis and treatment that need to be considered with implant restorations.

MeSH Key Words: anodontia/therapy; dental implants; orthodontics, corrective

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The successful use of dental implants to replace missing teeth has been one of the most “exciting and evolving areas of clinical dentistry” this decade.¹ At a time when esthetic dentistry has gained prominence, permanent prosthodontic solutions such as implants have become optimal esthetic treatment options.^{1,2} While implants have expanded restorative treatment options, treatment planning has become more complex for the dental practitioner, and an interdisciplinary team approach is recommended.²⁻⁴ This interdisciplinary approach may involve preprosthetic orthodontic treatment following consultations with an oral surgeon or periodontist and restorative dentist to ensure orthodontic alignment will facilitate the surgical, implant and restorative treatment.² Aspects of orthodontic treatment required for implant restoration of congenitally missing lateral incisors are discussed.

Orthodontic Treatment Planning

Treatment alternatives for restoring edentulous spaces resulting from congenitally missing laterals include removable partial dentures, conventional fixed bridges, resin-bonded bridges, autotransplantation, orthodontic repositioning of canines to close the edentulous space, and single-tooth implant.⁵ Although adjacent teeth may have to be repositioned orthodontically to create adequate space for an implant,

implants do not necessitate “altering” or “removing” parts of the natural dentition and are therefore the most conservative of the prosthodontic options for replacing missing lateral incisors.⁵⁻⁷ Implants can also maintain the alveolar ridge, enhance occlusal function and provide optimal esthetics.^{5,8}

When there is a family history of congenitally missing teeth, asymmetric loss of primary teeth, over-retention of deciduous lateral incisors and canines, lack of developmental canine bulge, or impacted maxillary canines, the possibility of missing lateral incisors should be immediately investigated.⁸ Early investigation is especially important due to the higher association of congenitally missing or peg-shaped lateral incisors with these anomalies.⁹ In addition, early investigation will give the patient time to explore all possible treatment options including implant restorations. A full set of orthodontic records including radiographs, models and clinical photographs are recommended for the diagnosis of congenitally missing laterals and to plan the preprosthetic orthodontic alignment. A diagnostic wax set-up is also beneficial for planning treatment and esthetics.^{7,9} Participating clinicians — the orthodontist, periodontist, oral surgeon, restorative dentist, prosthodontist — should determine the patient’s treatment plan collaboratively and communicate throughout the course of treatment to ensure all aspects of treatment are considered and the overall treatment objectives are achieved.¹⁰



Figure 1: Pretreatment intraoral photograph of a congenitally missing lateral incisor and canine that has drifted mesially. Preprosthetic orthodontic treatment is necessary to align the crowns and roots of the central incisor and canine before implant restoration.

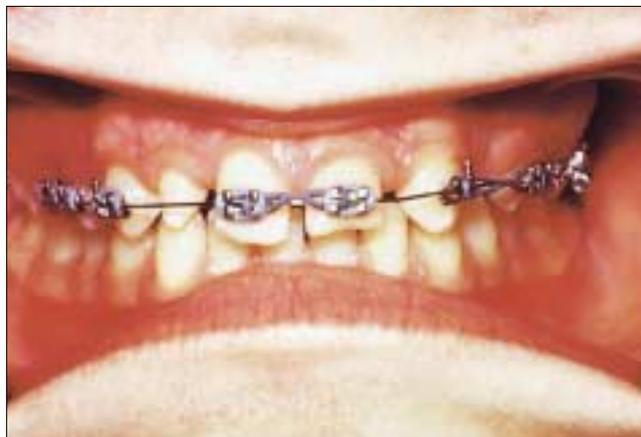


Figure 2: Mid-treatment intraoral view showing sufficient space between crowns for placement of a traditional fixed or removable prosthesis.

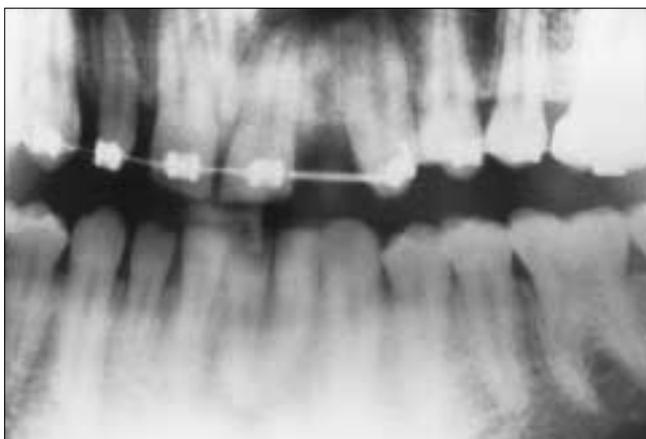


Figure 3: Mid-treatment panoramic radiograph revealing insufficient space between the roots of the teeth for placement of the implant, although there is sufficient space between the crowns.



Figure 4: The final orthodontic positions showing sufficient space between crowns for the implant and sufficient space to build up the contra-lateral peg-lateral.



Figure 5: Sufficient space between the roots has been created with additional orthodontic treatment by moving the central incisor and canine roots further apart to allow placement of the implant fixture.

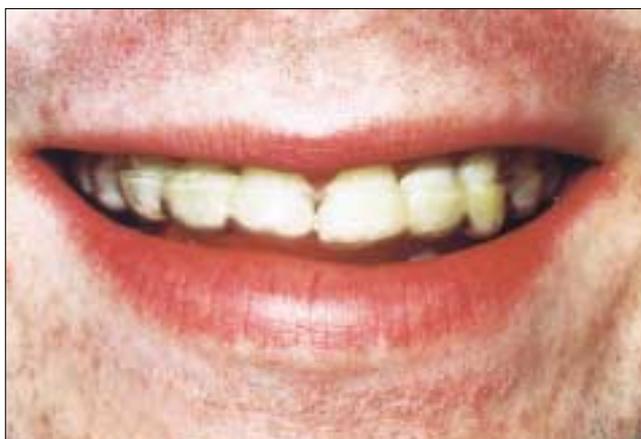


Figure 6: Vacuum-form retainer in place following orthodontic treatment. A denture tooth has been placed in the retainer to maintain the space for the implant restoration.

For patients with congenitally missing lateral incisors who have over-retained primary lateral incisors or canines, keeping the primary tooth as long as possible should be considered to preserve the supporting alveolar bone for future implants.¹¹ In these cases, composite resin can be added to the small deciduous tooth to create a tooth with similar proportions to the final restoration. This allows space and bone as well as esthetics to be maintained until the definitive implant is placed.¹¹ In addition to over-retained primary teeth, permanent canines may erupt or drift mesially into the edentulous space when maxillary lateral incisors are congenitally absent. If the space is to be opened for an implant, the canines will need to be moved distally, which may result in development of the alveolar ridge in the canine region.¹¹ Fortunately, the expected bone loss across the lateral area edentulous ridge from orthodontically moving the canine is significantly less than if the tooth is extracted.¹¹ In cases where the occlusion and esthetics of the canine in the lateral position are acceptable, closure of the lateral space by the mesially positioned canine may be the simplest alternative treatment option. The benefits of space closure over prosthetic replacement depends on the specific occlusion as well as the morphology and esthetics of the canine.

When planning for the placement of a single-tooth implant, the orthodontist must ensure adequate space between the crowns and roots (**Fig. 1**). Both the quantity and quality of alveolar bone must be assessed before implant placement is considered.¹² To accommodate a standard implant there should be a minimum of 10 mm of inciso-gingival bone and a minimum of 6.0 mm of facial-lingual bone.¹¹ In cases where there is insufficient alveolar bone for implant placement, ridge augmentation may be necessary in addition to orthodontic repositioning of adjacent teeth.¹² Adequate space for the implant is also required between the adjacent roots.^{4,10} The average dental implant fixture is 3.75 mm wide, and 1 to 2 mm of space is necessary between the fixture and the adjacent roots.¹² Typically, between 6 and 8 mm of bone between the central and canine roots is recommended. Creating adequate space between the roots must be specifically addressed since the central and canine roots may be brought into closer proximity when the teeth are initially aligned orthodontically (**Figs. 2 and 3**).¹¹ To create adequate space for the implant, further orthodontic treatment may be necessary to move the roots further apart (**Figs. 4 and 5**). Space for the coronal restoration must also be assessed. The average implant platform, which is 4.0 mm wide, requires a space of 1.0 mm mesially and distally between the platform and the adjacent tooth to facilitate proper healing and the development of a papilla postoperatively.^{6,11} Thus, a minimum of 6 mm of space for the lateral crown is required.

As discussed above, one goal of orthodontic alignment is to achieve sufficient bone between the roots to place the implant. The roots of the central incisor and canine should be parallel to slightly divergent to avoid complications resulting from root proximity. Usually, the tip of the central incisor is approximately 5 degrees while that of the canine is 13 degrees, which

means that the roots are slightly divergent. There are additional mechanotherapy treatment options that can be used to orthodontically position the roots of the adjacent teeth and create adequate space for the implant. These include ideal placement of brackets to achieve the correct root and crown positions; bending the archwire to accentuate root divergence; or bonding a contralateral bracket on a *central* incisor (such as placing the maxillary right central incisor bracket on the maxillary left central incisor) to accentuate root divergence in the implant area.⁴ (Placement of the contralateral bracket on the canine is never indicated as this would cause the canine root to move into the edentulous area and compromise implant placement.)

Esthetics as well as occlusion must be considered in the final orthodontic positioning of the teeth adjacent to the edentulous space. To satisfy the "golden proportion" principle of esthetics, the space for the maxillary lateral incisor should be approximately two-thirds of the width of the central incisor.^{11,13} However, if the patient is missing only one maxillary lateral incisor, the space required to achieve symmetrical esthetics and occlusion is primarily dictated by the width of the contralateral incisor.¹¹ When both laterals are congenitally absent, the occlusion may influence the amount of space required for the implant restoration and the proportional relationship between the central and lateral incisors.¹¹

Once the permanent central incisor and canine have been positioned orthodontically to create adequate mesio-distal space between the crowns and the roots of the teeth, orthodontic retention is necessary to maintain this space and the position of the teeth.¹⁴ While the braces are in place, an acrylic denture tooth with a bonded bracket can be ligated to the archwire to further maintain space and improve esthetics. Following removal of the fixed appliances, conventional types of orthodontic retainers (Hawley retainers) can be used to maintain the space until the implant is placed and restored.¹⁵ Removable vacuum-form retainers containing bonded acrylic denture teeth are also acceptable in the interim as they prevent relapse in 3 dimensions (**Fig. 6**).¹³ However, caution should be taken when using vacuum-form retainers with respect to the occlusion especially when only one arch has been treated orthodontically. Open bites, both anterior and posterior, may be created with a vacuum-form retainer as this type of full-coverage retainer may allow selective teeth to overerupt and thus create more orthodontic problems. When a patient does not plan to have implant treatment immediately, resin-bonded bridges or transitional all-acrylic partial dentures are also acceptable options that satisfy the goals of retention, function and esthetics. The length of time in retention prior to implant placement will depend on the orthodontic treatment that was completed. For example, if significant rotations were corrected orthodontically, longer or possibly permanent retention may be required.

The optimal time for placement of implants is after growth of the maxilla, mandible and alveolus is complete.¹¹ If implants are placed before growth is complete, the surrounding alveolar bone may continue to develop vertically and

adjacent teeth may continue to erupt. Thus a discrepancy between the gingival margins of the implant and the natural teeth is created and the implant appears to become submerged.¹¹ This creates a functional as well as an esthetic problem. Methods of evaluating growth include superimposition of sequential cephalometric radiographs and growth charts.¹¹ For males, completion of facial growth, which often corresponds to general growth, may not occur until the age of 21 years; in young women, growth may be completed by age 15.¹¹ If growth is complete, dental implants can be placed as soon as the edentulous space has been created and the tissues have stabilized following orthodontic treatment.¹¹

Conclusions

Dental implants are a treatment of choice for most patients with congenitally missing laterals. An implant will preserve tooth structure and alveolar bone and provide esthetics and function. However, successful restorative treatment involving implants depends on interdisciplinary treatment planning, especially if preprosthetic orthodontic tooth alignment is required. The roots of the teeth adjacent to the edentulous implant region must be parallel or slightly divergent to create sufficient bone for implant placement, and there must be sufficient space between the crowns to place and restore the implant. ♦

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