

Interdisciplinary Management of  
Congenitally Missing Lateral Incisors

7

Vincent Kokich, Jr  
Greggory Kinzer

Several treatment options exist for the replacement of congenitally missing maxillary lateral incisors. These options include canine substitution, resin-bonded fixed partial dentures, cantilevered fixed partial dentures, conventional fixed partial dentures, and single-tooth implants. Depending on which treatment option is chosen, specific criteria have to be addressed. A primary consideration of all treatment plans is conservation of tooth structure. Generally, the treatment of choice should be the least invasive option that still satisfies the expected esthetic and functional objectives.

Space appropriation is a critical factor in any of the different restorative options. The orthodontist plays a key role in achieving specific space requirements by positioning the teeth in the ideal restorative position. The correct amount of space is generally determined by the esthetic placement of the central incisors and the functional positioning of the canines. The orthodontist and restorative dentist must develop the treatment plan and treat the patient together for the most predictable outcome. Any of the aforementioned treatment options can be used to achieve an excellent, esthetic result. However, if a given treatment option is utilized in the wrong patient, the final result may be less than ideal. Therefore, it is important that the orthodontist know the treatment plan early so that the buccolingual inclination and mesiodistal angulation of the teeth can facilitate the final restorations.

Over the past several years, the single-tooth implant has become the primary method of replacing missing teeth. However, there are certain instances in which implants cannot be used. Furthermore, some patients are not willing to undergo the treatment necessary to facilitate proper implant placement. How then does the dentist determine which restoration should be used? What restorative and orthodontic factors have to be addressed when alternative restorative options are considered? This chapter will answer these questions by describing the different options available for restoring these edentulous spaces.

### Canine Substitution

Canine substitution can be an excellent treatment alternative for patients who are congenitally missing the permanent maxillary lateral incisors. However, specific case selection criteria must be evaluated before this alternative is selected as the appropriate treatment:



Fig 7-1a Canines have been moved to the area of the missing lateral incisors.

Fig 7-1b Central incisors are intruded orthodontically.

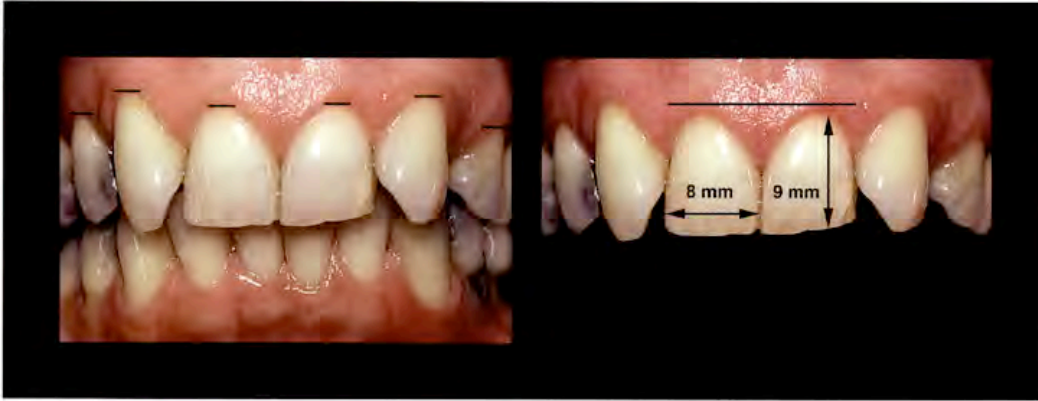
Fig 7-1c Central incisors are lengthened restoratively to regain the normal width-to-length proportion.

Fig 7-1d Canines are extruded and then reduced in length and thickness to better simulate the missing lateral incisor crowns.

1. The patient must have a Class II dental relationship with little or no crowding in the mandibular arch or a Class I dental relationship with enough crowding in the mandibular arch to merit extracting permanent teeth.
2. The patient must have a good facial profile.
3. The canines must have flat labial surfaces and insignificant cingula, and they cannot be wide at the cemento-enamel junction.
4. The color of the canines should blend with the color of the central incisors. If they are too saturated with color, they may require veneer restorations following orthodontic treatment.

In the patient shown in Fig 7-1a, the canines were substituted for the missing lateral incisors. How could the patient have been treated differently to achieve a more esthetic final result? The central incisors





should have been intruded orthodontically (Fig 7-1b) and lengthened restoratively (Fig 7-1c) to regain a normal width-to-length proportion. In addition, the canines should have been extruded (Fig 7-1d) and reduced in length and thickness to better simulate the missing lateral incisor crowns.

When evaluating the pretreatment photograph, how does the orthodontist determine how far to intrude the central incisors to restore these teeth to the appropriate length? Normally, the gingival margins of the central incisor and canine are located at the same level. However, when the canine is substituted for the lateral incisor, the canine gingival margin will not finish in its normal position (Fig 7-1e). Therefore, the width-to-length ratio is critical in determining where to position the central incisors. First, the width should be measured mesiodistally. That width can be used to calculate the length based on an ideal 0.75 to 0.80 width-to-length ratio.<sup>1</sup> Because the width in this patient was 8 mm, the appropriate length should have been approximately 10 mm rather than 9 mm, as measured in this patient (Fig 7-1f).

Because the initial incisal edge position was level with the posterior occlusal plane, the central incisors cannot just be lengthened 1 mm. To change their length, they must be orthodontically intruded 1 mm (see Fig 7-1b). The central incisors may then be restored to the more proportional 10-mm length (see Fig 7-1c). This recoordinates the levels of the incisal and occlusal planes.

To improve the esthetics of these teeth in the canine substitution patient, it is important to level the gingival margins as if the canines were lateral incisors. This will improve the overall esthetics of the smile. Therefore, the canines should be extruded (see Fig 7-1d).

**Fig 7-1e** When the canine is substituted for the lateral incisor, the gingival margin of the canine will not end up in its normal position.

**Fig 7-1f** Because the width of the central incisor in this patient is 8 mm, the appropriate length should be approximately 10 mm (rather than 9 mm, as measured).



**Fig 7-1g** Generally, the width of the canine is approximately 1.5 times the width of the lateral incisor.

**Fig 7-1h** Canines with large cingula or bulbous labial surfaces requiring significant reduction may not be appropriate candidates for canine substitution.

**Fig 7-1i** If palatal reduction is not performed on the canines, the tooth will be positioned too far labially, detracting from the final esthetics.

**Fig 7-1j** As the canines are extruded, the cusp tips begin to extend below the level of the occlusal and incisal planes and have to be reshaped.

Unfortunately, the occlusion will be adversely affected as the canine is extruded, because of the buccolingual width of the canine crown. Generally, this width is approximately 1.5 times the width of the lateral incisor (Fig 7-1g). When an outline of the lateral incisor crown is superimposed on the canine crown, it is possible to see those areas that require enameloplasty during orthodontic treatment. Therefore, canines with large cingula or bulbous labial surfaces requiring significant reduction may not be appropriate candidates for canine substitution (Fig 7-1h).

As the canines are extruded, the palatal surface of the crown must be reduced significantly to achieve a normal overbite and overjet. If this is not done, the tooth will be positioned too far labially, detracting from the final esthetics (Fig 7-1i). As the canines are extruded, the cusp tips begin to extend below the level of the occlusal and incisal planes and must be reshaped<sup>23</sup> (Fig 7-1j).





After the proper overbite has been obtained and the gingival margins are appropriately positioned, the cusp tips must be reduced in length. This is generally a simple procedure. Occasionally, however, it may have to be carried out gradually, over several appointments, to reduce tooth sensitivity<sup>2-4</sup> (Fig 7-1k). After the canines have been extruded and the cusp tips have been transformed into incisal edges, the mesioincisal corners of the crowns may require restoration with resin composite to achieve a more realistic lateral incisor crown shape<sup>4,5</sup> (Fig 7-1l). In addition, depending on their shape, the first premolars may be restored with veneers to simulate the shape of the canine.

**Fig 7-1k** Incisal reduction may have to be carried out gradually, over several appointments, to reduce tooth sensitivity.

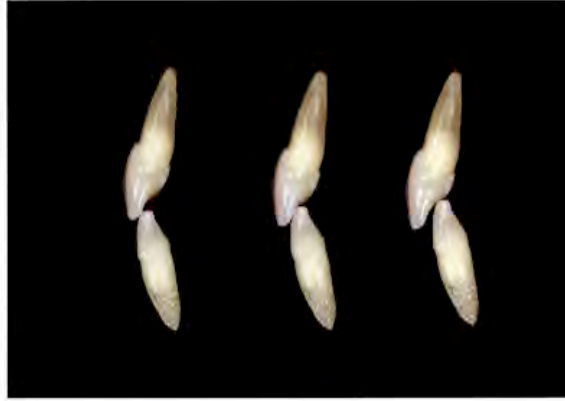
**Fig 7-1l** The mesioincisal corners of the simulated lateral incisor crowns may have to be restored with resin composite to achieve a more realistic shape.

### Resin-Bonded Fixed Partial Denture

By far, the most conservative tooth-supported restoration is the resin-bonded fixed partial denture, because it leaves the adjacent teeth relatively untouched. However, this treatment option also has some of the most stringent criteria that must be met to ensure long-term success. Unfortunately, because of the high failure rates reported in the literature<sup>6-9</sup> and the availability of single-tooth implants, these restorations are not widely used today.

Dental research shows that a deep overbite is associated with higher failure rates.<sup>10</sup> This failure is mainly due to the presence of increased lateral forces. In addition, as the overbite increases, either the surface area available for bonding the retainer must decrease or the teeth must be prepared and the occlusion placed on the retainer. A shallow overbite will decrease lateral forces as well as maximize the surface area available for bonding (Fig 7-2).

**Fig 7-2** A shallow overbite will decrease lateral forces as well as maximize the surface area available for bonding.

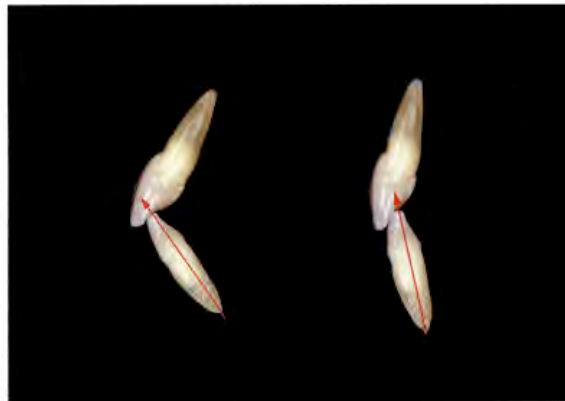


The second concern with regard to tooth position involves proclination of the abutment teeth. The direction of normal occlusal forces on proclined teeth places a tensile force on the bond interface (Fig 7-3). Teeth that are upright direct a more shear type of force toward the bond interface. From a physics standpoint, an object can withstand approximately 40% more force in a shear mode than in a tensile mode before failure will occur (Fig 7-4).

Figure 7-5a presents a patient who received a resin-bonded fixed partial denture to replace congenitally missing lateral incisors. The anterior teeth were proclined. In addition, the central incisors exhibited Grade I mobility. The fixed partial dentures began debonding after placement and eventually fractured (Fig 7-5b).

**Fig 7-3** The direction of normal occlusal forces on proclined teeth produces a tensile-type force at the bond interface.

**Fig 7-4** Upright teeth generate a more shear-type force at the bond interface.



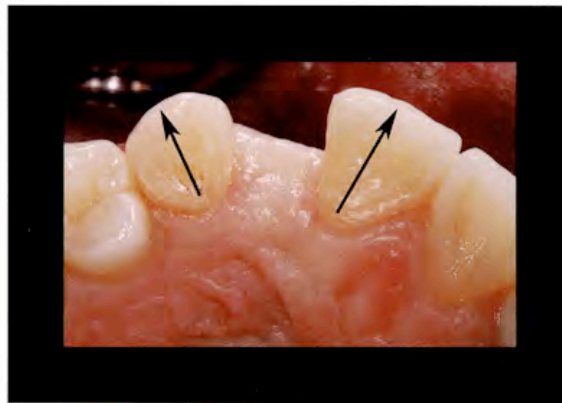


**Fig 7-5a** A patient with a resin-bonded fixed partial denture to replace congenitally missing lateral incisors exhibits proclination of the anterior teeth. In addition, the central incisors have Grade I mobility.

Mobility of the abutment teeth is a contraindication for bonded fixed partial dentures because of the stress placed on the bond interface when the rigidity of the retainer tries to prevent movement of the abutment teeth. Generally, it is the least mobile of the abutments that is at risk of debonding. The direction of the mobility is also a concern. For example, while the central incisor moves faciolingually in one direction, the canine moves faciolingually along a different vector. This difference also increases the stress at the bond interface (Fig 7-6).

**Fig 7-5b** The fixed partial dentures began debonding after placement and eventually fractured.

Tooth thickness and translucency can affect both the final esthetics of the abutment teeth and the amount of bondable surface area (Fig 7-7a). It is very difficult not to affect the transmission of light in thin or very translucent teeth. The translucency of the abutment



**Fig 7-6** The central incisor moves buccolingually in one direction; the buccolingual movement of the canine is along a different vector. This difference increases the stress at the bond interface.





**Fig 7-7a** Tooth thickness and translucency can affect both the final esthetics of the abutment teeth and the amount of bondable surface area.

**Fig 7-7b** If the retainer design in this patient only covered the gingival third, the small amount of bondable surface area would significantly decrease the structural integrity of the restoration.

teeth must be evaluated prior to placement of the restoration. If the retainer design in this patient only covered the gingival third, to prevent graying of the facial surface, the small amount of bondable surface area would significantly decrease the structural integrity of the restoration (Fig 7-7b).

The ideal candidate for a resin-bonded fixed partial denture is one in whom the adjacent teeth are relatively opaque and the translucency is mainly localized to the incisal third (Fig 7-8a). A shallow overbite allows maximum surface area for bonding the retainers with little or no tooth preparation (Fig 7-8b). The shallow anterior occlusal scheme will also impart the least amount of force on the bond interface. The resin-bonded fixed partial denture in this situation can be used as an interim restoration until hard and soft tissue

**Fig 7-8a** The ideal candidate for a resin-bonded fixed partial denture is one in whom the adjacent teeth are relatively opaque and the translucency is mainly localized to the incisal third.

**Fig 7-8b** A shallow overbite allows maximum surface area for bonding the retainers with little or no tooth preparation.

**Fig 7-8c** A resin-bonded fixed partial denture can be used as an interim restoration until hard and soft tissue grafting have been completed.



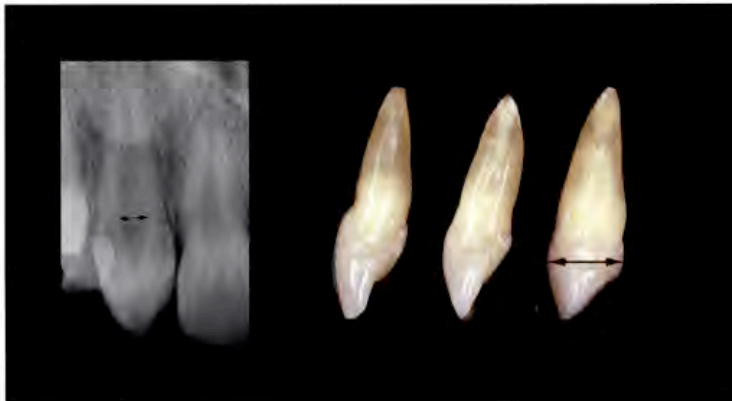
grafting have been completed. Following implant placement, the bonded fixed partial denture can then be removed without damage to the adjacent teeth (Fig 7-8c).

### Pin-Ledge Cantilevered Fixed Partial Denture

If the esthetics of the adjacent teeth do not have to be altered, the next most conservative tooth-retained restoration is a pin-ledge cantilever extending from the canine.<sup>11</sup> The success of this type of restoration, unlike that of a bonded fixed partial denture, is not determined by the amount of proclination or the mobility of the abutment teeth.

To provide retention and resistance for this restoration, pins must be placed in the canine abutment tooth. Therefore, the size and location of the pulp within the tooth must be evaluated (Fig 7-9). Because the dental pulp is large in many young patients, age may be a relative contraindication for this type of restoration. Given its root length and crown dimensions, the canine is an ideal abutment for a cantilevered restoration (Fig 7-10). Nevertheless, the thickness and translucency of the abutment must be evaluated to prevent show-through of the retainer.

Figure 7-11a shows a patient who had a bonded fixed partial denture, extending from canine to canine, to replace the missing lateral incisors. Two years after initial placement, the restoration debonded. The restoration continued to debond after recementation, despite attempts to create mechanical retention. Washout of the cement was observed on the canines upon removal of the restoration (Fig 7-11b).



**Fig 7-9** Because pins are placed in the canine abutment tooth, the size and location of the pulp must be evaluated.

**Fig 7-10** Because of its root length and crown dimensions, the canine is an ideal abutment for a cantilevered restoration.



**Fig 7-11a** Two years after initial placement of a bonded fixed partial denture, extending from canine to canine, to replace the missing lateral incisors, the restoration has debonded. The restoration has continued to debond after recementation, despite attempts to create mechanical retention.

**Fig 7-11b** Washout of the cement can be observed on the canines upon removal of the restoration.

**Fig 7-11c** The completed preparation of the canine reveals two pinholes placed at a depth of 2 to 3 mm on the distal surface and in the area of the cingulum, with a groove placed on the mesial.

Furthermore, the cement was thicker on the central incisors because of the multiple recementations.

Two pinholes were prepared at a depth of 2.00 to 3.00 mm on the distal surface and in the area of the cingulum of the canine, with a groove placed on the mesial (Fig 7-11c). The remainder of the preparation ranged in depth from 0.50 to 0.75 mm. Plastic impression pins were then picked up in the final impression to transfer the information to the working cast. Platinum-palladium pins were picked up in the completed waxup and cast in the final restoration (Fig 7-11d).

The pontic was baked in traditional feldspathic porcelain. The restorations were bonded with resin cement. The coronal extension of the retainer was dictated by the occlusion and esthetics. The mobility of the central incisors was addressed with a wire and resin composite splint (Fig 7-11e). The final restoration allowed a conservative treatment option to replace the missing lateral incisor without impacting the esthetics of the abutment teeth (Fig 7-11f). The key to predictability of a cantilevered restoration is to remove all eccentric contacts from the pontics.<sup>12,13</sup>

Figure 7-12a shows a patient whose original treatment plan called for orthodontics to align the teeth and create the appropriate space for implant placement. However, because of the significant proclination of the teeth, the orthodontist could not create the required amount of space in the apical region. To restore the palatal surfaces and change the esthetics of the proclined canines, complete-coverage restorations with cantilevered lateral incisor pontics were planned



**Fig 7-11d** Platinum-palladium pins have been picked up in the completed waxup and cast in the final restoration. The pontic was baked in traditional feldspathic porcelain.

**Fig 7-11e** The mobility of the central incisors has been addressed with a wire and resin composite splint.

**Fig 7-11f** The final restoration to replace the missing lateral incisors incorporates a conservative treatment option that does not impact the esthetics of the abutment teeth. (Restorations by Dr Frank Spear, Seattle, WA.)

(Fig 7-12b). Connective tissue grafts were performed in the edentulous spaces to enhance the gingival appearance. The final restorations replaced the missing lateral incisors and restored the proper functional relationship of the canines (Fig 7-12c). As was true for the pin-ledge restoration, all excursive contacts must be removed from the cantilevered lateral incisors.

**Fig 7-12a** Because of the significant proclination of the teeth, the orthodontist cannot create the amount of space required in the apical region for implant placement.

**Fig 7-12b** To restore the palatal surfaces and change the esthetics of the proclined canines, complete-coverage restorations with cantilevered lateral incisor pontics are planned.

**Fig 7-12c** The final restorations replace the missing lateral incisors and restore the proper functional relationship of the canines.



## Conventional Fixed Partial Denture

The least conservative of all tooth-retained restorations is a conventional fixed partial denture. This restoration is usually chosen when the adjacent teeth require restoration either for structural reasons (caries or fracture) or to alter the facial esthetics.

It is important that the appropriate final restoration be chosen prior to removal of the orthodontic appliances. This allows the orthodontist to position the teeth in a way that will facilitate the desired restorative treatment (Fig 7-13).

One area of concern that should be addressed for complete coverage restorations is the alignment of the anticipated abutment teeth along a common pathway. When the orthodontist aligns the central incisor and canine during treatment, it is important to evaluate their inclination and angulation. When the patient's teeth are viewed from the front, it is imperative that the long axis of the central incisor and the labial surface of the canine be parallel (Fig 7-14). This will allow the restorative dentist the proper line of draw when preparing these teeth. If the inclination of the canine is incorrect, the restorative dentist will have to excessively prepare the canine to achieve the proper line of draw (Fig 7-15). This may ultimately weaken the abutment or impinge on the pulp chamber.

When the patient's teeth are evaluated from a lateral perspective, the long axis of the canine and the labial surface of the central incisor must also be parallel to allow proper tooth preparation (Fig 7-16). If the central incisors are too proclined at the completion of orthodontic treatment (Fig 7-17), it will be difficult for the restorative den-

**Fig 7-13** It is important that the appropriate final restoration be chosen prior to removal of the orthodontic appliances. This enables the orthodontist to position the teeth in a way that will facilitate the desired restorative treatment.





Fig 7-14 It is imperative that the long axis of the central incisor and the labial surface of the canine be parallel.

Fig 7-15 If the inclination of the canine is incorrect, the restorative dentist will have to excessively prepare the canine to achieve the proper line of draw.

Fig 7-16 When the patient's teeth are evaluated from a lateral perspective, the long axis of the canine and the labial surface of the central incisor must be parallel to allow proper tooth preparation.

tist to adequately prepare the labial surface of the central incisor for proper esthetics and appropriate line of draw.

If the central incisor and canine are positioned correctly (Fig 7-18), tooth preparation for a conventional fixed partial denture is simplified. However, the orthodontist must know how to align these teeth according to the specific restorative requirements for the chosen restoration. He or she must also know the orthodontic limitations that may suggest selection of an alternative restoration to replace the missing lateral incisor.

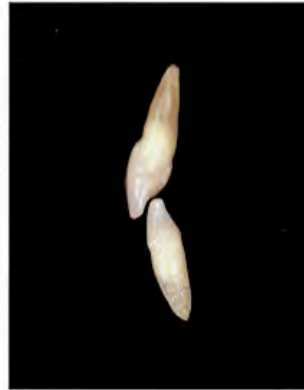
Another important reason to evaluate the buccolingual position of the abutment teeth is the overall effect on joint size (Fig 7-19). Failure of all-ceramic fixed partial dentures is commonly a problem

Fig 7-17 If the central incisors are too proclined at the completion of orthodontic treatment, it will be difficult for the restorative dentist to adequately prepare the labial surface of the central incisor for proper esthetics and appropriate line of draw.

Fig 7-18 If the central incisor and canine are positioned correctly, tooth preparation for a conventional fixed partial denture is simplified.

Fig 7-19 Joint fracture of all-ceramic fixed partial dentures is commonly a problem of joint size.





**Fig 7-20** The orthodontist can help increase the size of the joint by leaving an anterior open bite or excess overjet.

**Fig 7-21a** A conventional fixed partial denture is commonly used when a fixed partial denture has previously been in place. Soft tissue esthetics around the restoration must also be addressed.

**Fig 7-21b** Connective tissue grafting has been completed in the edentulous area of the right central incisor, and facial crown lengthening has been performed for the left central incisor to enhance the gingival architecture and align the gingival levels.

of joint size.<sup>14-16</sup> The orthodontist can help increase the size of the joint by leaving an anterior open bite or excess overjet (Fig 7-20). This can ultimately be closed with the final restoration, thereby increasing the joint dimension. This type of positioning also allows a more conservative palatal preparation, which may be important in young patients or patients with thin teeth.

A conventional fixed partial denture is commonly used when a fixed partial denture has previously been in place (Fig 7-21a). Because the adjacent teeth have already been prepared, conservation of tooth structure is not as critical to the treatment decisions.

As is true in all cases involving tooth replacement, soft tissue esthetics around the restoration must also be addressed. Figure 7-21b shows connective tissue grafting that was completed in the edentulous area of the right central incisor as well as facial crown lengthening-



ing of the left central incisor to enhance the gingival architecture and even the gingival levels. The final restoration included a metal-ceramic fixed partial denture extending from the maxillary right lateral incisor to the left central incisor and a single crown on the maxillary left lateral incisor.

### Single-Tooth Implant

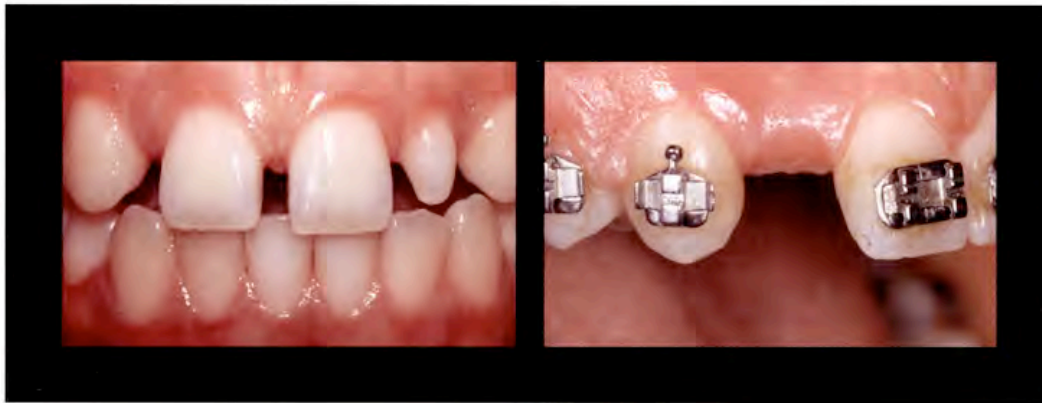
Today, the single-tooth implant is the most widely used treatment option for the replacement of missing teeth. This popularity is attributable to the high success rates<sup>17-20</sup> of the anterior single-tooth implant and the fact that the adjacent teeth remain untouched.

The patient shown in Fig 7-22a is an ideal candidate for an implant-supported restoration to replace the missing maxillary right lateral incisor. What rules should the orthodontist follow to make it easy for the surgeon and restorative dentist to properly place and restore the implant?

During initial alignment, the appropriate amount of space should be opened to replace the missing lateral incisor crown (Fig 7-22b). When space is being created, a commonly made mistake is failure to take the time to align the roots properly. When the space is opened, the crowns of the central incisor and canine are tipped apart (Fig 7-22c). Unfortunately, the roots of these teeth do not move as quickly. This root proximity problem is often left uncorrected by the orthodontist and makes implant placement impossible for the surgeon.

**Fig 7-22a** This patient is an ideal candidate for an implant-supported restoration to replace the missing maxillary right lateral incisor.

**Fig 7-22b** During initial alignment, the appropriate amount of space should be opened to replace the missing lateral incisor crown.

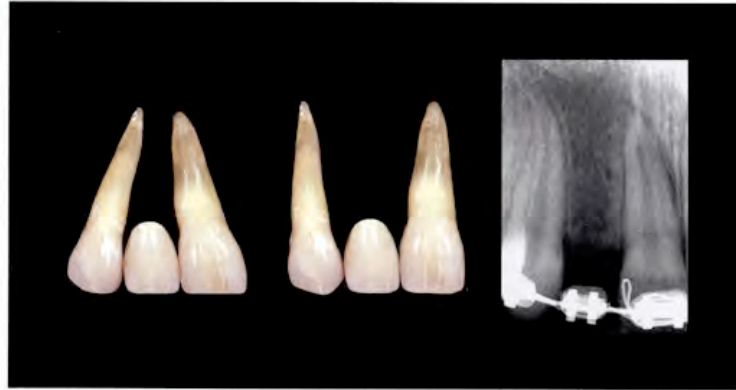




**Fig 7-22c** When the space is opened, the crowns of the central incisor and canine are tipped apart.

**Fig 7-22d** Ideal root position is obtained when the long axes of the central incisor and canine are parallel to each other.

**Fig 7-22e** To confirm the clinical evaluation, a periapical radiograph is taken during orthodontic treatment to evaluate the relationship between the roots of the central incisor and the canine.



Ideal root position is obtained when the long axes of the central incisor and canine are parallel to each other (Fig 7-22d). The most effective method of evaluating this relationship during orthodontic treatment is by taking a periapical radiograph of the edentulous space to confirm the clinical evaluation. This should always be done prior to removal of the orthodontic appliances, because an improper root relationship can only be corrected by actively moving the roots apart (Fig 7-22c).

Because the mesiodistal space for a lateral incisor varies from 5 to 7 mm, implant diameter and placement are crucial (Fig 7-22f). A provisional implant crown should be placed to manipulate and influence the soft tissue form prior to the final restoration.

The final implant restoration will restore the missing lateral incisor without affecting the adjacent teeth (Fig 7-22g). With the hard

**Fig 7-22f** A periapical radiograph reveals the relationship between the mesiodistal space available for a lateral incisor and the implant diameter.

**Fig 7-22g** The final implant restoration restores the missing lateral incisor without affecting the adjacent teeth.



and soft tissue grafting procedures that are available, harmonious soft tissue architecture can be maintained. A single-tooth implant is by far the most conservative restoration and is usually the first treatment option that is considered.

## References

1. Magne P, Gallucci GO, Belser UC. Anatomic crown width/length ratios of unworn and worn maxillary teeth in white subjects. *J Prosthet Dent* 2003 May;89:453-461.
2. Zachrisson BU, Mjor IA. Remodeling of teeth by grinding. *Am J Orthod* 1975;68:545-553.
3. Thordarson A, Zachrisson BU, Mjor IA. Remodeling of canines to the shape of lateral incisors by grinding: A long-term clinical and radiographic evaluation. *Am J Orthod Dentofacial Orthop* 1991;100:123-132.
4. Sabri R. Management of missing lateral incisors. *J Am Dent Assoc* 1999;130:80-84.
5. Zachrisson BU. Improving orthodontic results in cases with maxillary incisors missing. *Am J Orthod* 1978;73:274-289.
6. Probst B, Henrich GM. 11-year follow-up study of resin-bonded fixed partial dentures. *Int J Prosthodont* 1997;10:259-268.
7. Priest GF. Failure rates of restorations for single-tooth replacement. *Int J Prosthodont* 1996;9:38-45.
8. Hansson O. Clinical results with resin-bonded prostheses and an adhesive cement. *Quintessence Int* 1994;25:125-132.
9. Williams VD, Thayer KE, Denehy GE, Boyer DB. Cast metal, resin-bonded prostheses: A 10-year retrospective study. *J Prosthet Dent* 1989;61:436-441.
10. Creugers NH, Kayser AF, Van't Hof MA. A seven-and-a-half-year survival study of resin-bonded bridges. *J Dent Res* 1992;71:1822-1825.
11. Small BW. The use of cast gold pinledge retainers with pontics as an esthetic and functional restorative option in the maxillary anterior. *Gen Dent* 2004;52:18-20.
12. Decock V, De Nayer K, De Boever JA, Dent M. 18-year longitudinal study of cantilevered fixed restorations. *Int J Prosthodont* 1996;9:331-340.
13. Hochman N, Ginio I, Ehrlich J. The cantilever fixed partial denture: A 10-year follow-up. *J Prosthet Dent* 1987;58:542-545.
14. Oh WS, Anusavice KJ. Effect of connector design on the fracture resistance of all-ceramic fixed partial dentures. *J Prosthet Dent* 2002;87:536-542.
15. Kelly JR, Tesk JA, Sorensen JA. Failure of all-ceramic fixed partial dentures in vitro and in vivo: Analysis and modeling. *J Dent Res* 1995;74:1253-1258.
16. Raigrodski AJ, Chiche GJ. The safety and efficacy of anterior ceramic fixed partial dentures: A review of the literature. *J Prosthet Dent* 2001;86:520-525.
17. Mayer TM, Hawley CE, Gunsolley JC, Feldman S. The single-tooth implant: A viable alternative for single-tooth replacement. *J Periodontol* 2002;73:687-693.
18. Davarpanah M, Martinez H, Etienne D, et al. A prospective multicenter evaluation of 1,583 3i implants: 1- to 5-year data. *Int J Oral Maxillofac Implants* 2002;17:820-828.
19. Romeo E, Chiapasco M, Ghisolfi M, Vogel G. Long-term clinical effectiveness of oral implants in the treatment of partial edentulism. Seven-year life table analysis of a prospective study with ITI dental implants system used for single-tooth restorations. *Clin Oral Implants Res* 2002;13:133-143.