Congenitally Missing Maxillary Lateral Incisors: Treatment

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LEARNING OBJECTIVES

After reading this article, the individual will learn:

- Factors in determining whether to close an open space or to open enough space for a prosthetic treatment for congenitally missing maxillary lateral incisors.
- The importance of a total treatment approach using an interdisciplinary dental specialty team to maximize function, aesthetics, and oral health.

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INTRODUCTION

Congenitally missing maxillary lateral incisors are the second most common dental agenesis, exceeded only by third molars.\(^1\)\(^2\) Hypodontia, the absence of one or a few teeth, arises from a disturbance early in the tooth formation process during initiation or proliferation of the tooth bud. As a rule, if a tooth is absent, the most distal tooth of a type will be affected. Tooth malformations result from later
disturbances during the differentiation stages of dental development, and these are most commonly manifested as size variations. Other dental anomalies that are frequently associated with congenitally missing teeth include microdontia, delayed dental development, and certain discrete ectopic eruption of the tooth. There is a significant association between the agenesis of maxillary lateral incisors and the agenesis of other permanent teeth, as well as an increased occurrence of microdontia of the maxillary lateral incisors, palatal displacement of canines, and distal angulation of mandibular second premolars.

The congenital absence of one or more maxillary lateral incisors introduces a potential imbalance in the maxillary and mandibular dental arch length in the permanent dentition. Treatment planning for congenitally missing maxillary lateral incisors often presents a difficult task for practitioners because aesthetic as well as functional treatment results are desired. Therefore, to produce the most predictable aesthetic results, it is important to choose a treatment that will best focus on the initial diagnosis. To provide aesthetic anterior tooth shape and correct the problem of missing teeth, patients must be informed of their total dental needs, not just those associated with a limited specialty. That is, patients need to be offered a total treatment approach from an interdisciplinary dental specialty team that will integrate and coordinate treatment to maximize function, aesthetics, and oral health.

This article discusses factors in determining whether to close an open space or to open enough space for a prosthetic treatment for congenitally missing maxillary lateral incisors. Further, the importance of a total treatment approach using an interdisciplinary dental specialty team to maximize function, aesthetics, and oral health is discussed.

**TREATMENT SELECTION**

The treatment method selected for congenitally missing maxillary lateral incisors should provide treatment results acceptable to both facial and dental aesthetics. A number of factors need to be considered when deciding whether to close the space left by a missing maxillary lateral incisor or to open space in preparation for a prosthetic tooth. These factors include the posterior occlusal relationships, the position of the canines at the time of diagnosis, the shape and color of the canines, whether or not extractions would be necessary, and the potential for referring and coordinating prosthodontic treatment with orthodontic therapy.

In most cases, the existence of a skeletal malocclusion serves as the primary criterion in the treatment selection for congenitally missing maxillary lateral incisors. Apart from this, selecting an appropriate treatment option for each patient depends on the specific space requirements, tooth-size relationship, and size and shape of the canines. The ideal treatment is the most conservative approach that minimizes the need for tooth reduction and is the least invasive method of satisfying the patient's aesthetic and functional requirements. In contemporary dentistry, there are 3 treatment options for replacing missing lateral incisors: a canine substitution, a tooth-supported prosthesis, or a single-tooth implant.

Even though an orthodontist may position a canine in the most aesthetic and functional location, the prosthodontist often still needs to place a porcelain laminate or full crown to create normal lateral incisor shape and color because the size and shape of maxillary canines is usually significantly different than that of maxillary lateral incisors. Orthodontic space opening and lateral incisor replacement, the other treatment options, are sometimes preferred. As the permanent canine is moved distally to create space for a lateral incisor prosthesis or implant, an alveolar ridge is created. The clinician should align the maxillary central incisor midline with the upper lip and face when creating mesiodistal space for lateral incisor restoration. Radiographs should be taken after the alignment is complete to confirm the ridge and root positions of the central incisors and the canines. For implant or restorative cases, the root position should be evaluated by the orthodontist, the surgeon, and the prosthodontist.

**CANINE SUBSTITUTION**

There are several patient-specific dentofacial criteria that must be evaluated before selecting canine substitution treatment for replacing a missing maxillary lateral incisor. These include the presence of malocclusion and amount of crowding, facial profile, canine shape and color, lip level, and gingival contours. A fixed prosthesis or single-tooth implant should be considered if the patient fails to meet any
of these criteria. Patients with a missing permanent incisor and a coexistent malocclusion must therefore be managed with an overall treatment plan in which aesthetics and long-term dental health are of paramount importance.\textsuperscript{7,11,13}

**Malocclusion**

The presence of malocclusion is a primary criterion for making canine substitution the treatment choice for congenitally missing lateral incisors. The first type of malocclusion is an Angle Class II malocclusion with no or slight crowding in the mandibular arch. With Class II malocclusion cases, the molar relationship remains Class II, and a first premolar is located in the traditional canine position and acts as a canine. By closing space, anterior overjet is corrected to achieve optimal interincisal relationships. The next alternative is an Angle Class I malocclusion with severe crowding, which requires extraction in the mandibular arch. In these 2 malocclusions, the final occlusion should be designed so that the lateral excursive movements are in an anterior group function.\textsuperscript{14} Evaluation of the anterior tooth-size relationship is important when substituting canines for lateral incisors. Canine substitution can create excessive size of maxillary anterior teeth, and in order to achieve a normal overbite and overjet relationship, this excessive size must often be reduced.\textsuperscript{11} Completion of a diagnostic wax-up is a valuable tool in the treatment selection process to identify tooth surfaces, which will require functional and aesthetic changes to facilitate desired occlusal relationships.

**Profile**

Patients with a balanced, relatively straight profile are ideal candidates for canine substitution of congenitally missing lateral incisors. Patients with a mildly convex profile may be acceptable, too, but patients having a moderately convex profile with a retrusive mandible and a deficient chin contour may not be appropriate candidates for this treatment. It would be more appropriate to choose a treatment option that addresses not only the dental malocclusion but the facial profile as well.\textsuperscript{7,15} With skeletal Class III profiles, it is often wiser to choose space opening for a single-tooth implant or tooth-supported restoration because space closing may aggravate the Class III facial profile.

**Canine Shape and Color**

The shape and color of the canine are not the primary criteria for selecting canine substitution as a treatment for congenitally missing maxillary lateral incisors, but they are important factors if the canine substitution is to be successful and aesthetic. The canine is a much larger tooth than the lateral incisor it replaces, with a wider crown and a more convex labial surface. As such, canines usually require a significant amount of reduction in order to achieve acceptable occlusion and aesthetics. However, removal of a considerable amount of enamel with the goal of establishing proper surface contours may result in the underlying dentin showing through the thin enamel, thereby decreasing the aesthetics.\textsuperscript{7} In a canine with a greater degree of labial convexity, dentin exposure can occur, leading to the need for prosthetic replacement. Depending on the amount of incisal edge wear of the canine, it may be necessary to restore the mesioincisal and distoincisal edges to create normal lateral contours.\textsuperscript{12} A significant amount of incisal and lingual reduction is generally required to vertically position a canine in the appropriate lateral incisor location.\textsuperscript{7,8}

The color of the substituted canine should also be examined and should be approximately the same as the central incisor. However, canines are usually darker than central incisors, therefore the most conservative way to correct the color difference is to individually bleach them. If this fails to approximate the desired color, a laminate may be indicated.

**Lip Level**

The amount of gingival exposure during a smile may cause aesthetic concerns after canine substitution in some cases. Gingival levels will be more visible, and canine root eminence will be more prominent, in patients with excessive gingiva-to-lip distance when smiling. This may be due to a vertical maxillary gingival contours and an unaesthetic frontal view.
maxillary excess or a lip incompetency. Occasionally, a gingivectomy may need to be performed to properly scallop the gingival margins.\(^6,\!^7\) In patients with high smile-lines, a prominent canine root eminence may also be unaesthetic (Figure 1).\(^16,\!^17\)

**Gingival Contours**
Maxillary canines frequently exhibit high gingival contours, which produce unaesthetic smile-lines. This causes irregularities in the maxillary gingival contour. After the maxillary canines have been extruded, a restorative touch-up is often needed to recreate an ideal lateral incisor contour.\(^7\)

Since maxillary canines have more triangular contours than incisors, the contact point between maxillary central incisors might show open gingival embrasures. This causes aesthetic problems, and gingival inflammation is more frequent due to plaque accumulation in these embrasures.\(^18\) Open gingival embrasures are influenced by the direction of tooth movement and by the labiolingual thickness of the supporting bone and soft tissue after orthodontic treatment. In order to eliminate or reduce open gingival embrasures, it is recommended that the root movement of substituted maxillary canines be adequate to converge roots after space closure. In addition, restorative reshaping of the crown may be indicated.

**Orthodontic Treatment for Space Closing**
The decision whether to close space and substitute maxillary canines for lateral incisors or to open space for restoration of missing teeth will depend on several factors including the patient's age, attitude toward orthodontic treatment, treatment expectations, and financial obligations.\(^19,\!^20\) To substitute canines for maxillary lateral incisors, space should be created either by extracting deciduous canines or by allowing permanent canines to move mesially adjacent to the maxillary central incisors. Lateral brackets may be placed on canines when treating patients with canine substitution, positioned according to gingival margin height rather than on the cusp tip of the substituted canines. The brackets on the substituted canines should be placed at a distance from the gingival margin such that they will erupt these teeth to the appropriate lateral incisor vertical height. The canine tips may then be contoured to mimic lateral incisors, thus leveling the gingival margin. By placing canines in the correct vertical height, aesthetic gingival contours can also be achieved. The gingival margin of the substituted canine should be positioned slightly incisal to the central incisor gingival margin. This helps camouflage the substituted canine (Figure 2).\(^7\)

In the finishing stage, the orthodontist must reduce the width of the canine interproximally to achieve optimal aesthetics and a normal overjet relationship. Interproximal as well as occlusal canine tips need to be contoured to imitate lateral incisors. Adjunctive prosthetic treatment is often necessary to create ideal lateral incisor shape and color. When the final stages of orthodontics are complete, verify that the space closure is proper and that angulation and mesiodistal positioning of incisors are appropriate. Interdisciplinary treatment is often necessary to achieve optimal final aesthetics and may involve additional crown

![Figure 2](image-url) (a) Orthodontic extrusion of the maxillary canines. (b) The maxillary canine gingival lines are similar to the lateral incisors. (c) Equilibration of the canine cusp tips is completed. (d) Composite restoration of the mesioincisal areas.
recontouring, composite restorations, or gingivectomy (Figures 3 and 4). Patients treated with orthodontic space closure were generally more satisfied with the appearance of their teeth than patients treated with prosthetic replacements. Although no significant differences in the prevalence of signs and symptoms of temporomandibular joint disorders were found between the 2 treatment modalities, patients treated with prosthetic replacement experienced impaired periodontal health from plaque accumulation and gingivitis.

**SPACE OPENING FOR PROSTHETIC REPLACEMENT OF MAXILLARY LATERAL INCISORS**

In cases with Class I skeletal relationships where there is neither mandibular arch crowding nor dentoalveolar protrusions, orthodontic space opening treatment and prosthetic lateral incisor replacement is preferred to treatment by space closing for maintaining posterior occlusion. To replace a congenitally missing lateral incisor with a prosthetic restoration, specific criteria must be evaluated on a patient-by-patient basis by an interdisciplinary team of prosthodontist and orthodontist to achieve the most predictable treatment results. The treatment of choice should be the least invasive option that satisfies the expected aesthetic and functional objectives for the individual patient.

In creating the proper mesiodistal space for lateral incisor

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**Figure 3. (a)** Recontouring (red area) of the maxillary canine to simulate a lateral incisor. (b) Enamel recontouring (blue area) of the maxillary first premolar for canine substitution.

**Figure 4. (a)** Recontouring (red area) of the prominent labial ridge of a canine before bonding a bracket. During the finishing stage, the lingual surface is reduced (blue area) to establish a balanced occlusion. (b) To make the canine appear less curved and more like a lateral incisor, the bracket is positioned more distally.

**Figure 5.** Pretreatment intraoral photographs and a panoramic radiograph showing missing maxillary lateral incisors with unaesthetic gingival contours and deep overbite.
restoration, the clinician should position the central incisors with respect to the midpoint of the cupid’s bow on the philtrum of the upper lip and upper face, and have maxillary and mandibular midlines coincide. Aligning the maxillary midline to the upper lip and face is more important. Radiographs should be taken after the alignment is completed to confirm the ridge and root positions of the central incisors and canines. For implant or prosthetic cases, the root position must be evaluated by an orthodontist, surgeon, and prosthodontist.

**Determination of Appropriate Spacing**

The first step in opening space for a tooth-supported prosthesis or single-tooth implant is to determine how much space is necessary for the missing lateral incisor replacement. There are several methods for doing this. The first method is called the “golden proportion.” The perceived width of each anterior tooth should have a ratio of 1:1.618 to the tooth adjacent to it.

The second method is to use the contralateral lateral incisor as a reference, but this method is not suited for patients with missing or peg-shaped contralateral incisors.

The third method is to conduct a Bolton analysis. It involves dividing the sum of the mesiodistal widths of the 6 anterior mandibular teeth by the sum of the mesiodistal widths of the 6 anterior maxillary teeth. The anterior Bolton ratio should be approximately 77.2. The Bolton analysis is a quick and reliable way to determine the appropriate space necessary for patients with congenitally missing lateral incisors.

The fourth and most predictable guide for determining the ideal replacement space is to construct a diagnostic wax-up. Generally, the maxillary lateral incisor width ranges from 5 to 7 mm.

**Three Types of Tooth-Supported Prostheses**

There are 3 basic types of tooth-supported prostheses available today. They are a resin-bonded fixed bridge, a cantilevered fixed bridge, and a conventional full-crown fixed bridge. The primary consideration among these treatment options is conservation of tooth structure. Ideally, the treatment of choice should be the least invasive option that satisfies both aesthetic and functional objectives for the patient.
Resin-bonded Fixed Bridge—This is the most conservative method for replacing a missing lateral incisor with a tooth-supported prosthesis. The success rate with this type of prosthesis varies widely from 46% over 11 months to 90% over 11 years, with the most common form of failure being debonding. The specific criteria for a successful treatment using a resin-bonded fixed bridge include the position, mobility, thickness, and translucency of the abutment teeth as well as the overall occlusion.

Resin-bonded fixed bridges placed in a deep overbite relationship have been shown to have a higher incidence of failure. The ideal anterior relationship for a resin-bonded fixed bridge is a shallow overbite. Another concern regarding tooth position is inclination of the abutment teeth. Abutment teeth with increased inclination are more prone to debonding. The mobility of the abutment teeth is a contraindication for a resin-bonded fixed bridge. A final area of concern regarding placement of a resin-bonded fixed bridge is occlusal parafunction, which places too much stress on the pontic and subsequently results in prosthesis failure. Abutment teeth that are immobile, moderately thick, and have translucency mainly localized in the incisal one third are ideal candidates for a resin-bonded fixed bridge. A shallow overbite allows maximum surface area for bonding retainers with little or no tooth preparation.

Cantilever Bridge—The second most conservative tooth-supported prosthesis designed to replace a congenitally missing lateral incisor is a cantilevered fixed bridge. The success of this type of restoration is not dependent on the amount of proclination or mobility of the abutment teeth. Intracoronal pins provide retention and resistance for a cantilevered bridge; therefore, the size of the pulp and its location within the tooth must be evaluated prior to the selection of this type of restoration. The long-term success of the cantilevered fixed bridge depends on management of the effects of occlusion on the pontic(s). Heavy occlusal forces applied on the pontics cause early failures.

Conventional Full-Coverage Fixed Bridge—The least conservative but sturdiest of all tooth-supported protheses is a conventional full-coverage fixed bridge. A conventional fixed bridge exerts control over the occlusion and occlusal forces. Before a full-coverage fixed bridge is placed, the alignment of the anticipated abutment teeth along a common pathway must be well planned.
be verified. From the frontal view, the long axis of the central incisor and the labial surface of the canine should be parallel. This allows the prosthodontist to achieve the proper “line of draw” when preparing these teeth. Also, from a lateral perspective, the long axis of the canine and the labial surface of the central incisor must be parallel for proper tooth preparation. The orthodontist must know how to align these teeth according to the specific restorative requirements for the chosen prosthesis. Another consideration is the faciolingual position of the abutment teeth as it relates to palatal tooth preparation and the amount of preparation. The orthodontist can help to reduce the need for tooth preparation by leaving an overjet of approximately 0.5 to 0.75 mm.  

Each of the above prosthetic methods can be used with a high degree of success if used in the appropriate situation. Interdisciplinary management of patients with congenitally missing lateral incisors often plays a vital role in the success of the treatment. The combined efforts of the prosthodontist and orthodontist can produce predictable and aesthetic treatment results for congenitally missing lateral incisors (Figures 5 to 9).

**SINGLE-TOOTH IMPLANT**

Today, the single-tooth implant has become one of the most common treatment alternatives for the replacement of missing teeth. As with treatment that uses fixed bridges, an interdisciplinary approach is necessary to provide the most predictable treatment results when single-tooth implants are inserted to replace congenitally missing lateral incisors. Osseointegration enables long-term stability of a prosthesis supported by a single-tooth implant.  

The most important advantage of using implants to replace missing lateral incisors is that they leave proximal teeth untouched. Implants have become the restoration of choice for most patients when the treatment option is to open space. For implant treatment to be successful, there must be an adequate intercoronal and interradicular space opening and root paralleling of the adjacent teeth, including the apical areas, and the abutment teeth must be completely stabilized.

When maxillary lateral incisors are congenitally missing, permanent canines frequently erupt mesial to their normal positions. After the canine has erupted, it can be moved...
distally into its normal position by orthodontic treatment. By moving the tooth distally, bone is laid down, forming an alveolar ridge with adequate buccolingual width to allow proper implant placement. Since implants are most suitable as a restorative option for adults after facial growth is complete, the need to maintain alveolar bone for several years until growth has ceased presents another challenge.\(^{32,33}\)

**SUMMARY**

The 2 major treatment approaches for congenitally missing maxillary lateral incisors are space closure via orthodontic therapy, or space opening to allow prosthodontic replacements either with a fixed prosthesis or single-tooth implant. Both of these treatment approaches can potentially compromise aesthetics, periodontal health, and function. It is essential for an interdisciplinary dental specialty team to establish realistic treatment objectives, communicate the sequence of treatment, interact during treatment, evaluate dental and gingival aesthetics, and position teeth to permit proper prosthetic treatment. If this interdisciplinary approach is used, the aesthetics and long-term dental health of the patient following treatment will be greatly enhanced.

**REFERENCES**

Congenitally Missing Maxillary Lateral Incisors: Treatment


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1. Other than third molars, which teeth are most commonly missing?
   a. Maxillary second premolars.
   b. Mandibular central incisors.
   c. Maxillary lateral incisors.
   d. Mandibular second molar.

2. Congenital missing teeth are frequently associated with these dental anomalies, EXCEPT:
   a. Palatal displacement of canines.
   b. Distal angulation of premolars.
   c. Macroodontia.
   d. Agenesis of other teeth.

3. Which treatment option(s) is/are recommended for replacement of missing maxillary lateral incisors?
   a. Canine substitution.
   b. A tooth-supported prosthesis.
   c. A single-tooth implant.
   d. All of the above.

4. Which of the following is a criterion for selecting treatment options for congenitally missing maxillary lateral incisors?
   b. Size and shape of the canine.
   c. Existence of a skeletal malocclusion.
   d. All of the above.

5. The decision whether to perform a canine substitution or space opening for the restoration of missing maxillary lateral incisors depends on:
   a. The patient’s age.
   b. Treatment expectations.
   c. Financial obligations.
   d. All of the above.

6. What is the primary criterion for selecting canine substitution to replace a missing maxillary lateral incisor?
   a. Canine shape and color.
   b. The presence of malocclusion.
   c. Lip level and gingival contours.
   d. Facial profile.

7. For skeletal Class III profile patients with congenitally missing maxillary lateral incisors, which treatment option is generally not recommended?
   a. A canine substitution.
   b. A single-tooth implant.
   c. A full-coverage fixed bridge.
   d. A resin-bonded fixed bridge.
8. The contact point between maxillary central incisors and maxillary canines might show open gingival embrasures. Open gingival embrasures are influenced by which of the following?
   a. Direction of tooth movement.
   b. The labiolingual thickness of the supporting periodontal tissue.
   c. The shape of crowns.
   d. All of the above.

9. After space opening to restore missing maxillary lateral incisors, the alveolar ridge and adjacent root positions must be evaluated with:
   a. A diagnostic model.
   b. Radiographs.
   c. A set-up model.
   d. Palpation.

10. The anterior Bolton ratio should be approximately:
   a. 67.3%.
   b. 77.2%
   c. 87.2%.
   d. 91.3%.

11. The most predictable guide for determining ideal space for a missing maxillary lateral incisor replacement is:
   a. Assessing the “golden proportion” from a frontal perspective.
   b. Using contralateral lateral incisors as a reference.
   c. Constructing a diagnostic wax-up.
   d. Using Bolton’s Ratio as an estimation.

12. The ideal tooth relationship for a resin-bonded fixed bridge is:
   a. Abutment teeth with increased inclination.
   b. A shallow overbite.
   c. Mobile abutment teeth.
   d. The presence of occlusal parafunction.

13. What is the main benefit of treating patients with orthodontic space closure rather than with a prosthetic replacement?
   a. Decreased prevalence of temporomandibular joint disorder symptoms.
   b. Improved mastication.
   c. Improved speech and pronunciation.
   d. Periodontal health with less accumulation of plaque and gingivitis.

14. What would be the least invasive treatment option be for a tooth-supported prosthesis replacement of congenitally missing maxillary lateral incisors?
   a. A resin-bonded fixed bridge.
   b. A cantilever bridge.
   c. A full-coverage fixed bridge.
   d. A three fourths coverage fixed bridge.

15. For a single implant to be successful with a congenitally missing maxillary lateral incisor, the following is necessary:
   a. Adequate intercoronal space opening.
   b. Adequate interradicular space opening.
   c. Root paralleling of adjacent teeth.
   d. All of the above.

16. The most important advantage of using implants as a replacement of congenitally missing maxillary lateral incisors is:
   a. They are the most economical means of restoration.
   b. They leave adjacent teeth untouched.
   c. They erupt passively with alveolar bone when vertical growth is uncompleted.
   d. They don’t require root paralleling of adjacent teeth.
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