

Congenitally Missing Maxillary Lateral Incisor Treated with Atypical Extraction Pattern

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The congenital absence of one or more maxillary lateral incisors poses a challenge to effective treatment planning for general dentists and dental specialists. An evaluation of anterior smile esthetics must include both static and dynamic evaluations of frontal and profile views to optimize both dental and facial appearance. This article presents a case with canine substitution treatment to replace a missing maxillary lateral incisor combined with the extraction of two mandibular lateral incisors and a small maxillary lateral incisor. Both the patient's occlusion and facial appearance were significantly improved after orthodontic treatment.

Keywords: Missing maxillary lateral incisor, canine substitution, mandibular incisor extraction

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INTRODUCTION

Missing maxillary lateral incisors are one of the most common dental problems.^{1,2} Hypodontia, the absence of one or more teeth, is caused by a disturbance that occurs during the first stage of tooth formation (the initiation or proliferation stage). In general, if a tooth is absent, the most distal tooth of a given type will be affected. Disturbances that occur during the later stage of dental development (differentiation stage) result in tooth malformations, most commonly presenting as size variations.³

Congenitally missing teeth are often related to other

dental anomalies such as microdontia, delayed tooth development, or ectopic tooth eruption.^{4,5} 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.⁵⁻⁷

The congenital absence of one or more maxillary lateral incisors creates a potential imbalance in the dental arch length in the permanent dentition. Treatment planning for congenitally missing maxillary lateral incisors often presents a difficult task for clinicians because both esthetic and functional treatment results are desired. In order to create the most predictable esthetic results, it is important to choose a treatment that will best focus on the initial diagnosis.⁸ To correct the problem of missing teeth and provide esthetic anterior tooth shape, patients must be informed of their total dental needs, not just those related with a limited specialty.⁹ This clinical report presents a successful treatment in which a congenitally missing maxillary lateral incisor was replaced with canine, a small maxillary lateral was extracted, and two mandibular incisors were extracted to relieve crowding and improve the patient's profile.

Case Report

A 7-year 6-month-old female patient was referred to the orthodontist by her dentist for evaluation of malocclusion. A review of her medical history showed nothing remarkable. She presented with mesofacial, a symmetrical face and protrusive lips (Figure 1). Clinical examination showed an early mixed dentition comprised of permanent maxillary first molars, permanent maxillary central incisors, permanent

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Figure 1. Pretreatment facial photographs.

mandibular first molars, and permanent mandibular central and lateral incisors. Amalgam filling was noticed in the left deciduous maxillary first molar. Because of tooth size-arch length discrepancies in her permanent dentition, the patient will develop severe crowding in both arches. She presented with a Class I molar relationship and a Class I primary

canine relationship with 1 mm overjet and 10% overbite. The mandibular dental midline was deviated to the right side about 2.5 mm (Figure 2).

A panoramic radiograph showed no caries or pathologies. Her left permanent maxillary lateral incisor was missing while her erupting right permanent maxillary lateral incisor showed microdontia (Figure 3A). Lateral cephalometric analysis revealed a slight skeletal Class II (ANB: 3.3°) tendency. However, because of the clockwise rotation of her jaws relative to SN, Wits revealed -6.7 mm along with a hyperdivergent growth pattern (SN-MP: 42.3°). Her maxillary and mandibular incisors were proclined (U1 to SN: 105.9°, IMPA: 100.6°) (Figure 3B and Table). The specific treatment objectives were to: (1) choose appropriate treatment options for her missing maxillary lateral incisor; (2) monitor the development of her permanent dentition and perform a mixed dentition space analysis to estimate the size of unerupted permanent teeth;^{10,11} (3) relieve the crowding on both arches and maintain a Class I molar relationship;



Figure 2. Pretreatment intraoral photographs.

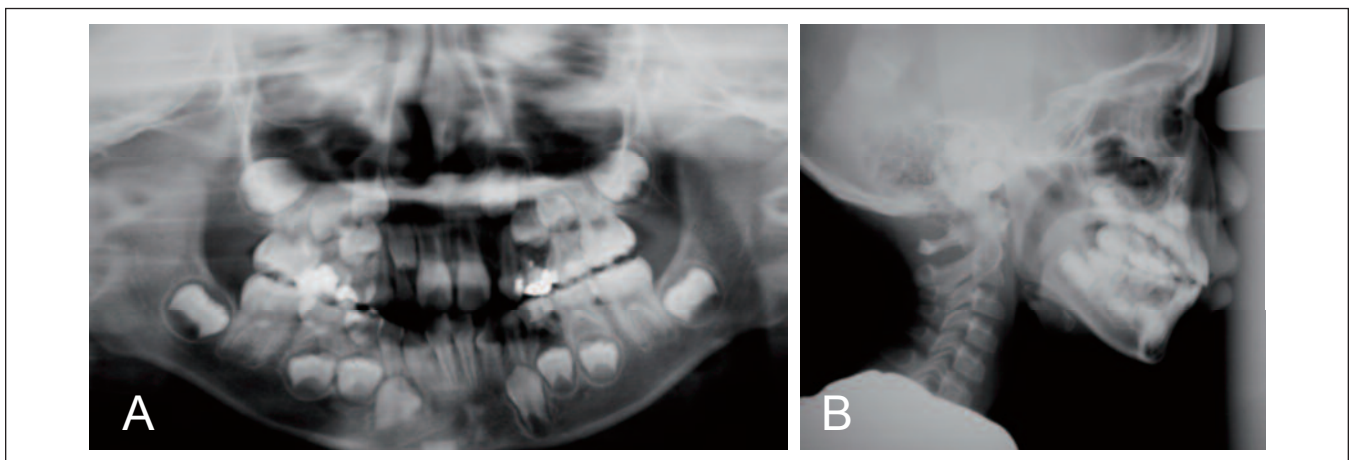


Figure 3. Pretreatment radiographs; A, panoramic radiograph; B, lateral cephalogram.



Figure 4. Intraoral photographs at 11.5 years old.

Table. Cephalometric measurements

Measurement	Japanese Norm	Pre-treatment	Post-treatment	3y Postretention
SNA (°)	82.0	77.9	78.6	78.8
SNB (°)	80.0	74.6	75.9	76.2
ANB (°)	2.0	3.3	2.7	2.6
Wits (mm)	1.1	-6.7	-5.0	-5.2
SN-MP	32.0	42.3	42.2	41.9
FH-MP	25.0	32.1	32.5	32.5
LFH(ANS-Me/N-Me)(%)	55.0	56.2	56.0	55.7
U1 to SN (°)	104.0	105.9	96.7	96.5
U1 to NA (°)	22.0	22.0	18.0	17.0
IMPA (°)	90.0	100.6	81.4	81.8
L1 to NB (°)	25.0	37.6	19.5	19.5
U1/L1 (°)	124.0	117.1	139.8	139.3
Upper lip (mm)	1.2	6.2	-2.5	-2.7
Lower lip (mm)	2.0	7.5	-2.0	-2.2

(4) correct her mandibular dental midline; and (5) improve her profile.

Because of issues in the early mixed dentition stage and the developing crowding of unerupted permanent teeth, it was recommended that the patient should visit the orthodontist every 6 months for a regular check-up and to determine when orthodontic treatment should begin. When the patient was 11 years 5 month old, it was determined that the patient was ready to start orthodontic treatment (Figures 4 and 5). Because the left permanent maxillary lateral incisor was missing and the right permanent maxillary lateral incisor showed microdontia, it was decided to extract the latter.

The missing left maxillary lateral incisor space could be opened for prosthetic replacement and the right small lateral could be restored. However, this treatment plan was not chosen because it would worsen the patient's profile due to the proclination of her maxillary incisors.

While extracting the two mandibular first premolars is



Figure 5. Panoramic radiograph at 11.5 years old.

the typical treatment of choice for two missing teeth or for when two teeth need to be extracted in the maxillary arch, extracting the mandibular incisors could be a therapeutic alternative if the occlusal results are acceptable. Kokich and Shapiro¹² reported that deliberate extraction of a lower incisor in certain cases allows the orthodontist to improve occlusion and dental esthetics with minimal orthodontic manipulation. In any such case, however, a full diagnostic set-up is required to predetermine the precise occlusal possibilities.^{12,13}

Even though the patient still had her deciduous second molars, a diagnostic set-up was fabricated to determine what the occlusal possibilities would be if 2 mandibular incisors and a maxillary right lateral incisor were extracted (Figure 6). Full-fixed .018 edgewise brackets (3M Unitek Corp, Monrovia, Calif) were placed on both arches. To replace her missing lateral and small lateral with canines, a special bracket placement was necessary for both maxillary canines and first premolars. The lateral incisor brackets were bonded to the canines and the canine brackets were placed on the first premolars. Before bonding the lateral incisor bracket on the canine, the labial surface was reshaped for the bracket adaptation. It was necessary to position the brackets gingivally to allow for extrusion of the canines to contour

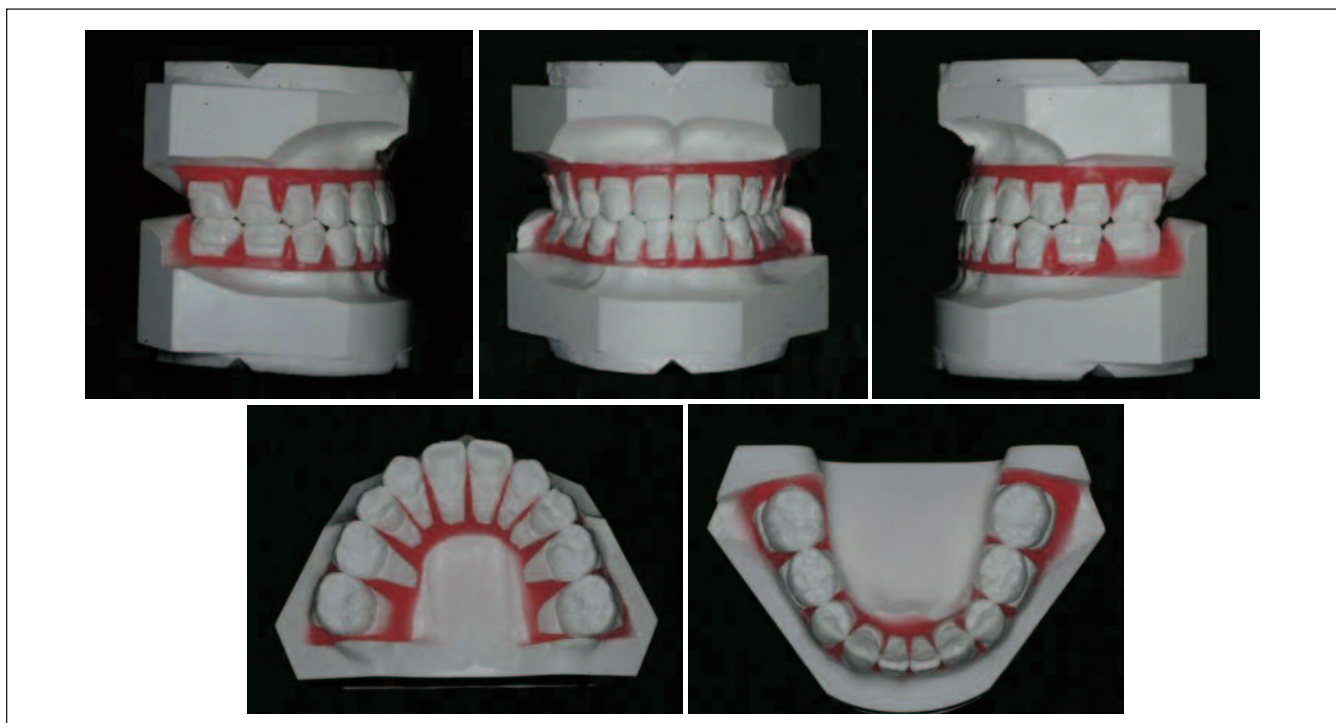


Figure 6. Diagnostic set-up model photographs.

gingival lines similar to the lateral incisors (Figure 7A). To make the canine appear less curved and more like a lateral incisor, the bracket was placed more distally in the center of the canine rather than at the height of contour (Figure 7B). In addition, a canine bracket was placed on the first premolar in the same mesiodistal position (more distally) as it was placed on the canine.

After the leveling stage using the sequential nickel

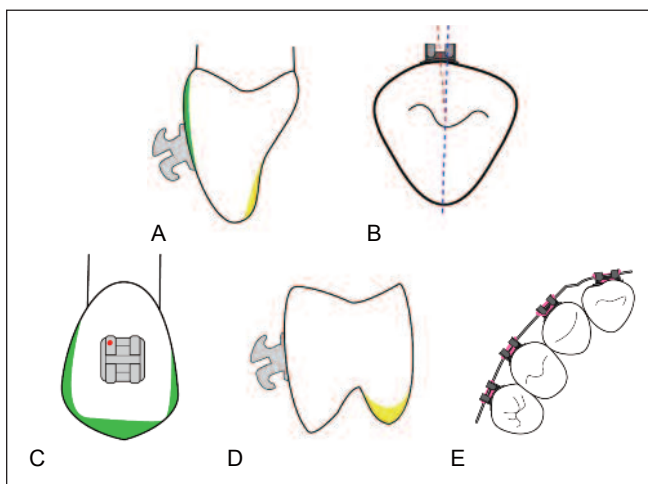


Figure 7. A. Recontouring (green area) of the prominent labial ridge of a canine before bonding a bracket. During the finishing stage, the lingual surface is reduced (yellow area) to establish a balanced occlusion. B. To make the canine appear less curved and more like a lateral incisor, the bracket is positioned more distally. C. Recontouring (green area) of the maxillary canine to simulate a lateral incisor. D. Enamel recontouring (yellow area) of the maxillary first premolar for canine substitution. E. To improve the interproximal contact points in the archwire design, the first order (in-out) bends were performed on the maxillary canines.

titanium archwire, the extraction spaces were closed using a .016" x .022" stainless steel archwires. During treatment, enamel was recontoured to flatten and create an incisal edge on the canine cusp tip (Figure 7C). To eliminate traumatic occlusion of the mandibular lateral incisors with the lingual surfaces of the canines and to establish a balanced occlusion, the lingual cusps of the maxillary canines and first premolars were recontoured (Figures 7A and 7D).^{9,14} In the finishing stage, .017" x .025" archwires were used for torque control. In addition, to improve the interproximal contact points, offset bends (in-out) were needed between the central incisor and canine (Figure 7E).

Total treatment time was 23 months. Following the treatment, a .0175 inch twistflex wire fixed retainer was bonded from first premolar to the first premolar on the mandibular arch. On the maxillary arch, a .0175 inch twistflex wire fixed retainer was bonded from canine to canine.

As a result of treatment, the patient's profile improved (Figure 8). The severe mandibular crowding has been relieved. Dental midlines were aligned with the patient's



Figure 8. Posttreatment facial photographs.

facial midline, and her overbite and overjet have been improved (Figure 9). The panoramic radiograph showed proper space closure and acceptable root parallelism, with no sign of bone or root resorption (Figure 10A). Lateral cephalometric analysis revealed no significant skeletal changes (ANB: 2.7°). To retrude her protrusive lips, the maxillary and mandibular incisors were retroclined (U1 to SN: 96.7°, and IMPA: 81.4°). Her upper and lower lip profile has improved. (Figures 10B and 11, Table). After three years of retention, the patient showed fairly stable occlusion (Figures 12–14).

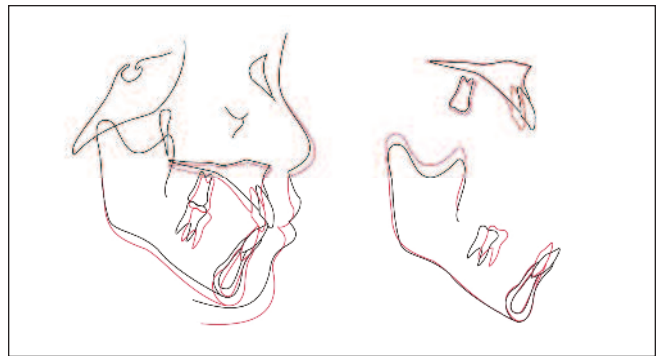


Figure 11. Cephalometric superimposition. Black line, pretreatment; red line, posttreatment.



Figure 9. Posttreatment intraoral photographs.

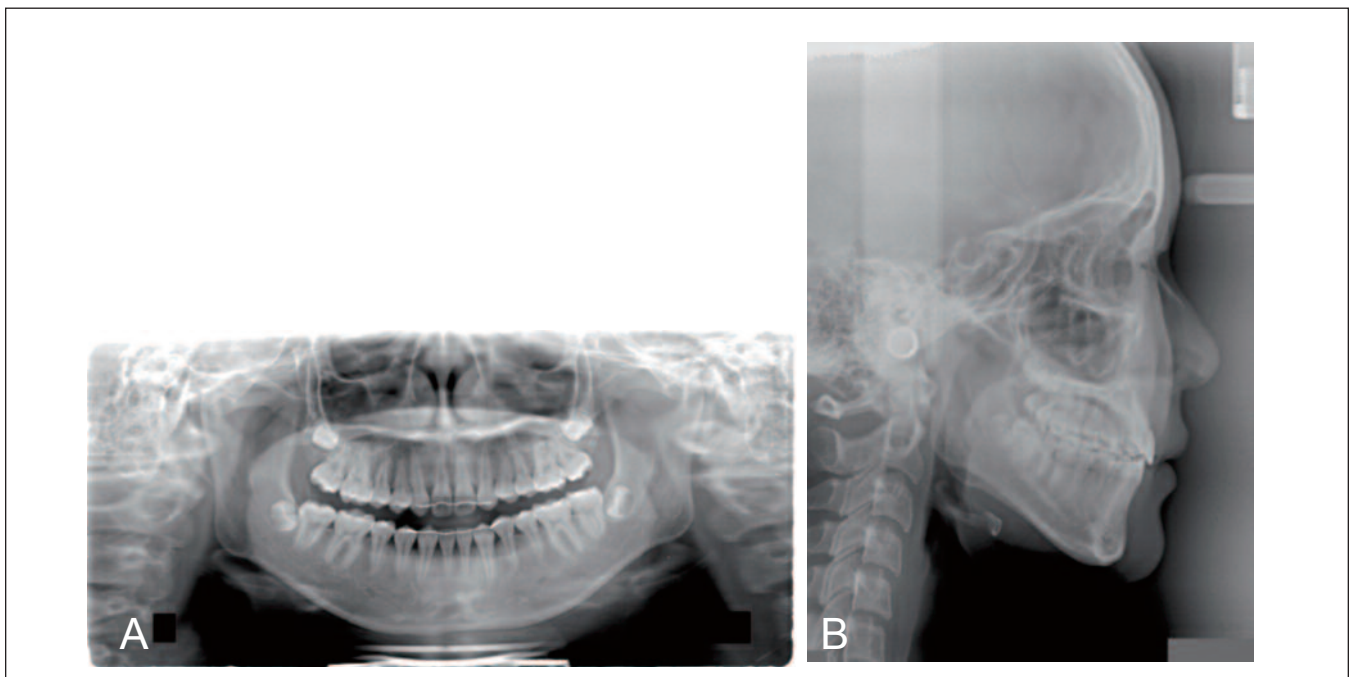


Figure 10. Posttreatment radiographs; A, panoramic radiograph; B, lateral cephalogram.



Figure 12. Three-year posttreatment facial photographs.

DISCUSSION

The treatment method chosen for congenitally missing maxillary lateral incisors should offer treatment results acceptable to both facial and dental esthetics. 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 position of the canines at the time of diagnosis, the color and shape of the canines, the posterior occlusal relationships, whether or not extractions would be necessary and the possibility for referring and coordinating prosthodontic treatment with orthodontic therapy.^{9,15}

In most cases, the skeletal malocclusion decides as the primary criteria in the treatment selection for congenitally missing maxillary lateral incisors.¹⁶ Aside from this, the appropriate treatment option for each patient depends on the specific space requirements, shape and size of the canines, and tooth-size relationship. 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 esthetic and functional requirements. In contemporary dentistry, there are three treatment options for replacing missing lateral incisors; a canine substitution, a single-tooth implant, or a tooth-supported prosthesis.

Often the ideal choice is a canine substitution of the



Figure 13. Three-year posttreatment intraoral photographs.



Figure 14. Three-year posttreatment CBCT images; A, panoramic rendering; B, lateral maximum intensity projection (MIP) images.

maxillary lateral incisor. Even though an orthodontist may position a canine in the most esthetic 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.⁸ The other treatment options, orthodontic space opening and lateral incisor replacement, 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, surgeon and prosthodontist.⁸⁻¹⁰

The extraction of a mandibular incisor could be chosen in the following clinical situations: anomalies in the number of anterior teeth, tooth size anomalies, ectopic eruption of incisors, and moderate Class III malocclusions.¹⁷ In this particular case, not only the maxillary left lateral incisor was missing, but maxillary right lateral incisor showed microdontia. In addition, two maxillary central incisors showed a discrepancy in the mesiodistal width compared with the six mandibular anterior teeth. After a small maxillary lateral and two mandibular lateral incisors were selected for extraction, a full diagnostic set-up was fabricated to pre-determine the occlusal possibilities.

Studies have reported that compared to typical premolar extraction, a mandibular incisor extraction is more stable,¹⁸⁻²⁰ however, a number of issues should be considered, such as the open anterior extraction site which could be unattractive or the mandibular dental midline which will not be coincident with the maxillary dental midline, or the loss of the interdental papilla leading to the potential formation of a black triangle, or the fact that it is usually not possible to have an ideal overjet and overbite while maintaining a correct transverse canine relationship except in cases where there is a significant Bolton²¹ discrepancy, characterized by small maxillary lateral incisors and large mandibular incisors.

In the case of mandibular incisor extraction or where congenitally missing maxillary lateral incisor space has been closed, even if clinical photographs of posterior occlusion seem to show ideal relationships, there is no canine contact. This raises the question of the importance of an ideal canine relationship. Some studies found no differences between group function and canine guidance.^{22,23} Furthermore, Riedel *et al*¹⁸ found that where there is significant crowding it may be reasonably treated with either premolar or incisor extraction, but one or two incisor extractions might yield a more stable result. Note that this is not a recommendation to resolve all cases of mandibular crowding with mandibular incisor extraction; rather, it's a factor when considering treatment options.^{13,18,24}

CONCLUSION

There are several dentofacial criteria that must be evaluated before selecting canine substitution treatment for replacing a missing maxillary lateral incisor. Although the indication to extract mandibular incisors is relatively rare, in the right situation and when properly planned, it can be an effective treatment option.

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