

Orthodontic Space Closures with Canine Substitution for Bilateral Congenitally Missing Maxillary Lateral Incisors: A Case Report

Sutti Malaivijitnond*

Abstract

Missing maxillary lateral incisors creates an esthetic and functional issue that necessitates unique orthodontic and restorative considerations. Consequently, various patient-specific factors, in particular patient satisfaction, should be meticulously evaluated prior to determining whether to close the space with canine substitution or open the space with tooth replacement. This case report describes successful space closure and canine repositioning used in the orthodontic treatment of a 25-year-old female patient with Class I malocclusion with bimaxillary dental protrusion and bilateral congenitally missing maxillary lateral incisors. Enhancing a patient's appearance and functionality requires minimizing the use of a prosthesis and improving the patient's facial profile, which includes the canine-like size, color, and shape of the maxillary first premolar. Orthodontic treatment was completed, with favorable results. The treatment time was 25 months. Although this case required some adjunctive procedures to improve the esthetics, the patient declined as she was very satisfied with the achieved results. After two years of follow-up, a stable occlusion with a satisfactory facial profile and functional excursion without interference was achieved. Functionality and esthetics can be improved by choosing this approach, which is less invasive as well as more economical.

Keywords: Canine substitution, Missing maxillary lateral incisor, Orthodontic space closure

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Introduction

Permanent tooth agenesis is one of the most common developmental anomalies in humans¹ with an incidence ranging from 1.60 % to 9.60 %, excluding third molars, which occur in 20 % of the population.² The frequency of congenitally missing maxillary lateral incisors varies greatly between populations. The majority of reports in the literature show a variation between 1 % and 3 % for missing lateral incisors.³ According to research by Kanchanasevee et al., 8.98 % of Thai people have tooth agenesis with the maxillary lateral incisor being the third most prevalent form of missing teeth after the mandibular second premolar and mandibular lateral incisor.⁴ Dental agenesis is mostly caused by genetic factors⁵ but it can also be caused by environmental factors, such as dentoalveolar trauma⁶ and radiation therapy.⁷ Agenesis of both maxillary lateral incisors is more common than agenesis of only one, and it occurs slightly more frequently in females.⁸

Concerns about how to manage agenesis instances, particularly those involving lateral incisors, have persisted in the fields of orthodontics and restorative dentistry. Thorough diagnostic and thorough multidisciplinary treatment planning are required to determine whether to open a lateral incisor space for a prosthesis or close the space with canine mesial movement. In either case, the best option of treatment for maxillary lateral incisor agenesis must be determined to achieve the optimal esthetic, occlusal (functional), and periodontal outcomes. When treating patients with either a space opening or closure because their maxillary lateral incisors are missing, there are a lot of considerations. These factors include the type of malocclusion, age of the patient, tooth-to-tooth connections, crowding/spacing, canine position, canine morphology, canine color, lip level, and the patient's expectations from treatment.^{9,10} If these selection criteria are fulfilled, the patient can expect a functional and esthetically pleasing end result.¹⁰

This case report aims to present a successful orthodontic treatment for bilateral congenitally missing maxillary lateral incisors by space closure with repositioning the canines. The functionality and esthetics can improve by choosing this less invasive and less costly approach.

Case report

Case history and diagnosis

A 25-year-old Thai female came to the orthodontic clinic with the chief complaint of difficulty biting and the desire to improve the appearance of her protruding lips and her anterior teeth spacing. She was physically healthy, had no medical history, and her teeth had previously been straightened. She had facial symmetry with a convex profile, an acute nasolabial angle, upper and lower lips protrusion, incompetent lips during relaxation, hyperactive mentalis muscle, and a normal smile line. The intraoral examination presented Class I canine and molar relationships on both sides with clinical absence of the maxillary left and right lateral incisors. She was wearing circumferential retainers with bilaterally positioned maxillary lateral incisor pontics and a fixed lower 3-3 retainer to maintain her teeth and appearance. The patient also presented with reduced overjet and overbite. The maxillary and mandibular dental midlines were coincident with the facial midline. In addition, a tongue thrusting habit during swallowing was observed (Figure 1 and Figure 2).

A panoramic radiograph revealed missing maxillary lateral incisors and the presence of all third molars. The overall alveolar bone level was within normal limits (Figure 3). The cephalometric analysis indicated a skeletal Class II relationship with an ANB angle of 7° due to a slightly prognathic maxilla (SNA = 88°) and an orthognathic mandible (SNB = 81°). Vertically, the patient had a high-angle tendency (FMA = 33°) and hyperdivergent facial pattern. The dental relationship evaluation indicated an acute interincisal angle (U1-L1 = 93°) due to both maxillary and

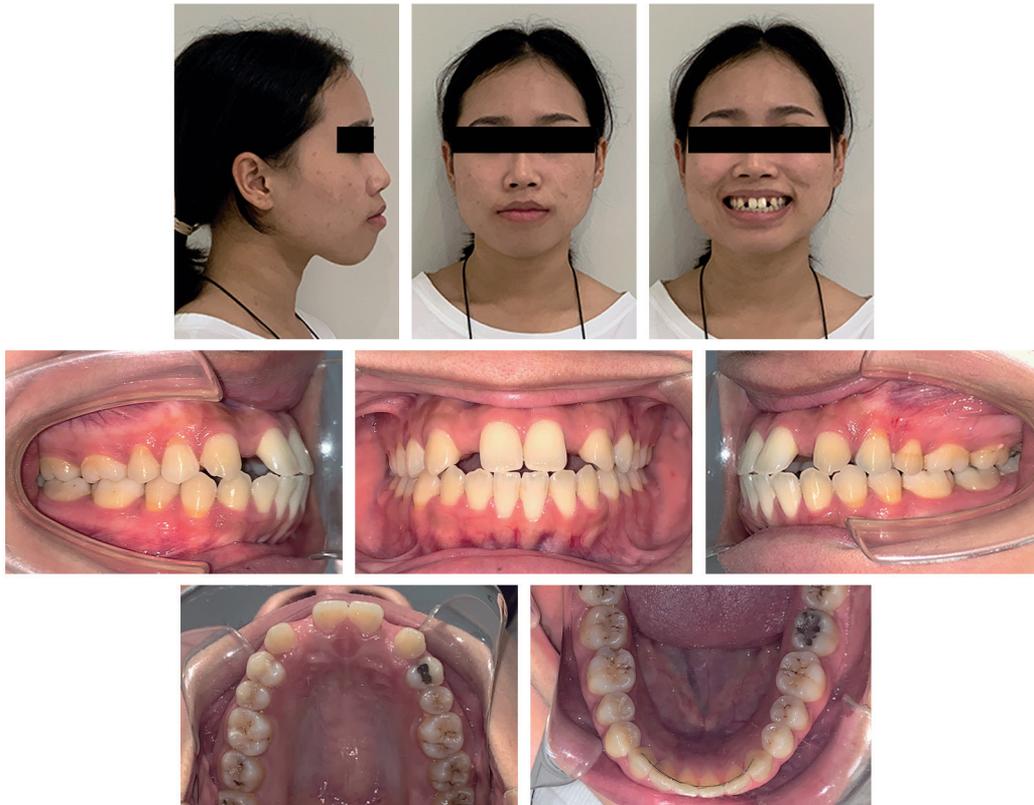


Figure 1 Pretreatment facial and intraoral photographs.

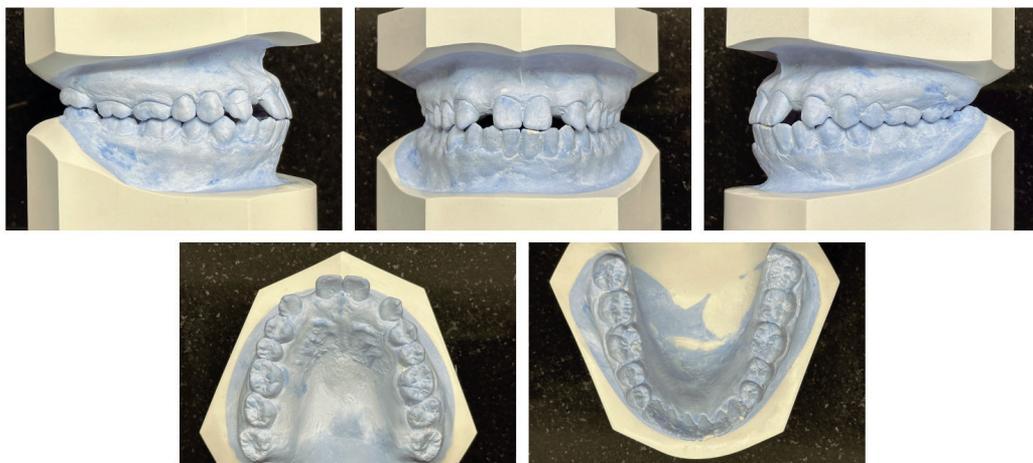


Figure 2 Pretreatment dental cast photographs.

mandibular incisors that were in forward positions and protruded. In relation to the E-line, the upper and lower lips protruded (Figure 4 and Table 1).

The diagnosis of this case according to the skeletal, dental, and soft tissue parameters was 1) skeletal Class II hyperdivergent pattern with prognathic maxilla and orthognathic mandible, 2) dental Class I

malocclusion with bilateral congenitally missing maxillary lateral incisors, maxillary anterior teeth spacing and well-aligned mandibular anterior teeth, proclined and forward positioned maxillary and mandibular incisors with coinciding maxillary and mandibular dental midlines, and 3) convex facial profile and protruded upper and lower lips.

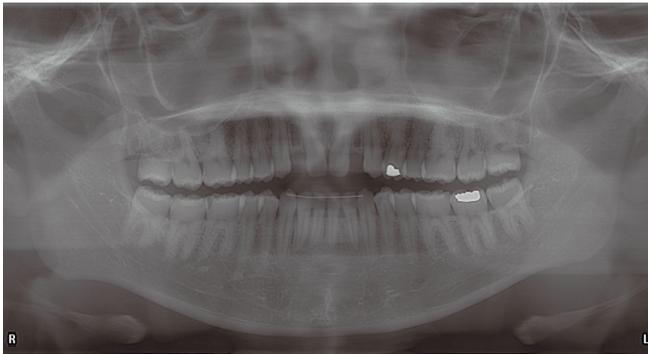


Figure 3 Pretreatment panoramic radiograph.

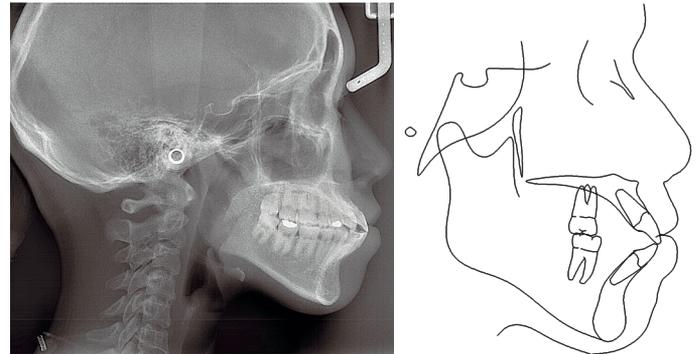


Figure 4 Pretreatment lateral cephalometric radiograph and tracing.

Table 1 Pretreatment cephalometric analysis (Thai norm).¹¹

| Area | Measurement | Norm Mean \pm SD | Pretreatment | Interpretation | |
|--------------------|---------------------------|--------------------|--------------|---------------------------------|--------------------------------|
| Reference line | FH-SN (degree) | 6 \pm 3 | 5 | Normal cranial base inclination | |
| Skeletal | Maxilla to cranial base | SNA (degree) | 84 \pm 4 | 88 | Orthognathic maxilla |
| | | SN-PP (degree) | 9 \pm 3 | 8 | Normal inclination of maxilla |
| | Mandible to cranial base | SNB (degree) | 81 \pm 4 | 81 | Orthognathic mandible |
| | | SN-MP (degree) | 29 \pm 6 | 34 | Normodivergent pattern |
| | | SN-Pg (degree) | 82 \pm 3 | 81 | Orthognathic mandible |
| | | NS-Gn (degree) | 68 \pm 3 | 70 | Normodivergent pattern |
| | Maxillo-mandibular | ANB (degree) | 3 \pm 2 | 7 | Skeletal Class II |
| | | Wits (mm) | -3 \pm 2 | 0 | Skeletal Class II |
| MP-PP (degree) | | 21 \pm 5 | 26 | Normodivergent pattern | |
| FMA (degree) | | 23 \pm 5 | 33 | Hyperdivergent pattern | |
| Dental | Maxillary dentition | U1 to NA (degree) | 22 \pm 6 | 26 | Normal inclined upper incisor |
| | | U1 to NA (mm) | 5 \pm 2 | 10 | Forward position upper incisor |
| | | U1 to SN (degree) | 108 \pm 6 | 118 | Proclined upper incisor |
| | Mandibular dentition | L1 to NB (degree) | 30 \pm 6 | 47 | Proclined lower incisor |
| | | L1 to NB (mm) | 7 \pm 2 | 24 | Forward position lower incisor |
| | | L1 to MP (degree) | 99 \pm 5 | 110 | Proclined lower incisor |
| Maxillo-mandibular | U1 to L1 (degree) | 125 \pm 8 | 93 | Acute interincisal angle | |
| Soft tissue | Soft tissue | E line U. lip (mm) | -1 \pm 2 | 2 | Protruded upper lip |
| | | E line L. lip (mm) | 2 \pm 2 | 7 | Protruded lower lip |
| | Nasolabial angle (degree) | 91 \pm 8 | 113 | Obtuse nasolabial angle | |
| | H-angle (degree) | 14 \pm 4 | 19 | Protruded upper lip | |

Treatment objectives

The treatment objectives were the following: 1) perform orthodontic space closures with canine substitution for bilateral congenitally missing maxillary lateral incisors; 2) obtain Class I canine (first premolar) and molar relationships with normal overjet and overbite; 3) create a good functional occlusion; 4) improve the facial esthetics; and 5) eliminate the tongue thrusting habit.

Treatment alternatives

In the case of a missing maxillary lateral incisor, the key question becomes one of treatment planning. Should the space be opened and a prosthesis placed or should the canine be moved forward and reshaped to simulate the missing lateral incisor? A comprehensive interdisciplinary approach is required for treatment planning¹² in addition to many factors that must be considered before making a decision. It seems reasonable to assume that both facial appearance and dental esthetics can be acceptable. Occlusal characteristics, such as overjet, overbite, and molar relationship, in addition to facial types and profile, arch length, and tooth size discrepancies are commonly influencing factors. Canine morphology, including size, shape, and color, may also influence the treatment modality.¹³ Finally, patient compliance and expectations may influence the development of a treatment plan.

Following the data collection, the interdisciplinary team discussed treatment options with the patient who had a Class II skeletal jaw relationship with a hyperdivergent pattern and missing maxillary lateral incisors. She had already undergone orthodontic treatment and presented with a convex profile, an acute nasolabial angle, and bimaxillary dental protrusion. It was expected that the treatment strategy used to address the issue of missing lateral incisors would have an impact on the patient's soft tissue profile due to the planned treatment goals for facial esthetics and function. It was reported that the

nasolabial angle significantly increased as a result of the retraction of the maxillary central incisors, and the upper lip also receded considerably.¹⁴ Patients with convex profiles and missing the maxillary lateral incisor teeth can benefit from proper orthodontic treatment; however, it is required to extract both mandibular first premolars. The maxillary anterior teeth can be retracted using the following procedures. 1) Use the maxillary first premolars to take the position of the canines and close the lateral incisor spaces with canine mesial movement. After that, retract the maxillary anterior teeth by closing the spaces that remain, therefore minimizing the requirement for prosthetic restorations. The canine-like size, color, and shape of the maxillary first premolar are further enhanced by this treatment, which also makes the canines appear more like the maxillary lateral incisors. 2) To create spaces, remove the maxillary first premolars, retract the maxillary anterior teeth, and keep the spaces for the maxillary lateral incisors. Next, replace the lateral incisors at both sites with dental implants.

To achieve the treatment goals, the patient preferred canine mesialization and the use of maxillary first premolars to replace the canines and retract the maxillary anterior teeth, followed by canine reshaping to resemble the lateral incisor. In a long-term clinical and radiographic follow-up study by Thordarson and colleagues, the canines were ground to the shape of lateral incisors as part of the orthodontic treatment.¹⁵ The patients were called back after 10 to 15 years for a clinical evaluation. The results, they said, were encouraging since reshaping the canines rather than using prosthetic devices to replace missing incisors can lead to better long-term esthetic outcomes and healthier periodontal status.

Completing the diagnostic wax-up is an important step in the patient selection process, as is evaluating the anterior tooth-size relationship when substituting canines for lateral incisors and using the maxillary first premolars to replace the canines (Figure 5). According to Bolton's analysis, the anterior ratio of this patient,

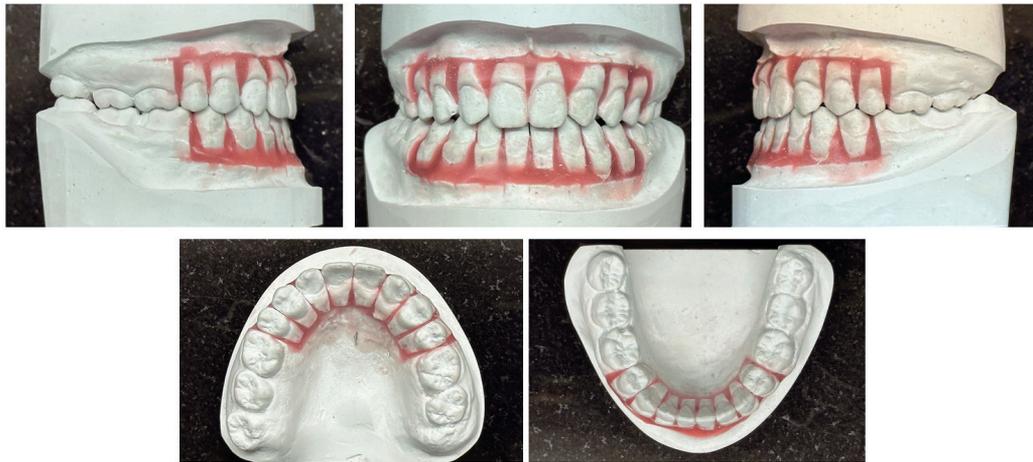


Figure 5 Set-up model.

which was 71 %, was less than normal. It is known that the optimal anterior ratio is 77.2 %. This indicates that the upper anterior tooth, measuring 4 mm, would be bigger than it should be. Therefore, it is frequently required to reduce the anterior tooth-size excess created in the maxillary arch in order to establish a normal overbite and overjet relationship.¹⁶ This allows the orthodontist to assess the final occlusion, determine how much canine reduction is required, and determine whether an esthetic final result is achievable.¹⁷

Treatment progress

The patient was treated with preadjusted 0.022" McLaughlin, Bennett, and Trevisi (MBT) prescription brackets after extraction of the mandibular first premolars, and both the maxillary and mandibular teeth were bonded. After the canines were moved mesially enough to allow adequate access to all proximal surfaces, the canines should have been reshaped but this was delayed until the end of treatment. To simulate the proper position of the canine eminence, the maxillary first premolar roots were torqued buccally while the canine roots were torqued palatally. The maxillary canine brackets on both sides were inverted for a +7° torque which nearly matched the torque of the maxillary lateral incisor tooth. The maxillary canine brackets were positioned

slightly gingivally to match with the gingival line and proper contact point of the maxillary central incisors. The first premolar bracket was positioned slightly distal to hide the palatal cusp of the first premolars on both sides and to give a cervical prominence as that of a canine.

The arches were aligned using the following sequence of archwires: 0.014" NiTi and 0.018" NiTi, 0.016" × 0.022" SS. Later, 0.017" × 0.025" SS wire followed by 0:019 × 0:025" SS wire was placed to level and express the prescription of the bracket. Consolidation of the anterior segment was achieved using an elastic chain. Retraction of the anterior teeth and using an elastic chain were employed to close all spaces left by sliding mechanics with a maximum anchorage situation. First-order bends were performed on the maxillary canines and "cuspid curves" were used on the first premolars to improve the interproximal contact points in the archwire design (Figure 6). Following the diagnostic wax-up, the patient was satisfied and was able to freely perform lateral movement. Therefore, the tip, canine convexity, and palatal cusp tip of the maxillary first premolars were not ground on the following visits. Bolton's analysis indicated that the anterior ratio was less than normal; however, the patient refused to have the maxillary canine teeth reduced. Therefore, the maxillary anterior teeth must be upright in order to provide a proper occlusion

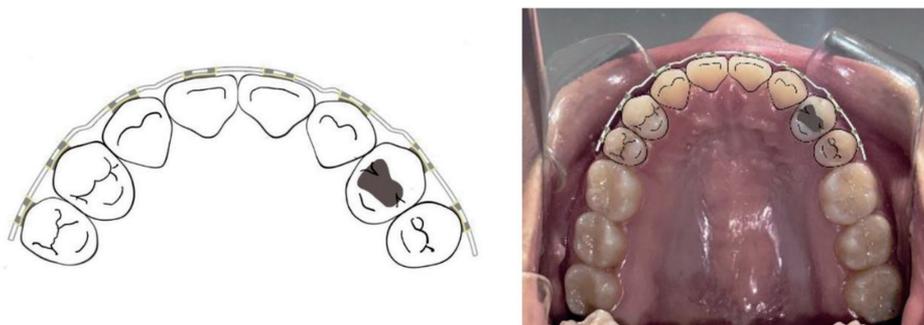


Figure 6 First-order (in-out) bends were performed on the maxillary canines, and “cuspid curves” were used on the first premolars to improve the interproximal contact points in the archwire design.



Figure 7 Posttreatment facial and intraoral photographs.

with an optimal overjet and overbite. From earlier research, it is clear that the canine is a larger tooth than the lateral incisor it would replace. The underlying dentin may start to show through the thin enamel if a substantial quantity of enamel is removed to make the right surface contours, which would reduce the esthetics.¹⁸ In any case, Zachrisson showed that extensive grinding with diamond instruments and a lot of water spray cooling can be done on immature teeth without affecting their sensitivity over a long period of time. However, he found that for 1-3 days after grinding, temperature variations led to temporary increases in

tooth sensitivity.^{15,19} Finishing and detailing were done, and the appliance was debonded. The total treatment time was 25 months. In the retention phase, wrap around retainers were placed in both arches.

Treatment results

The post-treatment facial photographs exhibited a remarkable improvement of facial esthetics, and the patient's smile had improved. Intraorally, an optimal overbite and overjet relationship was established. A well-interdigitated buccal occlusion with class I molar relationship and a class I canine (first premolar)

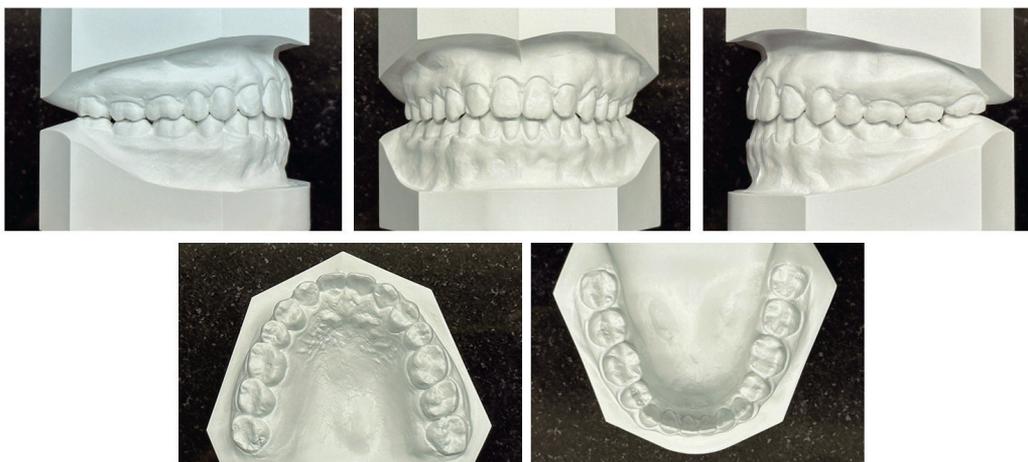


Figure 8 Posttreatment dental cast photographs.

Table 2 Comparison of pretreatment and post-treatment dental cast analysis.

| Parameters | | Pretreatment | Post-treatment |
|----------------------|--------------------|-------------------|-------------------|
| Overjet | | 0.50 mm | 2 mm |
| Overbite | | 0.50 mm | 2 mm |
| Canine relationships | Right | Class I | Class I |
| | Left | Class I | Class I |
| Molar relationships | Right | Class I | Class I |
| | Left | Class I | Class I |
| Upper | Midline | Center | Center |
| | Arch form | Paraboloid-shaped | Paraboloid-shaped |
| | Inter canine width | 35 mm | 37.50 mm |
| | Inter molar width | 54 mm | 52 mm |
| Lower | Midline | Center | Center |
| | Arch form | Paraboloid-shaped | Paraboloid-shaped |
| | Inter canine width | 29 mm | 28 mm |
| | Inter molar width | 52 mm | 46 mm |

relationship on both sides were achieved, as well as upper and lower dental midlines which coincided with the facial midline (Figures 7 and 8). According to a previous study, mandibular intercanine width tends to expand during treatment by 1-2 mm and contract postretention to approximately the original dimension.²⁰ In this case, the mandibular intercanine

width was reduced slightly by 1 mm to avoid traumatic occlusion between the mandibular canine’s cusp tip and the inclined plane of the buccal cusp of the maxillary first premolar. Since the maxillary first premolar is now used instead of the maxillary canine, the maxillary intercanine width increased slightly by 2.50 mm (Table 2). There was canine guidance



Figure 9 Posttreatment panoramic radiograph.

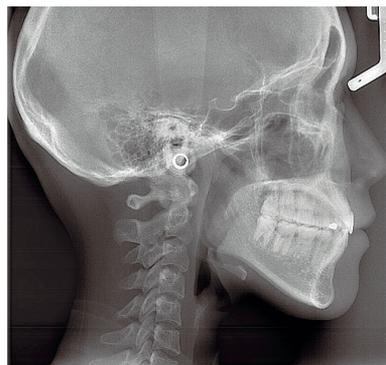
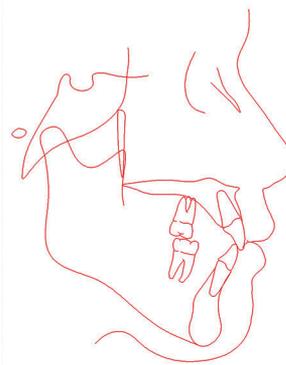


Figure 10 Posttreatment lateral cephalometric radiograph and tracing.



in lateral excursions with proper anterior guidance without balancing side interferences. The spaces left by missing maxillary lateral incisors were closed with canine mesialization. Contact of the canines, gingival line, and color in relation to the surrounding teeth should all be in acceptable condition. This case was completed with esthetically and functionally satisfactory results. Although this case required some adjunctive procedures to improve the esthetics, the patient decided she was very satisfied with the achieved results. Radiographs revealed parallelism of dental roots and no root resorption of the maxillary canines or other teeth (Figure 9). The post-treatment cephalometric radiograph (Figure 10) showed significant changes in the dental measurements after treatment. In particular, the measurements intended to decrease the protrusion of the anterior teeth (U1-NA, U1-SN, L1-NB, L1-MP, U1-L1).

Appropriate anchorage control was applied to both the maxillary and mandibular molars by adding a reverse curve of Spee on the main arch wires and bonding buccal tubes to the third molars for increased anchorage. In the lateral cephalometric analysis between the pretreatment and post-treatment stages, there was no increase in face height, but the technique significantly decreased the protrusion of the maxillary anterior teeth (Figure 11). Furthermore, both the maxillary and mandibular incisors had lingual

inclinations with a 42° increase in the interincisal angle. According to the cephalometric superimposition, the skeletal measurement variables had not changed; however, the interincisal angle had increased. Furthermore, the soft tissue profile indicated that the upper and lower lip had moved backward with a 2 mm decrease in the U-lip to E-line and a 7 mm decrease in the L-lip to E-line.

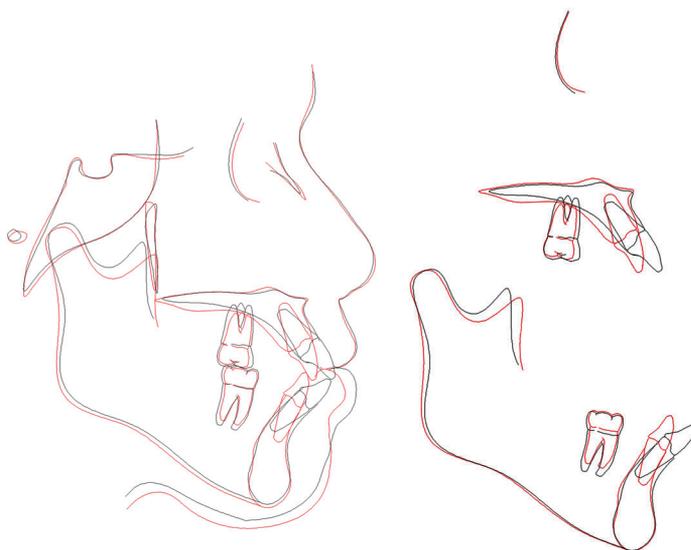


Figure 11 Cephalometric superimpositions between the pretreatment and posttreatment stages: overall, maxilla, and mandible. The black and red lines showed pretreatment and post-treatment, respectively.

Table 3 Pretreatment, posttreatment, and postretention cephalometric analysis (Thai norm).

| Area | | Measurement | Norm Mean \pm SD | Pretreatment | Posttreatment | Postretention |
|----------------|--------------------------|---------------------------|-----------------------|--------------|---------------|---------------|
| Reference line | | FH-SN (degree) | 6 \pm 3 | 5 | 5 | 5 |
| Skeletal | Maxilla to cranial base | SNA (degree) | 84 \pm 4 | 88 | 88 | 88 |
| | | SN-PP (degree) | 9 \pm 3 | 8 | 8 | 8 |
| | Mandible to cranial base | SNB (degree) | 81 \pm 4 | 81 | 81 | 81 |
| | | SN-MP (degree) | 29 \pm 6 | 34 | 34 | 34 |
| | | SN-Pg (degree) | 82 \pm 3 | 81 | 81 | 81 |
| | | NS-Gn (degree) | 68 \pm 3 | 70 | 70 | 70 |
| | Maxillo-mandibular | ANB (degree) | 3 \pm 2 | 7 | 7 | 7 |
| | | Wits (mm) | -3 \pm 2 | 0 | 0 | 0 |
| | | MP-PP (degree) | 21 \pm 5 | 26 | 26 | 26 |
| | | FMA (degree) | 23 \pm 5 | 33 | 33 | 33 |
| Dental | Maxillary dentition | U1 to NA (degree) | 22 \pm 6 | 26 | 13 | 14 |
| | | U1 to NA (mm) | 5 \pm 2 | 10 | 1 | 2 |
| | | U1 to SN (degree) | 108 \pm 6 | 118 | 99 | 100 |
| | Mandibular dentition | L1 to NB (degree) | 30 \pm 6 | 47 | 25 | 26 |
| | | L1 to NB (mm) | 7 \pm 2 | 24 | 8 | 9 |
| | | L1 to MP (degree) | 99 \pm 5 | 110 | 84 | 85 |
| | Maxillo-mandibular | U1 to L1 (degree) | 125 \pm 8 | 93 | 135 | 134 |
| Soft tissue | Soft tissue | E line U. lip (mm) | -1 \pm 2 | 2 | 0 | 0 |
| | | E line L. lip (mm) | 2 \pm 2 | 7 | 0 | 0 |
| | | Nasolabial angle (degree) | 91 \pm 8 | 113 | 117 | 117 |
| | | H-angle (degree) | 14 \pm 4 | 19 | 18 | 18 |

During the postretention phase, which occurred two years and two months after the end of active treatment, no significant changes in the facial profile or occlusion were observed. Also, stable occlusion with a satisfactory facial profile and functional excursion without interference were achieved. The maxillary canines and neighboring teeth were in good condition but the patient declined to reshape the maxillary

canines to resemble lateral incisors and grind the lingual cusp of the maxillary first premolars (Figures 12-14). A comparison of post-treatment and postretention lateral cephalograms revealed only minor differences in the U1-NA, U1-SN, L1-NB, L1-MP, and interincisal angle (Figure 15 and Table 3). The patient maintained a stable occlusion without functional interference.



Figure 12 Postretention facial and intraoral photographs.



Figure 13 Postretention dental cast photographs.



Figure 14 Postretention panoramic radiograph.

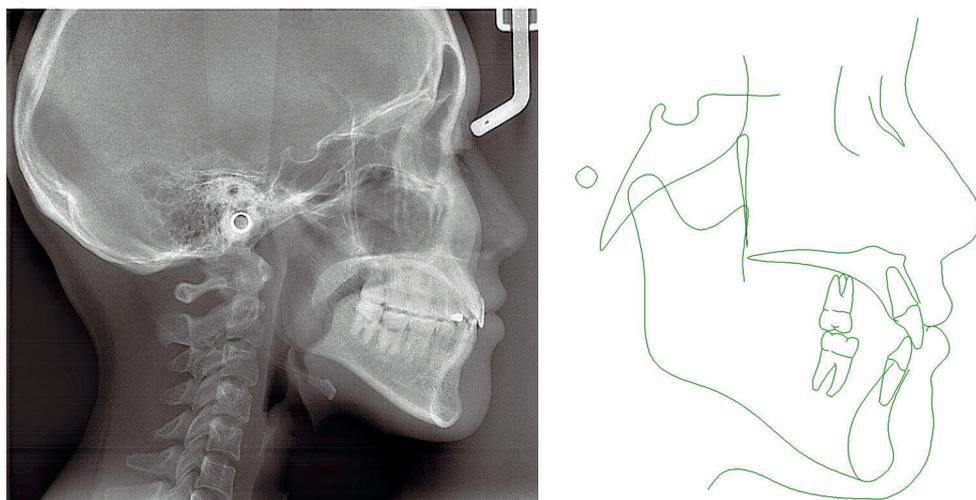


Figure 15 Postretention lateral cephalometric radiograph and tracing reveal a slight distinction between post-treatment and postretention.

Discussion

In many routine dental malocclusions, orthodontic treatment alone may not be sufficient to provide esthetic anterior teeth and correct agenesis. Therefore, patients must be informed of their total dental needs and not just those associated with a limited specialty. There are numerous difficulties in achieving and maintaining an ideal result, regardless of whether canine substitution, single implants, or tooth-supported restorations are the method of choice for patients with missing maxillary lateral incisors. Before closing the missing lateral incisor spaces by canine substitution, the degree of esthetic improvement varies depending on the shape and position of the canines and the clinician's ability to make these teeth resemble and function as lateral incisors.²¹ A lack of color contrast between the canines and central incisors, as well as inappropriate reshaping of the canines can result in an unpleasant esthetic result.¹⁹ Furthermore, the type of malocclusion determines whether the spaces are open or closed. If the anterior teeth protrude or crowd, Class I and II malocclusion is the ideal kind of occlusion because the space needs to be closed to allow for proper tooth alignment. Finally, patient satisfaction will influence the treatment plan.

The canines can be moved mesially to close the lateral spaces, which reduces the need for a prosthetic restoration, and the maxillary first premolars can be used to replace the canines. The maxillary anterior teeth can be retracted, which directly alters lip position and increases the nasolabial angle, which improves the facial profile. A canine-protected occlusion cannot be obtained when the canines are relocated mesially, although some clinicians advise against closing missing lateral incisor spaces because they consider achieving a canine-guided occlusion a mandatory orthodontic treatment goal.²² However, after space closure, a functional occlusion can be obtained with lateral group function.²³ Others have found no significant differences in the adequacy of occlusal function between groups with space opening and those with mesial movement of the canines.^{10,21} To improve occlusal stability, canine incisal edges should be reduced to eliminate premature contacts with the mandibular incisors.²⁴ Furthermore, grinding of the maxillary first premolars can be performed to limit cross-tooth balancing interferences.¹⁸

Over the past few decades, dental implants have emerged as one of the most popular biomaterials to replace one or more lost teeth;²⁵ however, not all patients

can benefit from this. The replacement of a missing lateral incisor by an implant is a predictable treatment approach. However, it might best to defer an implant until dental maturity, at which time a dental implant can be accurately placed in a well-developed site through a multidisciplinary approach. Many patients may benefit from orthodontic space closure because it reduces the number of dental implants required. The study found that subjects who had orthodontic space closure felt more confident in the appearance of their teeth than patients who wore prosthetics.¹⁰ Furthermore, while high implant survival rates are anticipated, biologic and technical complications are common and can manifest as unethical soft- and hard-tissue changes around implant-supported porcelain crowns in the anterior maxilla. These complications can occur in patients even after a few years.²⁶ With either approach, no significant differences in the prevalence in the signs and symptoms of temporomandibular dysfunction were observed between patients.^{10,23}

Canines have a wide and long root, whereas lateral incisors frequently have a narrow alveolar bone area, which reflects the tooth's typical root shape. Placing a canine anteriorly to replace missing maxillary lateral incisors was reported to reduce the size of the maxillary arch, which resulted in a disharmonious smile and jeopardized facial balance.²⁷ Obviously, if a patient has bilateral agenesis of the maxillary lateral incisors, the maxillary bone volume is decreased.²⁴ Alveolar canine buttressing of the canine roots is visible anteriorly where the lateral incisors should be, and the dental arch narrows distally in the canine substitution case. Although the arch form appears to be condensed and constricted after canine mesialization, Gianelly²⁸ reported a similar conclusion that extraction treatments do not constrict arch form. However, even if the canines are reshaped esthetically, the dentoalveolar arch curvature cannot be changed. The patient in full smile displays the buccal corridor because the arch circumference is diminished with the closure of the lateral incisor spaces. There is less dentoalveolar

bone to work with to create an esthetic smile.¹⁵ In extraction cases, however, the buccal corridor can be eliminated by applying labial crown torque to lingually inclined canines and premolars during treatment.¹⁰ In this case, to improve the interproximal contact points, decrease the buccal corridor, and diminish recontoured canines in the archwire design, first-order bends (in-out) were performed on the maxillary canines, and "cuspid curves" were incorporated on the maxillary first premolars.

Canines typically appear darker in color than lateral and central incisors, consequently orthodontists must take the extent of this color difference into consideration when determining whether to open or close missing maxillary lateral spaces.²⁹ Lack of color harmony between maxillary canines and neighboring teeth, according to Robertsson and Mohlin,¹⁰ was a significant factor in patient dissatisfaction among individuals who received orthodontic treatment to close missing lateral incisor spaces. It is possible that the color difference between canines and central incisors will become even more pronounced due to the alteration in canine color degradation caused by labial enamel reduction, as well as the decrease in translucency and darker canine color given on by incisal edge recontouring.¹⁸ The appearance of the canines in respect to the central incisors could be improved through bleaching techniques.²⁴ Although this patient's canines, maxillary central incisors, and first premolars all seemed to be the same color, the teeth's forms and sizes were remarkably different. Some canines have such a distinct appearance that it is difficult to reshape them into acceptable lateral incisor anatomy. They take various shapes that range from conical to trapezoidal, and reshaping is only possible within certain limits. The patient may find the esthetic outcome to be rather unpleasant when the canine shape imposes severe limits on reshaping, leading the clinician to seek a space opening to obtain better esthetics. In this present case, the patient was content with the images produced by the setup models

and did not wish to reshape or recontour the teeth.

The ideal anterior gingival architecture has the central incisor and canine margins at the same level, while the lateral incisor gingival contour is approximately 1 mm more incisal.³⁰ In this present case of closing the missing lateral incisor spaces, the gingival margin of the natural canine should be positioned slightly incisal to the central incisor gingival margin. Also, the gingival margin of the first premolar was naturally positioned more coronally than the central incisor. This helped camouflage the substituted canine. Occasionally, a gingivectomy may be needed to properly position the gingival margin. As a result, space closure may result in an unsightly anterior gingival anatomy, particularly when combined with a high smile line.

When treating patients with canine substitution, proper bracket placement is critical. Canine brackets are typically placed at a distance from the gingival margin that allows the teeth to erupt into the appropriate lateral incisor vertical position. A thicker portion of the crown comes into contact with the mandibular incisors as they erupt. This frequently results in prematurities that must be adjusted on a regular basis during the alignment stage of orthodontic treatment. In this patient, we used inverted MBT canine brackets on the canines to deliver +7° of labial crown torque that nearly matched the torque of the lateral incisor on the contralateral side, and a 0.019" × 0.025" SS wire was used to level and express the prescription of the bracket. The advantage of using these techniques is that prior enameloplasty is not needed as the bracket base matches the surface contour of the tooth.

Selecting appropriate cases is essential to a treatment's success to achieve lasting results. The patient's desired type of occlusion, Class I malocclusion with bimaxillary dental protrusion, can be achieved by using the lateral incisor spaces to reduce the anterior teeth protrusion and avoid the need for prosthesis. In this current case, the post-treatment well-interdigitated occlusion, placement of all teeth in the appropriate bone housing, the patient's cooperation and attitude,

and functional excursion without interference were all significant factors that contributed to the stable results.

Conclusion

Closing the space with canine mesial movement and replacing the canines with maxillary first premolars are possible treatment options in the case of Class I malocclusion with bimaxillary dental protrusion and bilateral congenitally missing maxillary lateral incisors. The treatment in this case established a stable occlusion and a pleasing facial appearance in a comparatively short amount of time without the need for a prosthesis. The main benefits of orthodontic space closure are the long-term nature of the outcome and the possibility to conclude treatment in early adulthood.

Author contributions

SM: Conceptualization, Methodology, Resources, Writing-Original Draft, Writing-Review & Editing, Visualization.

Disclosure statement

The author has no conflicts of interest.

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