

การใช้ฟันเขี้ยวทดแทนฟันตัดซี่ช้างในผู้ป่วยปากแหว่งและเพดานโหว่: รายงานผู้ป่วย

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Canine Replacement for Lateral Incisor in Patient with Cleft lip and Palate: a case report

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หลักการและวัตถุประสงค์: ผู้ป่วยหญิงไทยอายุ 12 ปี ซึ่งมีภาวะปากแหว่งและเพดานโหว่ชนิดสมบูรณ์เพียงด้านเดียว ผู้ป่วยมีการสบพันกการตามเกณฑ์ของแองเกลเป็นความสัมพันธ์ประภากที่ 3 และมีการสบพันหน้าล่างคร่อมพันหน้าบน ลักษณะความสัมพันธ์ระหว่างโครงสร้างกระดูกขากรรไกรบน และล่างในแนวหน้าหลังเป็นประภากที่ 3 เล็กน้อย ส่วนความสัมพันธ์ในแนวตั้งเป็นแบบลบเปิด ผู้ป่วยมีฟันตัดบนซี่ช้างด้านซ้ายฝังอยู่ในบริเวณซ่องให้ของกระดูกสันเหงือกและมีลักษณะเป็นรูปหมุดในขณะที่ฟันซี่เดียวกันในด้านขวา มีลักษณะปกติ

วิธีการศึกษา: แผนการรักษาประกอบด้วยการปลูกถ่ายสันกระดูกและการถอนฟันตัดบนซี่ช้างในด้านซ้ายออกร่วมกับการถอนฟันกการตามน้อยซี่ที่หนึ่งในจุดภาคอื่นๆ ตามด้วยการปิดซ่องว่างโดยการจัดฟันด้วยการใช้ฟันเขี้ยวบนซี่ช้างแทนฟันตัดบนซี่ช้างในด้านเดียวกัน

ผลการศึกษา: ผลการรักษาพบว่ามีการสบพันที่ยอมรับได้มีการสบพันกการตามเกณฑ์ของแองเกลเป็นความสัมพันธ์ประภากที่ 1 ทั้งสองด้าน กำจัดการมีฟันสบคร่อม และมีความสวยงามเป็นที่น่าพึงพอใจโดยไม่ต้องอาศัยการใส่ฟันปลอม

สรุป: การใช้ฟันเขี้ยวบนทดแทนฟันตัดซี่ช้างเป็นหนึ่งในแผนการรักษาที่เป็นไปได้สำหรับผู้ป่วยปากแหว่งและเพดานโหว่ที่มีการขาดหายไปหรือมีความผิดปกติของฟันตัดแท้ซี่ช้างซึ่งทำให้หลีกเลี่ยงการใส่ฟันปลอมทดแทน อีกทั้งช่วยให้ผู้ป่วยมีสภาวะจิตใจที่ดีขึ้น

คำสำคัญ: การปิดซ่องว่างโดยการจัดฟัน ฟันตัดซี่ช้างรูปหมุด ปากแหว่งและเพดานโหว่

Background and Objective: A case of Thai female patient, aged 12 years old, presented with unilateral complete cleft lip and palate. She had Angle Class III with anterior crossbite on mild skeletal Class III openbite pattern. Her maxillary left lateral incisor was embedded in the cleft site and exhibited a peg-shape while that on the right side was normal.

Methods: Treatment plans included alveolar bone grafting and removal of maxillary left lateral incisor and first premolars on other quadrants, followed by orthodontic space closure with maxillary left canine to substitute lateral incisor on that side.

Results: The treatment resulted in an acceptable occlusion, Angle Class I on both sides, elimination of the dental crossbite, and a satisfactory esthetics without the need of prosthesis.

Conclusion: Maxillary canine substitution for lateral incisor is one of the possible treatment options for cleft patient with missing or anomalies of permanent lateral incisor. This method avoids prosthesis replacement and also improves patient's psychological condition.

Keywords: orthodontic space closure, peg-shape lateral incisor, cleft lip and palate

Introduction

Permanent maxillary lateral incisors on the cleft side are usually problematic in patients with cleft lip and palate. Frequently the teeth are absent with considerably variable prevalence reported between studies. There were 19.2% reported by Lai *et al*¹, 31.5% reported by Vichi and Franchi², 48.8% reported by Tortora *et al* *et al*³, 49.8% reported by Ribeiro *et al*⁴, 56.9% reported by Suzuki *et al*⁵ and 93.17% reported by Shapira *et al*⁶. Symons *et al*⁷ published that the frequency of congenital missing of these teeth in cleft subjects was 2.2 % higher than normal population. When not absent, the maxillary lateral incisor on the cleft site is often abnormal in size and shape.⁴ Suzuki and Takahama⁸ reported that the permanent maxillary lateral incisors in patients with cleft were found mostly in conical shape (round in occlusal view with a one point tip). The lowest percentage of malformed lateral incisors in the cleft area was reported by Slayton *et al*⁹ at 12%. Böhn¹⁰, Brattström and McWilliam¹¹, and Suzuki *et al*⁵ found a similar percentage which were 35%, 36.6%, and 35.5%, respectively. Hellquist *et al*¹² found a corresponding value of 49% while Lai *et al*¹ reported a higher incidence of 60.3% and the highest percentage was published by Ribeiro *et al* at 92.2%.⁴ Removal of lateral incisors, which are abnormal or sometimes severely displaced, should be taken into consideration in treatment of cleft patients.

Once the maxillary lateral incisor has been removed or missing, space in the arch can be managed by two principal options. They are (1) orthodontic space closure using the canine eruption process or conventional orthodontic treatments¹³⁻¹⁵, and (2) reopening or maintenance of the space for prosthesis replacement or dental implantation.¹⁶⁻¹⁸

The space closure method involves orthodontically closing the space by moving the canine into the space of the lateral incisor, and the first premolar assumes the same for the canine. This causes a discrepancy in the gingival margin level so a crown lengthening procedure may be necessary on the premolar to make its appearance looked like canine in overall length.

However, because most cleft patients do not have much lip elevation, even on a full smile, this gingival complex irregularity may not be noticeable so that periodontal surgery may be unnecessary. In addition, reshaping maxillary canine to resemble lateral incisor may improve esthetics and the premolar used to mimic canine may have to be modified its appearance as well.¹⁹

Prosthetic replacement is another treatment option in missing permanent maxillary lateral incisor in cleft patient whose space closure is not possible. However, orthodontic tooth movement to reposition abutment teeth may be needed. There are four prosthodontic options available which are fixed partial dentures, resin bonded bridges, removable partial dentures and osseointegrated implants. Creating an orthodontic space opening for missing maxillary lateral incisors favors an ideal intercuspalation of canines through first molars.^{20,21} On the other hand, wearing prosthesis tends to make periodontal health impaired due to accumulation of plaque and gingivitis.²² Importantly, the permanent fixed bridge will not be allowed unless the patient's vertical growth is completed.

Case History

A 12-year old Thai girl with repaired left unilateral complete cleft lip and palate complained about her crooked upper anterior teeth and spacing. She underwent lip repair and palate repair 8 and 18 months after birth, respectively.

Extra-oral examination

The patient had a mesomorphic body type with no apparent physical deformities. Her face was a slightly asymmetrical mesofacial form. Her nose was of medium-size with slightly asymmetrical alar bases and nostrils. The lips were incompetent at rest, with a thick and markedly protrusive lower lip. On smiling, the smile line was low, displayed 40% of the upper incisors and 100% of the lower incisors. Her chin deviated 2 mm to the left of the facial midline. The profile was slightly convex. The midface was slightly flat whereas the

chin was normal. The nasolabial angle was acute. No signs or symptoms of temporomandibular joints were presented. Her speech was mild hypernasal but the swallowing pattern was normal. (Figure 1)

Intra-oral Examination

The patient was in the permanent dentition stage with Class II molar relationship on the right side but Class I on the left side. Besides third molars, all teeth were erupted except maxillary left lateral incisor (#22). There was a dental crossbite in the anterior region. Maxillary right second premolar (#15) and maxillary left first premolar (#24) were palatoversion. She had reversed overjet of -4 mm and overbite was 5 mm. The upper dental midline deviated 3 mm to the left while the lower dental midline coincided with the mid-sagittal plane. There was no cant in the occlusal plane and the curve of Spee was 2 mm on both sides. No CR-CO discrepancies were observed. The space analysis showed 15 mm and 10 mm of crowding in the upper and lower arches, respectively. The patient's oral hygiene was fair. (Figure 1)

Radiographic Evaluation

The occlusal film (Figure 2A) presented unrepaired cleft of alveolar ridge located distally to maxillary left central incisor (#21). The pretreatment panoramic film (Figure 3A) showed that #22 was impacted with complete root formation and its shape looked like a peg lateral incisor. No supernumerary teeth presented as well as no bone pathology.

The lateral cephalometric (Figure 3B) revealed that the patient had retrognathic maxilla ($SNA = 78.5^\circ$) and mandible ($SNB = 78^\circ$) in relation to the anterior cranial base. The skeletal pattern was mild Class III ($ANB = 0.5^\circ$). Vertically, she had open bite pattern ($PP - MP = 30.5^\circ$) with clockwise rotation of mandibular plane ($FMA = 29^\circ$). Maxillary incisors were retroclined ($U1 - APog = 16.5^\circ$) but in normal position ($U1 - APog = 4 \text{ mm}$) relative to APog plane whereas lower incisors were proclined ($L1 - APog = 29^\circ$) and protruded relative to APog plane

($L1 - APog = 9.5 \text{ mm}$). She has straight profile (180°) with acute nasolabial angle (86°). The upper lip was slightly protrusive ($Ls to E line = 2 \text{ mm}$) whereas the lower lip was extremely protrusive ($Li to E line = 10.5 \text{ mm}$) relative to the esthetic plane. These findings are summarized in Table I and II.

Diagnosis

Dental Class III malocclusion with anterior crossbite on mild skeletal III openbite with left unilateral complete cleft of the lip and palate.

Treatment

The treatment plan in this case began with secondary alveolar bone grafting with iliac bone to correct the alveolar defect so as to permit movement of adjacent teeth into the cleft region and to stabilize the maxillary dental arch and. Since #22 in the cleft site was presented with abnormal size and bone support, removal of this fissural tooth was planned and the extraction was performed during the bone graft surgery. Orthodontic treatment started 6 months after alveolar bone graft. The patient was referred to have #15, mandibular left first premolar (#34) and mandibular right first premolar (#44) extracted to allow correction of anterior and posterior crowding. Fixed quad-helix (Figure 4) was used to control the transverse dimension, prevent forward movement of maxillary right first premolar (#14) as well as the upper anterior teeth when aligning with continuous NiTi arch wire. The device also moved #24 which was palatoversion into the line of occlusion. After teeth were aligned and leveled, space closure was performed by sliding mechanics using power chains. The maxillary left canine was moved into the previous cleft area to substitute the lateral incisor. Space closures in the other quadrants were performed with maximum anchorage to create proper overjet. Finishing was carried out before the appliance was debonded and wraparound retainers were inserted. The total active treatment time was 3 years and 2 months.

Table 1 Comparison of the pretreatment and posttreatment cephalometric measurements

Measurement	Standard norm*	Pretreatment	Posttreatment
Cranial base			
SN-FH	5 ± 6	10	12
Maxilla to cranium			
SNA	82	78.5	78
FH-NA	90 ± 3	89	89
A-N perp (mm)	1.1 ± 2.7	-1	-1.5
Co-A (mm)	100 ± 6	79	80
Mandible to cranium			
SNB	80	78	77
FH-NPog	87 ± 3	88	87
Pog-N prep	-0.3 ± 3.8	-5	-6
Co-Gn (mm)	134 ± 7	110.5	117
Maxilla to mandible			
ANB	2	0.5	1
Wits appraisal (mm)	0.5 ± 2	-10	-11.5
Vertical analysis			
SN-PP	7 ± 3	8	8
SN-MP	32	39	41
FH-MP (FMA)	25	29	30.5
PP-MP	23 ± 2	30.5	32
ANS-Me	74.6 ± 5	69	78.5
Dental analysis			
U1-SN	102 ± 2	93	104
U1-NA (deg)	22	14	27
U1-NA (mm)	4	3.5	9
U1-APog (deg)	28 ± 4	16.5	30
U1-APog (mm)	3.5 ± 2	4	11
IMPA	91.4 ± 3.8	94	84
FMIA	65	57	65
L1-NB (deg)	25	31.5	23
L1-NB (mm)	4	9.5	6.5
L1-APog (deg)	22 ± 4	29	20
L1-APog (mm)	1 ± 2	9.5	6.5
U1-L1	131	133	128.5
Soft tissue analysis			
Profile angle	168.7 ± 4	180	180
Nasolabial angle	102 ± 8	86	64.5
UL-E line	-2.5 ± 1.5	2	1.5
LL-E line	1 ± 1	10.5	7
U lip length	23.8 ± 1.5	19	25
L lip length	49.9 ± 4.5	50	53

* Standard norms in the Khon Kaen University analysis

Table 2 Summary of the pretreatment and posttreatment conditions

Region		Pretreatment	Posttreatment
Skeleton	Antero-posterior	Mild skeletal Class III	Mild skeletal Class III
	Vertical	Skeletal openbite	Skeletal openbite
Dental arch	Alignment	Mal-alignment, severe crowding, negative overjet	Well-aligned, no crowding, normal overjet
	Arch form	Parabolic maxillary and mandibular arches	Parabolic maxillary and mandibular arches
Dental	Canine relation	Class III on both sides	Class I on both sides
	Molar relation	Class II on right side Class I on left side	Class I on both sides
	Overjet	- 4 mm	2 mm
	Overbite	5 mm	1 mm
	Maxillary incisors	Retroclination	Normal inclination
	Mandibular incisors	Proclination	Normal inclination
	Midline	Upper dental midline shifted 3 mm to the left Lower dental midline coincided with the facial midline	Upper dental midline coincided with the facial midline Lower dental midline shifted 0.5 mm to the left
	Upper lip	Slight protrusion	Normal position
	Lower lip	Marked protrusion	Slight protrusion
Face	Frontal	Slight asymmetry	Slight asymmetry
	Profile	Straight	Straight

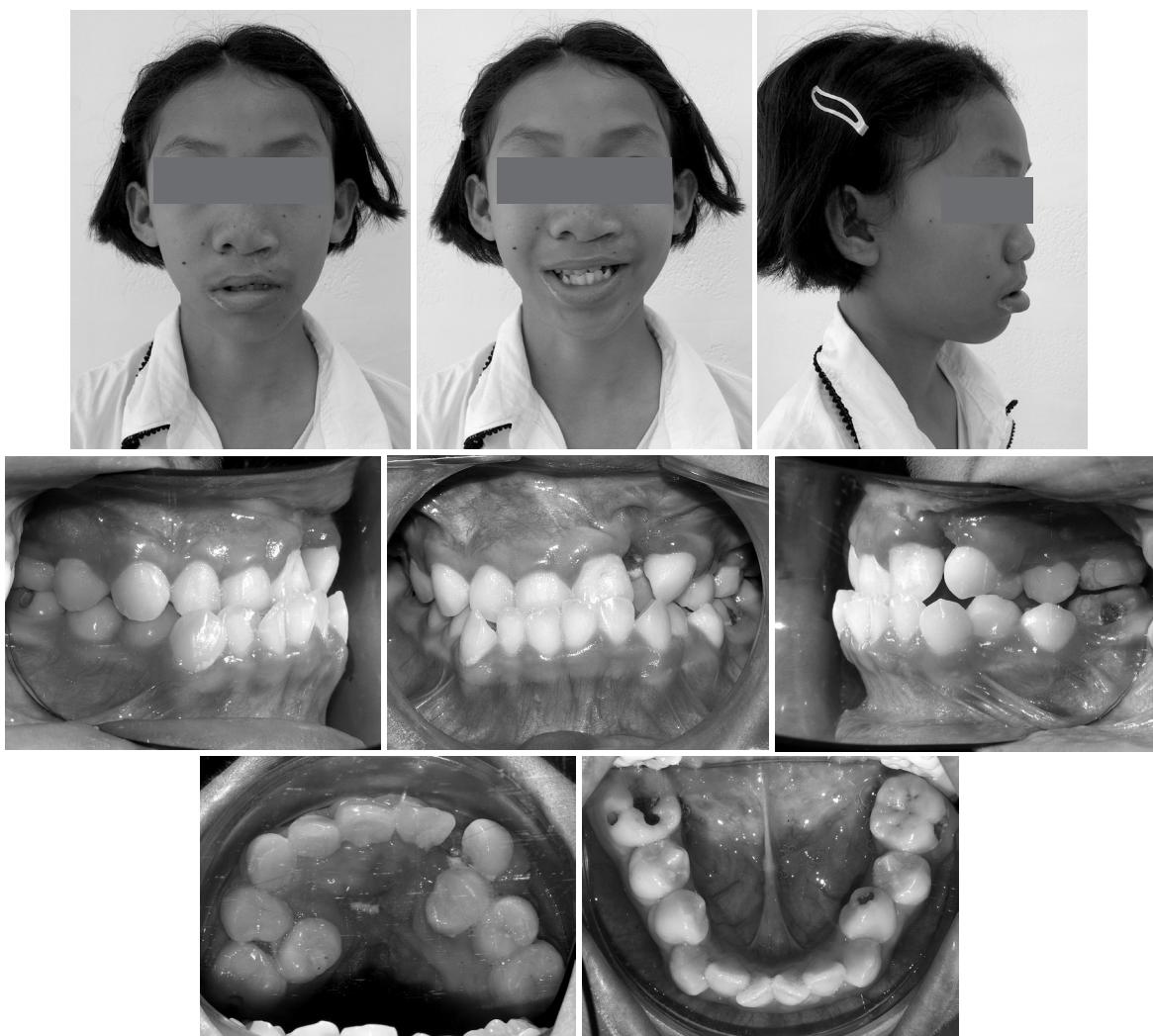


Figure 1 Facial appearance and occlusion at pretreatment

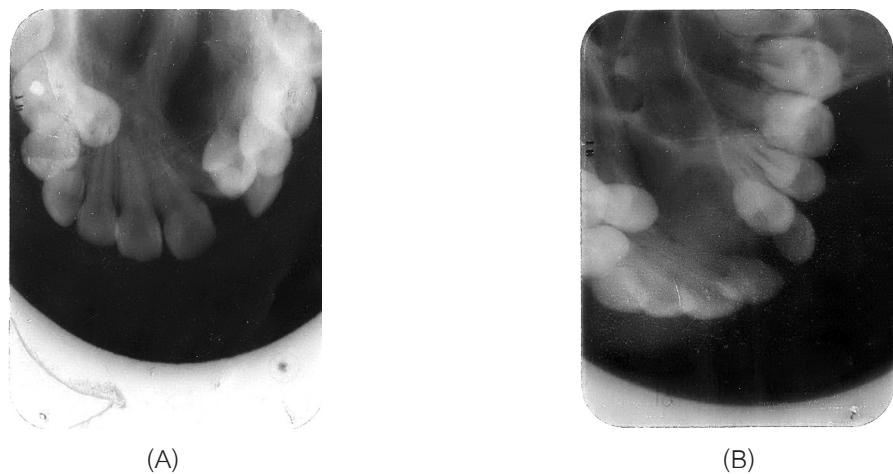


Figure 2 Occlusal radiograph (A) Before bone grafting (B) After bone grafting

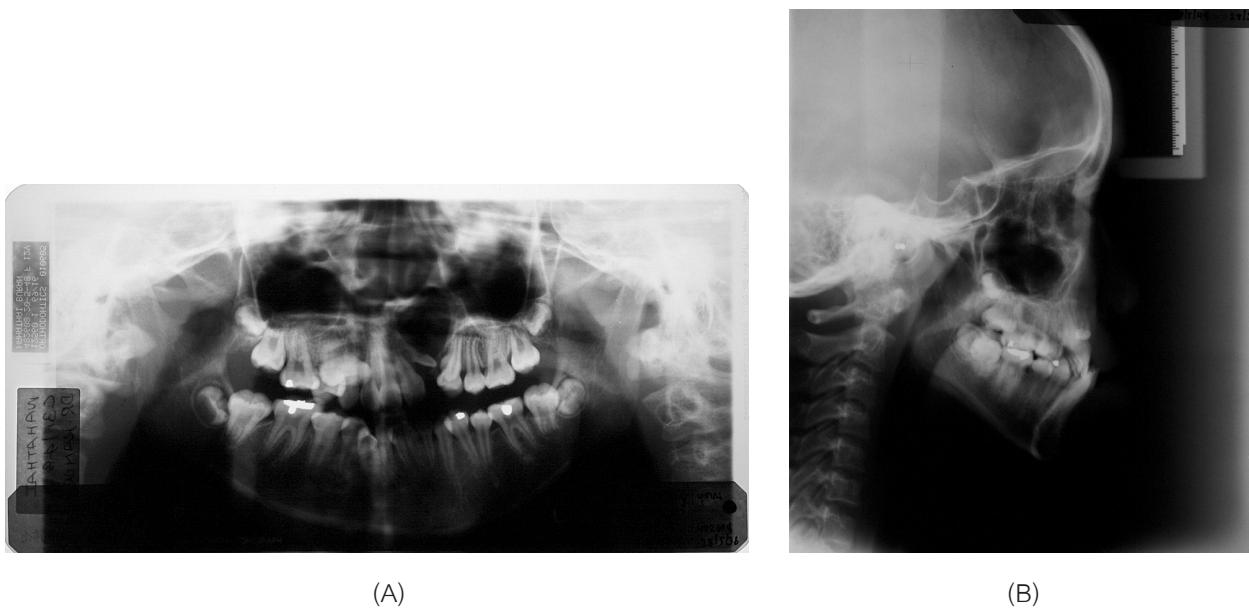


Figure 3 Panoramic radiograms (A) and lateral cephalograms (B) at pretreatment

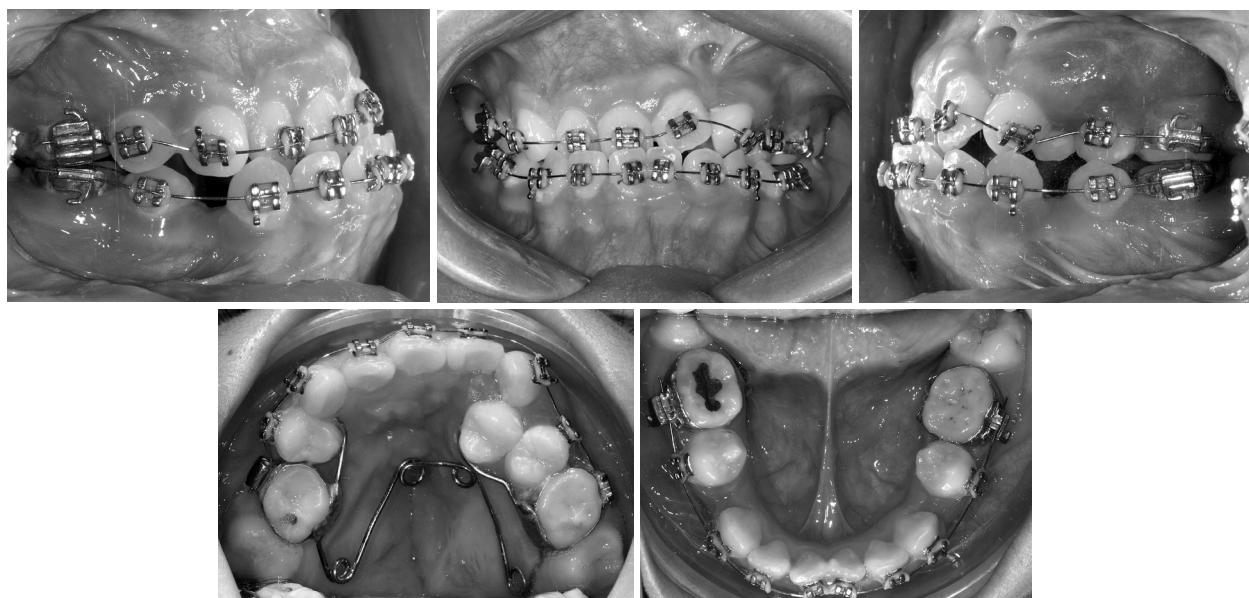


Figure 4 Intra-oral photographs at during treatment

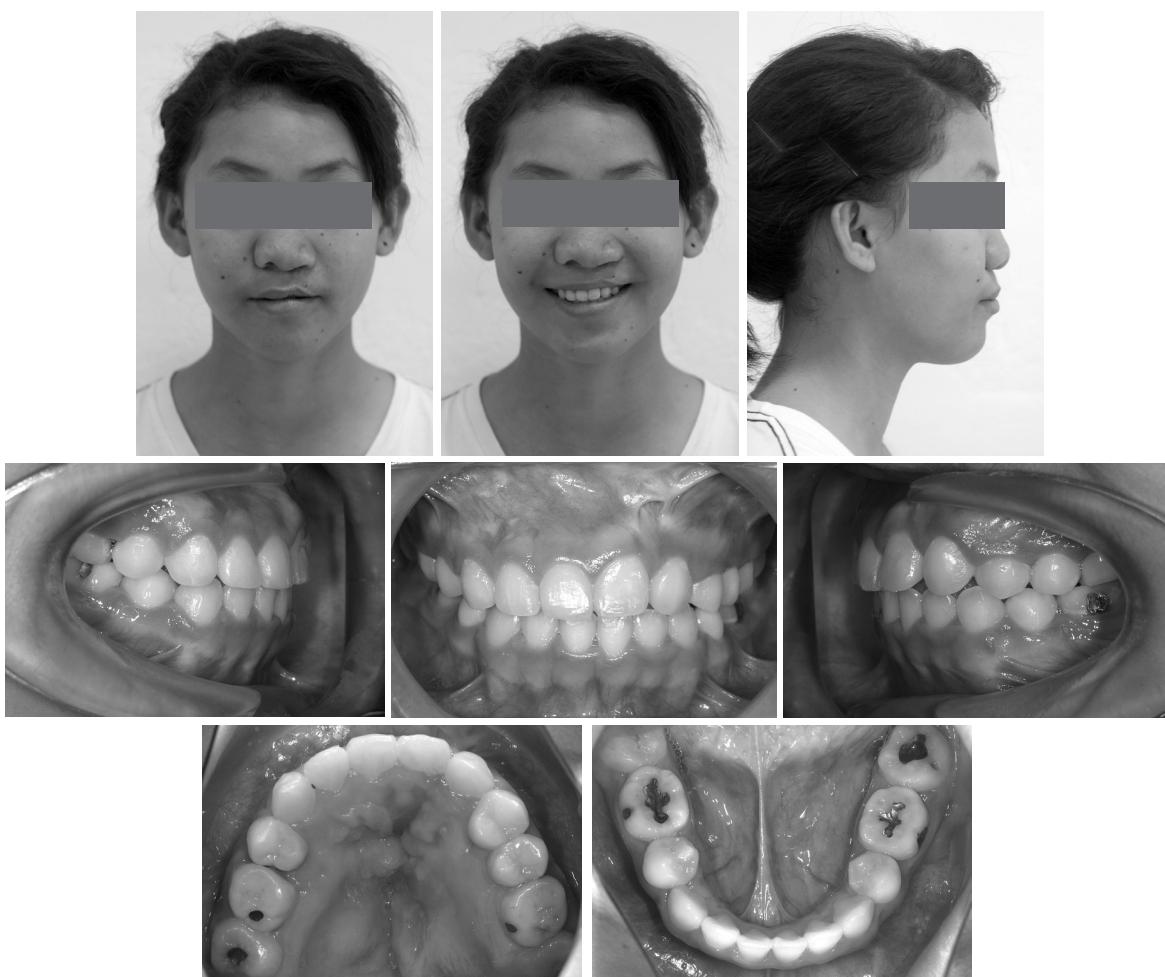


Figure 5 Facial appearance and occlusion at posttreatment

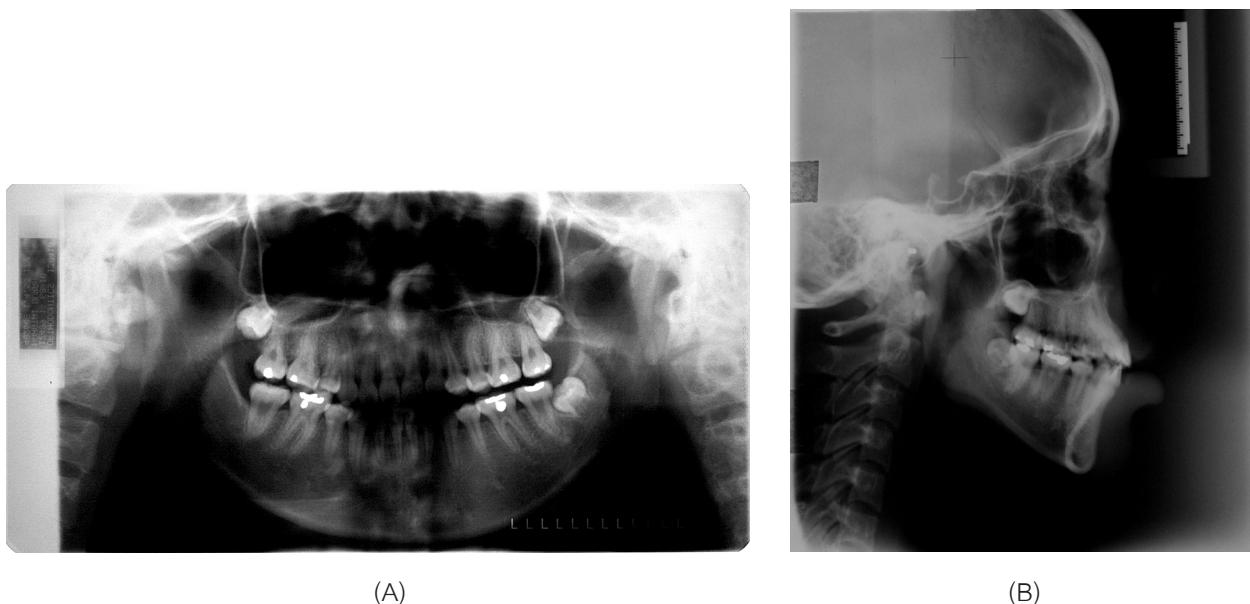


Figure 6 Panoramic radiograms (A) and lateral cephalograms (B) at posttreatment

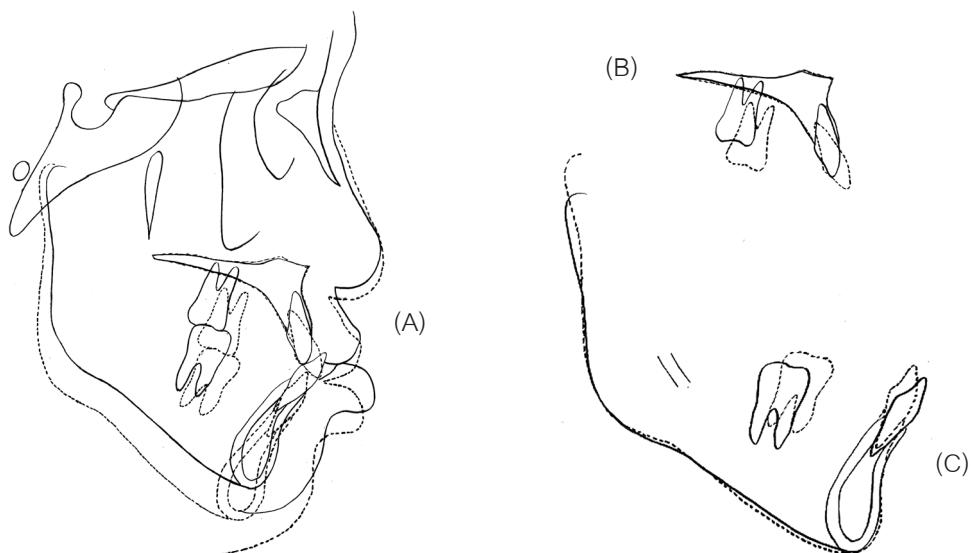


Figure 7 Results of tracing at pre- (solid line) and post- (dot line) treatment, and their superimposition on (A) the SN plane, (B) the internal palatal structure, (C) the inner contour of the cortical plate at the inferior border of symphysis

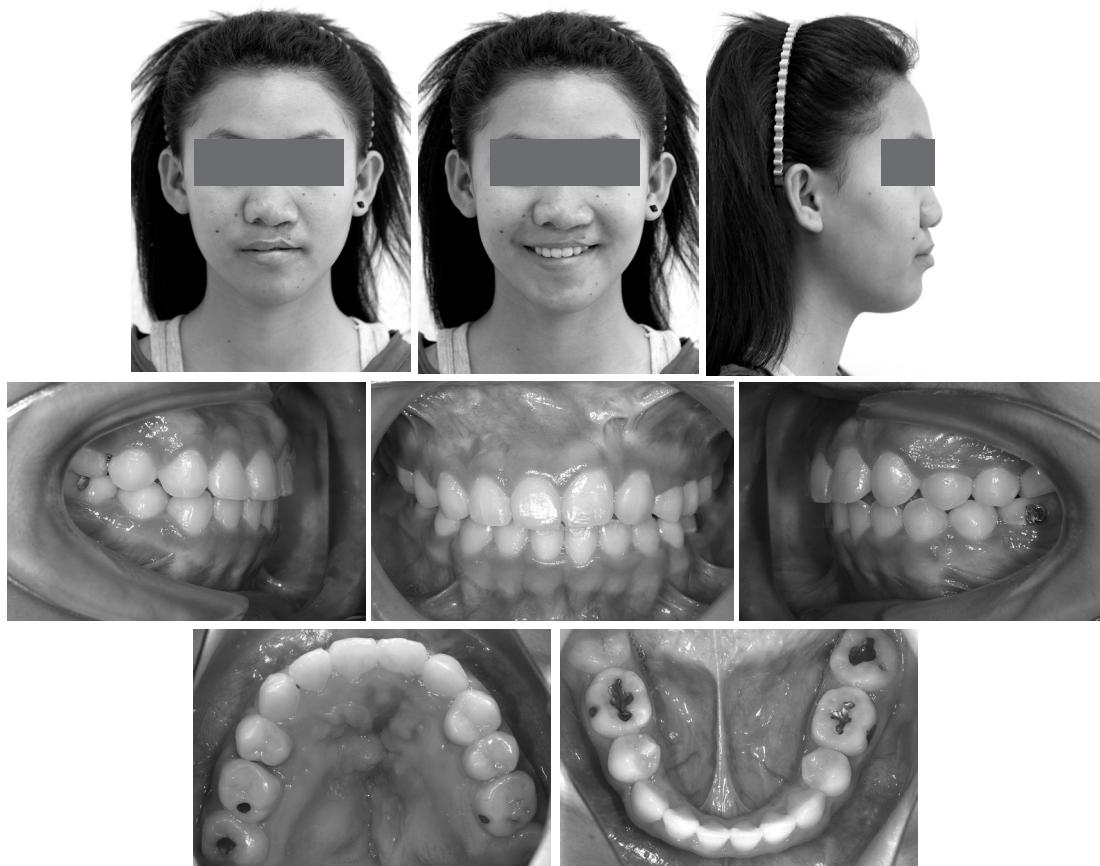


Figure 8 Facial appearance and occlusion at 6 months follow-up

Results

Occlusal radiogram (Figure 2B) showed that the alveolar cleft site was successfully constructed in this patient. The entire cleft site was filled with newly formed bone and the bone level was at the cemento-enamel junction of the teeth adjacent to the cleft site. At the end of treatment, the patient's skeletal pattern was slightly improved (ANB changed from 0.5° to 1°). She had Class I relationship of molars and canines. The anterior crossbite was eliminated and the curve of Spee was corrected. The dental arches were well aligned. A normal inclination and position of maxillary and mandibular incisors, a normal overjet and overbite were resulted. Additionally, there was good color balance between canine which used to mimic lateral incisor and the adjacent central incisor. Facial and intra-oral photographs, panoramic radiograph, and lateral cephalogram at posttreatment are shown in Figure 5, 6A and 6B. Table I illustrates comparison of the pre- and posttreatment cephalometric measurements. Summary of pre- and posttreatment conditions is demonstrated in Table II. In addition, superimposition at pre- and posttreatment on SN plane (Figure 7A) showed that maxilla position was maintained while mandible moved downward. Moreover, nose and upper lip were moved downward, lower lip backward and soft tissue chin downward. Superimposition on the inner palatal structure (Figure 7B) revealed that the maxillary incisor was labially tipped while maxillary molar was extruded and mesially moved. Superimposition on stable structures of mandible (Figure 7C) presented that the mandibular incisor was slightly extruded and lingually tipped whereas mandibular molar was extruded and mesially moved.

Retention

Upper and lower full arch wrap-around retainers were delivered and the patient was instructed to wear the retainers for full time. The patient was reviewed on the 6th months of retention period and no relapse was found. (Figure 8)

Discussion

The cleft-side lateral incisor is rarely present at the conclusion of orthodontic and surgical treatment of complete unilateral cleft lip and palate. Often absent due to agenesis, when present it is typically abnormal in size and bone support. These have an impact on orthodontic and prosthetic treatment planning decisions from a functional, as well as an esthetic, point of view.

Generally, to decide whether orthodontic or prosthodontic method should be used in closure of cleft space, several factors have to be assessed.²³

1. A presence of useful fissural tooth must be determined because it facilitates orthodontic space closure. Böhn¹⁰ suggested that a fissural tooth may be removed when severe malformation of the crown or root is present, as in this case. On the contrary, if a functional root length is provided, a malformed crown can be modified to an esthetically acceptable tooth.

2. The type of cleft anomaly since it has been suggested that orthodontic space closure was favorable in clefts of the primary palate especially whose bone grafting was done before the eruption of canine.

3. Intermaxillary relationship as well as aplasia of teeth outside the cleft region must be taken into consideration. Orthodontic space closure is difficult in cases with maxillary deficient growth and the absence of tooth tends to make this situation worse because the arch size seems to be reduced.

4. Width of the space has to be evaluated since larger cleft space makes orthodontic space closure more difficult.

Although this case was complete cleft of primary and secondary palate but she has mild skeletal III without marked discrepancy between the upper and lower jaws so it was possible to close space orthodontically. The major advantage of orthodontic space closure is the permanence of the finished result. It can be said that at the end of orthodontic treatment, the overall treatment is completed because prosthesis is not required.^{24,25} However, the tendency of space reopen between the anterior teeth is the major disadvantage of space closure. It was suggested that orthodontic space closure in unilateral lateral incisor agenesis can

pose a matching size or shape problem because the canine which replacing the missing lateral incisor will not be in harmony with the existing lateral incisor. There was an advice to extract the existing lateral incisor for symmetry.²⁶ In this case report, however, Bolton's tooth size analysis showed no discrepancies between the size of upper and lower anterior teeth when #23 and 24 were used to replace #22 and 23, respectively. In addition, the upper first premolar which was replaced canine presented in good intercuspal position with the lower canine and first premolar.

After complete aligning and leveling stage of fixed orthodontic treatment, the space closure in this case was traditionally performed with sliding mechanics by the use of elastomeric chains. Delaire's facemask is an optional device in moving posterior teeth forward into the former cleft site.²⁷ In the patients whose space closure cannot be performed by forward movement of posterior teeth, Hillerup *et al*²⁸ suggested a more invasive option of treatment which was autotransplantation of teeth to the grafted cleft site and several successful cases were published.

It is important to determine an appropriate time for alveolar bone graft. Bone grafting prior to the eruption of canine provides sufficient alveolar bone to facilitate spontaneous forward migration of canine.^{29,30} Therefore, orthodontic space closure was proved to be easier.²³ For this patient, alveolar bone graft was carried out after the eruption of canine but successful orthodontic space closure was demonstrated, clinically and radiologically, at the end of active treatment. Bergland *et al*²³ suggested that patients with cleft require a longer period of retention a long-term observation is needed.

Senty³¹ published that canine-protected occlusion was impossible with orthodontic space closure and there was periodontal attachment loss due to the stress placed on the premolars. But another study of him and that of Nordquist and McNeill²¹ revealed no differences in occlusal function as well as the prevalence of temporomandibular disorder (TMD) existed between subjects with open lateral incisor spaces and those with closed spaces. Additionally, the presence or absence of cupid rise was not related to periodontal status.

Strang³² suggested that the most ideal method in dealing with missing lateral incisors is space opening for artificial tooth whereas canine replacement in the lateral position resulted in loss of proper occlusion and blemished to the facial lines. But Senty³¹ reported no remarkable change in facial contour. It was suggested that shade discrepancies should be taken into consideration in order to minimize patient or parental objection when treatment is completed and it was likely to be acceptable in this patient. Robertsson and Mohlin²² compared orthodontic space closure with canines replaced lateral incisors to prosthodontic replacement in patients with congenitally missing upper lateral incisor and found that the patients treated by orthodontic space closure were more satisfied with the appearance of their teeth than those who had prosthetic replacement.

Conclusion

The high incidence of missing or anomalies of permanent maxillary lateral incisors in children with cleft lip and palate presents additional complications for treatment planning. Canine substitution for lateral incisor is one of the possible treatment alternatives for these cases. In this report, it demonstrated the effective space closure and all chief complaints were corrected. The result achievement was therefore fulfilled by an acceptable occlusion and a satisfactory esthetics. To sum up, the patient was pleased to avoid wearing dental prosthesis and she received a significant advantage in psychosocial well being.

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