

Case Report

Orthodontic Treatment of Unilateral Cleft Lip and Alveolus Patient with Maxillary Lateral Incisor Missing: Case Report

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The esthetics of a patient with a cleft lip and alveolus and missing maxillary lateral incisor is important. A girl, aged 9 years 3 months with repaired left unilateral cleft of primary palate only was referred for orthodontic evaluation of her anterior tooth-crowding. She was unhappy with the unattractive appearance of her maxillary anterior teeth, which were behind her mandibular anterior teeth. Alveolar bone grafting along with canine substitution to replace her missing lateral incisor were recommended for this patient. The post-treatment results were excellent with good occlusion, acceptable profile, and remained stable one year after conclusion of active treatment.

Keywords: Unilateral cleft lip and alveolus, Maxillary lateral incisor missing

J Med Assoc Thai 2013; 96 (Suppl. 4): S170-S176

Full text. e-Journal: <http://jmat.mat.or.th>

The most common craniofacial deformity is an oro-facial cleft which affects approximately 1 in 500 to 700 births as cleft of the lip, or palate, or a combination of cleft lip and palate⁽¹⁾. The incidence of cleft lip and/or palate at Maharatnakorn Ratchasima Hospital in Northeast Thailand was reported to be 1.4 in 1,000 or approximately 1 in 700 live-births⁽²⁾. Patients with cleft lip and palate are generally characterized by dental abnormalities such as missing, supernumerary and/or malformed teeth adjacent to the cleft site, displaced maxillary dental midline, frenum or periodontal abnormalities in the cleft, delayed dental development, and altered eruption pattern.

The high prevalence of congenitally missing maxillary lateral incisors may result from insufficient blood supply near the cleft, either congenitally or as a result of surgery, or from a deficiency in the mesenchymal support for the maxillary lateral incisor near the cleft⁽³⁾. Because a deficiency of the mesenchyme can lead to insufficient support for the maxillary lateral incisor, cleft patients with a severe deficiency of mesenchymal mass could have congenitally missing

maxillary lateral incisors⁽⁴⁾.

One option of treatment for cleft patients with missing lateral incisors is canine substitution⁽⁵⁾. It is an excellent choice if several conditions are satisfied: the maxillary dental midline is close to correct whether or not an alveolar cleft bone graft is planned; the canine next to the cleft is erupting mesially with reasonable root position and is fairly small and white; both premolars are present on the affected side; and the molar/canine relationships are Class II⁽⁶⁾.

The purpose of this article is to report the treatment of a girl who had a unilateral cleft lip and palate with congenitally missing maxillary lateral incisor. The patient was treated with orthodontics alone and orthognathic surgery was not performed.

Case Report

Thai girl 9 years 3 months was unhappy with her anterior crowding and wanted to have orthodontic treatment. She was referred to the Oral Diagnosis Department. She had a left unilateral cleft lip and alveolus without cleft of secondary palate. The history of surgical procedures at Srinagarind Hospital was cheiloplasty when she was 3 months old and secondary lip-nose revision when she was 2 years old. She had a symmetrical mesofacial type with asymmetrical upper lips. Her profile was slightly convex profile and acute

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nasolabial angle. The mandibular plane is steep (Fig. 1).

She was congenitally missing her left maxillary lateral incisor (#22). The maxillary dental arch was asymmetrical with tapered arch form with moderate crowding and mild crowding in the mandibular arch. She had a mixed dentition, Class I molar relationship on both sides, negative incisor overjet and openbite. The maxillary dental midline was deviated to the left 1 to 2 mms relative to the facial midline. There was no CR-CO discrepancy (Fig. 2).

Cephalometric analysis indicated skeletal Class II due to orthognathic maxilla and retrognathic mandible (SNA 84°, SNB 77°, ANB 7°) with slight openbite skeletal pattern (SN-MP 40°). The maxillary incisors were retroclined and retruded relative to alveolar bone base (U1-SN 82°, U1-NA 5°), and the mandibular incisors protruded but normally inclined (IMPA 98°, L1-NB 34°) (Fig. 3).

She has a slightly convex profile, an acute nasolabial angle, moderately protruding upper and lower lips, normal mentolabial fold and long lower anterior facial height.

Dental radiographs indicated the maxillary left permanent canine (#23) had approximately half-root development with its path of eruption directed towards the alveolar cleft which had bone deficiency (Fig. 3).

Objectives of treatment

The interdisciplinary team approach to comprehensive care of patients with oral clefts requires collaboration of orthodontist with the other members of the team. The treatment objectives were to obtain normal position and inclination of the incisors, prepare space for canine eruption, harmonize both arches to get a good dental intercuspitation and acceptable facial profile. Following exfoliation of the remaining primary teeth, the treatment plan was to open the cleft space to provide access for the surgeon to complete alveolar cleft bone grafting, and to allow eruption of the left maxillary canine into the bone graft thus substituting for the missing lateral incisor. To enable maxillary midline correction by moving the maxillary central incisors to the right, the maxillary right first premolar (#14) was extracted. The mandibular left and right first premolars (#34 and #44) were also extracted to enable some retraction of the mandibular incisors to correct the edge-to-edge incisor relationship, and then create vertical overlap of those teeth using maxillary and mandibular fixed labial appliances. The extraction of the #34 and #44 would also serve to approximately



Fig. 1 Pretreatment extraoral photographs.



Fig. 2 Pretreatment intraoral photographs.

balance the extraction of #14 and absence of #22. Modification of the crown form of the canine would be required to improve dental esthetics, consideration also being given to the esthetics of the maxillary left first premolar (#24) as a replacement for #23 which was substituted the missing #22.

Results of treatment

Incisor overjet, overbite and dental center lines were corrected (Fig. 4). Also, it was planned for her to be referred to a periodontist to correct the gingival margins of teeth #21 and #24 by esthetic crown lengthening after vertical growth had ceased approximately at 18 years of age (Fig. 5).

After treatment, the substitute maxillary left

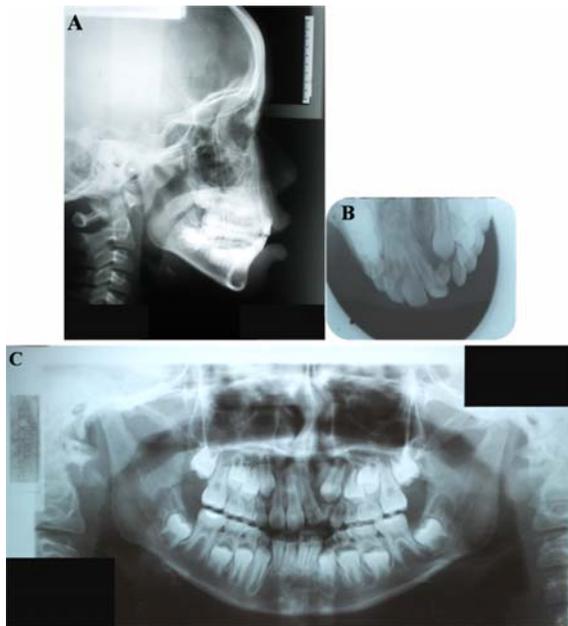


Fig. 3 Pretreatment radiographs: A) lateral cephalogram, B) occlusal radiograph, and C) panoramic radiograph. All permanent teeth up to second molar present, excepting the maxillary left lateral incisor.



Fig. 4 Post-treatment of intraoral photographs comparing left canine before and after restoration. The tooth sizes, shapes, and colors are almost identical on both sides.



Fig. 5 The further treatment plan is for the periodontist to adjust the gingival heights of teeth #21 and #24.

canine was reshaped to more closely resemble the missing lateral incisor using composite resin build-up. Lip and nose revisions were also considered and planned with her plastic surgeon (Fig. 6 and 7). The timing for further lip-nose revisions will be done when



Fig. 6 Post-treatment extraoral photographs. Asymmetry of nose comparing left and right nasal alar conditions. Left photo: patient at rest, right photo: smiling.



Fig. 7 The profile of patient after treatment.

she is 16 years old.

The post-treatment lateral cephalometric analysis and superimpositions (Fig. 8) show skeletal changes with ANB reduced to 4° from 7° , increase in the mandibular plane angle SN-MP from 40° to 42° , and relative decrease of lower anterior facial height compared with upper facial height from 35:65 to 40:60. The upper incisors were proclined (U1-SN from 82° to 99°) to correct the anterior crossbite (Table 1). The post-treatment panoramic radiograph shows acceptable root parallelism with no signs of bone or root resorption (Fig. 9). The esthetics were improved but the left alar of her nose remained slightly drooped.

Discussion

Patients with cleft lip and palate often have

abnormal sizes, shapes and numbers of teeth. The upper lateral incisor is the most frequent, congenitally absent tooth. Its absence affects the proportions of the maxillary labial segment and the esthetics of the smile. The unattractive smile can affect appearance, personality and psychology of patients⁽⁷⁾.

Timing and sequencing of orthodontic care for cleft patients can be divided into developmental periods, which are defined by age and dental development and should be considered as time frames in which to accomplish specific objectives⁽⁸⁾.

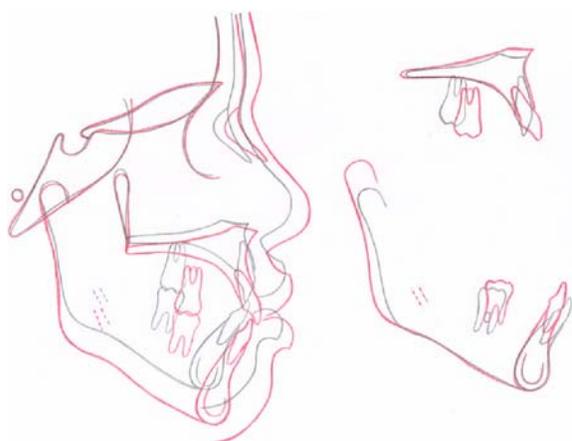


Fig. 8 Cephalometric superimposition: black line = pre-treatment; red line = post-treatment. There was anterior movement of Nasion related to S. The mandibular and maxilla profiles show growth increases.

Alveolar bone grafting of patient with cleft lip and palate is generally required when there is a significant bone defect. Early secondary alveolar bone grafting is ideally done between the ages 9 and 11 years

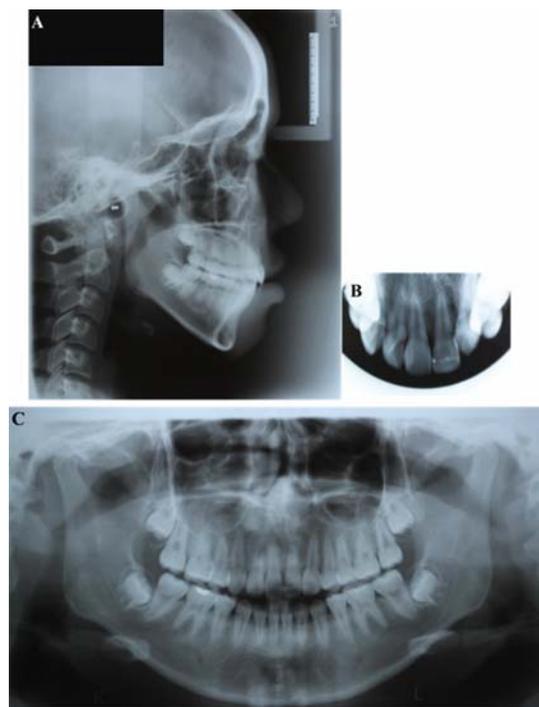


Fig. 9 Post-treatment radiographs: A) lateral cephalogram, B) occlusal radiograph, and C) panoramic radiograph.

Table 1. Cephalometric measurements

Measurement	Thai norm	Pre-treatment 15/09/2006	Post-treatment 16/11/2012
SNA (°)	85.4±4	84	80
SNB (°)	81±3.7	77	76
ANB (°)	3.8±2	7	4
Wit (mm)	-	2	2
SN-MP (°)	29±4	40	42
FH-MP (°)	22.7±5.4	34	33
LFH (ANS-Me/N-Me)	-	35:65	40:60
U1 to SN (°)	107±6	82	99
U1 to NA (°)	21±2	5	20
U1 to NA (mm)	3±2	1	4
IMPA (°)	97±6	98	86
L1 to NB (°)	30±5	34	25
L1 to NB (mm)	6±2	11	6
U1/L1 (°)	124±7	140	132
Upper lip (mm)	-	24	27
Lower lip (mm)	-	42	50

before eruption of the maxillary canine. The main goal of placing the bone is to allow the successful eruption of the permanent canine through the grafted site^(5,9). Secondary bone grafting can create a good osseous environment^(5,10,11). The key to improving the periodontal support of teeth adjacent to the cleft and obtain good inter-alveolar septum bone height in the alveolar cleft is to perform bone grafting at the mixed dentition stage when the adjacent un-erupted canine has one half to two thirds root formation⁽¹¹⁾. The erupting canine will help to stabilize the graft and result in more favorable bone height in the cleft site. If alveolar bone graft is done after the eruption of the canine, the bone will not improve the marginal bone height and resorb to the original level of crestal bone. So the dental age is preferable to using chronological age in deciding the timing of secondary bone grafting. The protocol of Khon Kaen University Cleft Center also recommends secondary bone graft at 9 to 11 years of age when canines are still not expected to have erupted. Orthodontic tooth movement should be delayed 3 to 6 weeks after the bone graft. Early movement of the roots into grafted bone appears clinically to consolidate the alveolar bone and to improve crestal alveolar height⁽⁸⁾.

There are many treatment options for the replacement of congenitally missing lateral incisors, including canine substitution, implants, prostheses, and auto-transplantation of a developing premolar. The principle of treatment planning should be both conservative and functional while maintaining best possible esthetics. However, the esthetic and functional success of canine substitution depends on variables such as the type of malocclusion and dental crowding, crown shape and color, facial profile, level of lip line on smiling. The patient's perceptions of the likely outcome could be provided by the orthodontist with examples of previous similar treatment records and dental model set-up⁽¹²⁾. The advantages of space closure with canine substitution are the avoidance of long-term maintenance of the prosthetic replacement of the lateral incisor with a denture, bridge, or implant, which can have future retreatment requirements and cost implications. Orthodontic space closure does not have to be postponed until the end of growth while waiting for a dental implant and, with another alternative of bridgework to replace a missing lateral incisor; adjacent healthy teeth do not have to be prepared⁽¹³⁾.

The disadvantage of space closure with canine substitution is tendency to reopening the space after space closure in a young patient⁽¹⁴⁾. So after treatment, this should be overcome with long-term fixed

retention by a bonded lingual retainer⁽¹⁵⁾. Balanced functional occlusion with modified group function on the working side can prevent reopening of the space. The final post-treatment retention should be supplemented with a removable plate or vacuum-formed retainer to be used full-time for 6 months and then at night⁽¹⁶⁾.

Turpin's observations for dealing with absence of maxillary lateral incisors by canine substitution are relevant to obtaining an acceptable esthetic outcome⁽¹⁷⁾. The lateral incisor has a small and flat-faced tooth when compared with canine. The canine has a conical shaped, broader neck and thicker tooth which contains more dentin, and is often darker in color. The gingival margin of the canine is usually higher than that of the lateral incisor, and canines tend to have a prominent tip. The first premolar is generally shorter and narrower than the approximating lateral canine. Therefore, these differences should be corrected to improve the esthetic outcome for patients^(12,17,18).

Most perceptions of smile attractiveness in patients with canines substituted for missing maxillary lateral incisors are narrow canine, brighter shades, gingival margin height slightly below that of the adjacent central incisor, and rounded tip of canine⁽¹⁹⁾. Several techniques can be used to improve esthetics. For example, the canine bracket can be inverted to increase palatal root torque, which might reduce the prominence of the canine. The bracket can be positioned more gingivally to extrude the canine and its gingival margin and the canine tip can then be reduced⁽¹⁹⁾ although this has the effect, through the need of some canine extrusion, of leading to increased labio-lingual crown thickness, possibly making the canine more prominent. The extensive grinding and reshaping of the canines in combination with porcelain veneers can improve aesthetics with less discomfort to the patients and with minor or no long-term clinical and radiographic consequences^(13,16). The width of canine can be reduced mesiodistally with interdental enamel reduction. The amount of crown reduction that is often required to position appropriately the canine; however, esthetically and functionally three planes of space can be excessive. Finally, because the canine is often naturally darker than the adjacent central incisor, the tooth can be bleached after orthodontic treatment. Moreover, esthetic improvement of the shorter and narrower first premolar may be possible by increasing length and width with porcelain veneers or resin buildups and crown lengthening⁽²¹⁾. In patients with small incisors,

the orthodontist should evaluate and may eventually suggest modifying central incisor morphology in order to improve esthetics^(18,22).

Nordquist and McNeill⁽²³⁾ stated that non-cleft patients, with maxillary lateral incisor spaces closed by substituting permanent canines, had significantly healthier periodontium than patients with prosthetic lateral incisors and no differences in adequacy of occlusal function between groups with open lateral incisor spaces and those with closed spaces. Robertson and Mohlin had similar conclusions, also stating that patients with space closure were more satisfied with the treatment results and without impaired temporomandibular joint function⁽²⁴⁾.

In bilateral cleft lip and palate, there are no significant differences between orthodontic space closure and prosthetic replacement in terms of aesthetics. But in terms of function, prosthetic replacement may result in significantly more impairment of specific masticatory functions⁽²⁵⁾.

Conclusion

The result of treatment was a satisfied patient with significantly improved esthetics and masticatory function. Although the appearance of the substituted, first maxillary left premolar for the canine was not ideal, the generalized esthetics and function were significantly improved, and it was stable one year after fixed appliance removal. It is beneficial to use an interdisciplinary treatment approach combining orthodontic, oral surgical, periodontal and dental restorative skills to obtain the most predictable and favorable outcome.

Acknowledgement

The authors wish to thank express their deepest and sincerest gratitude to Associate Professor Keith Godfrey for his constructive suggestions and knowledge, which enabled us to develop this article. And also thanks to the Center of Cleft Lip-Cleft Palate and Craniofacial Deformities, Khon Kaen University in association with the "Tawanchai Project".

Potential conflicts of interest

None.

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การรักษาทางทันตกรรมจัดฟันในผู้ป่วยปากแหว่งและกระดูกเบ้ารากฟันโหว่ข้างเดียวที่มีฟันหน้าบนซึ่งข้งหาย: รายงานผู้ป่วย

พูนศักดิ์ ภิกเสก, มนเทียร มโนสุดประสิทธิ์, ทศนีย์ วังศรีมงคล, อาภาภรณ์ ภาษาสุข, ธนัชชัชปียา สมสุข

ความสวยงามของผู้ป่วยปากแหว่งและกระดูกเบ้ารากฟันโหว่ที่มีฟันหน้าบนซึ่งข้งหายไปเป็นเรื่องสำคัญ เด็กผู้หญิงอายุ 9 ปี 3 เดือน ที่ได้รับการแก้ไขเพดานโหว่ปฐมภูมิข้างซ้ายด้านเดียวแล้ว ถูกส่งต่อมาประเมินทางทันตกรรมจัดฟัน สำหรับฟันหน้าที่ซ้อนเก ผู้ป่วยไม่สบายใจกับความไม่สวยงามของฟันหน้าบน ซึ่งอยู่หลังต่อฟันหน้าล่าง การปลุกกระดูกเบ้ารากฟันและใช้ฟันเขี้ยวมาแทนฟันหน้าบนซึ่งข้งที่หายถูกแนะนำในผู้ป่วยรายนี้ ภายหลังจากรักษาผลการรักษาดี โดยมีการสบฟันที่ดี มีใบหน้าด้านข้างที่ยอมรับได้ และยังคงเสถียรภาพภายหลังจากการรักษาแล้ว 1 ปี
