

# Case Report

## Movement of an Upper Central Incisor Across the Midline in a Patient with Cleft of Primary Palate

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*Orthodontic treatment for a 10-years-old girl, with repaired bilateral cleft lip and left incomplete unilateral alveolar cleft, was performed by moving her right maxillary central incisor across the midline to replace her congenital missing central incisor, and then moving the right lateral incisor toward the midline to act as a new central incisor. A malformed supernumerary tooth, positioned between the right central and lateral incisor, was extracted during incisor movement. Significant lip profile improvement was accomplished by maxillary and mandibular anterior teeth retraction into three-premolar extraction spaces.*

*Not only natural functional occlusion, deviated midpalatal suture along the central incisor, and no obvious root resorption were obtained but also narrowing the alveolar bone cleft which was beneficial for bone continuity supporting dental structures, satisfactory results were possible for the patient with primary palate cleft.*

**Keywords:** Central incisor, Cleft lip, Cleft palate, Midline, Missing tooth, Supernumerary tooth

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Cleft lip and/ or palate population were observed higher prevalence of dental anomaly than general population, especially in the abnormality of tooth number<sup>(1-3)</sup>. Congenital absence and supernumerary teeth often occur in the cleft site of oral cleft patients<sup>(4-10)</sup>. Orthodontic treatment during the mixed dentition in such cases not only deals with malocclusion from an incomplete dentition, malposed teeth, space discrepancy, and arch asymmetry, but also deficiency of dental support. The aim of treatment is to obtain good oral tissue environment, function, esthetics and stability.

Treatment options for unilateral missing central incisor could be space re-opening for premolar auto-transplantation<sup>(11)</sup>, dental implant<sup>(12,13)</sup>, prosthodontic substitution<sup>(14)</sup>, and orthodontic space closure<sup>(15,16)</sup>. If there is absence of a central incisor adjacent to an alveolar cleft, it may be possible to move the contralateral central incisor across the midline into the space. This could be followed by moving an existing lateral incisor to replace the vacated central incisor position. There have been several reports of movement of maxillary central incisor across the midline<sup>(17-21)</sup>. Most

of such treatment began in the mixed dentition and created satisfactory results of esthetics and occlusion and minimal relapse or adverse effect on root development. Follin et al<sup>(20)</sup> found less root resorption with central incisor movement but longer treatment time in young beagle dogs compared with the older dogs. However, desirable outcomes have been reported for an adolescent<sup>(22)</sup> and an adult<sup>(23)</sup>.

No reports of such treatment for oral cleft patients have been found. Following, is a case report of movement of a central incisor across the midline and associated orthodontic corrections for a patient with clefts of the primary palate. This case report received approval from the Khon Kaen University Ethics Committee for Human Research (HE562111).

### Case Report

#### Case history

A healthy female patient, aged 10 years, presented in 2008 with the main concern of a large space in maxillary anterior region. She had a non-syndromic bilateral complete cleft lip with left incomplete alveolar cleft. The history of cleft repairs was lip closure when she was 3 month of age. Her dental history was minimal due to lack of either regular dental check-up or basic oral care by the patient and her parents. Absence of the left central incisor was considered to be a congenital anomaly due to no report

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of trauma or extraction in that area.

### Clinical evaluation

#### Extra-oral assessment

She had normal height-weight relationship compared to her peer group but she had psychological issues related to her dental appearance and repaired lip. Her upper and lower lips were thick, protrusive, and incompetent at rest (interlabial gap 3 mm) (Fig. 1).

Her convex profile showed retrusive chin, upturned nose tip, the acute nasolabial angle due to protrusive upper lip, everted lower lip and deep mentolabial fold. All oro-nasal functions were normal.

#### Intra-oral assessment

The overall oral hygiene was poor with heavy plaque accumulation, and some treated and untreated dental caries (Fig. 2). Mild marginal gingivitis was obvious at the labial of rotated #12 and developing crowding affecting maxillary canines and second premolars and mandibular second premolars due to arch space loss. However, the attached gingiva was sufficient with no periodontal pocket or gingival recession. The frenum, palate and tongue were normal. There was incomplete alveolar cleft between #11 and #22.

She had a mixed dentition with eruption of first permanent molars and #14, #12, #11, #22, #23, #24 and all mandibular teeth except #45 (Fig. 2). There was mal-alignment in both arches; torsion of maxillary lateral incisors, tipping of #11 towards the left alveolar cleft, and mesial tipping of both mandibular first molars. The upper and lower dental midlines were deviated to the left 3 mm and right 1 mm, respectively. The inter-arch relationships were Class I molar on both sides, Class II canine on the left and unclassified on the right, 3 mm of overjet, 6 mm of complete overbite (90% vertical incisal overlap). The curve of Spee was 3 mm. There was no cant of occlusal plane or CO-CR discrepancy.

#### Model analysis

The maxillary and mandibular arches were in asymmetrical U-shaped arch form. The space condition of both arches indicated crowding 6.5 mm and 7 mm, respectively.

#### Radiographic evaluation

All radiographs were taken on the same date of her first visit. Panoramic radiograph evaluation revealed normal tooth development, missing #21, and questionable absence bilaterally of maxillary third



Fig. 1 Pre-treatment extra-oral photographs. (A) Frontal view in rest position. (B) Frontal view on smiling. (C) Profile view on left side.



Fig. 2 Pre-treatment intra-oral photographs. (A) Lateral view-right side. (B) Frontal view. (C) Lateral view-left side. (D) Occlusal view-maxillary arch. (E) Occlusal view-mandibular arch.

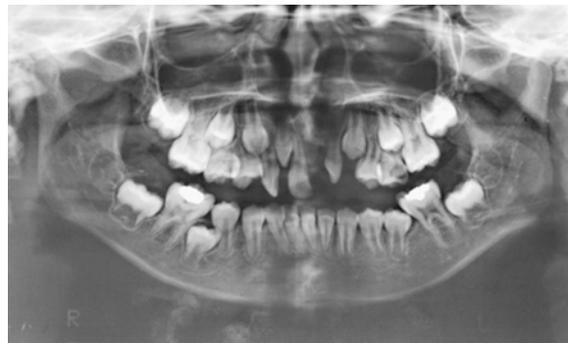


Fig. 3 Pre-treatment panoramic radiograph.

molars (Fig. 3). There was a supernumerary tooth positioned between #11 and #12 with much delayed root formation compared with nearby incisors (Fig. 4). There was a bone cleft mesial to #22. Both maxillary canines had 50% of root length formed. There was noticeable mesial crown tipping of mandibular first molar leading to impaction of #35 and #45.

Periapical radiographs exhibited sufficient alveolar bone thickness and height mesial to #22 at the level of its cervical constriction (Fig. 4A).

Occlusal radiograph confirmed the other

radiographic evaluations particular in narrow alveolar bone cleft (Fig. 4B). There was thin alveolar wall separate between root of #11 and intermaxillary suture. Supernumerary tooth demonstrated retarded root development.

The lateral cephalometric radiograph (Fig. 5A) was traced (Fig. 5B) and measurements recorded in Table 1, indicating skeletal Class II relationship, due to orthognathic maxilla and retrognathic mandible, with normal vertical skeletal relationship. The maxillary incisor was retroclined and retrusive but the mandibular incisor was normal inclined and positioned, resulting in obtuse interincisal angle. The soft tissue analysis exhibited mild convexity of facial profile, acute nasolabial angle, protrusive upper lip, protrusive lower lip, incompetent lip and retrusive chin.

### Treatment planning

Apart from the patient's complaint about large spacing in maxillary anterior region, the main concern with her mixed dentition was space deficiency for succedaneous teeth. Moreover, the treatment plan included orthodontic space closure in area of #21 by moving #11 across the midline, dental midline adjustments, and lip profile improvement.

With #21 congenital missing, dental substitution was necessary for esthetic purpose. Besides, the tooth morphology of supernumerary tooth and alveolar cleft would be reassessed for whether orthodontic space closure or space regain for prosthesis. The requirement of alveolar bone graft depended on decision of both orthodontist and oral surgeon. In the situation of small incomplete alveolar cleft with adequate bone width, height, and thickness for support and maintenance of the permanent teeth, following Santiago et al's decision criteria<sup>(24)</sup>, bone grafting was not considered necessary but still allowing for orthodontic space closure in preference to a possible prosthetic-fill at the left alveolar cleft. A bone graft at the cleft site was considered to be unnecessary for this girl because there appeared to be a good bony bridge reaching to acceptable alveolar cleft height (Fig. 4). The presence of the unerupted supernumerary incisor on the right side making up a full complement of teeth was also a factor in deciding that a prosthesis was not needed. If the right central incisor, #11, was to be moved to the cleft on the left, there was concern about the feasibility of moving that tooth through the mid palatal suture.

It was decided to rely on dental camouflage for correction of the sagittal skeletal Class II because,



Fig. 4 Pre-treatment periapical (A) and occlusal radiographs (B).

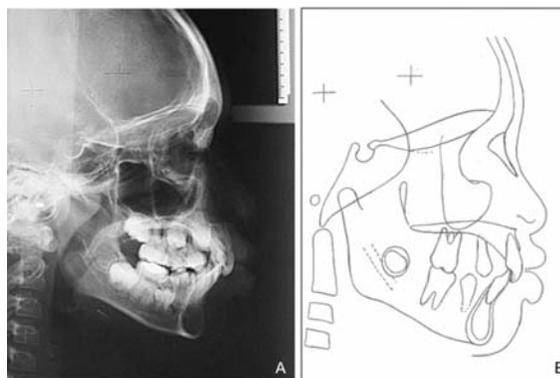


Fig. 5 Pre-treatment lateral cephalometric radiograph (A) and tracing (B).

although her mandible was retrognathic, her maxillary incisor overjet was relatively small, and lower lip was protrusive and everted which could help mask the skeletal problem.

Because of impaction of teeth #35 and #45, and in order to avoid greater proclination of mandibular incisors, it was decided to extract #34 and #44. This mandibular teeth loss was balanced by extraction of #24 and defective supernumerary incisor. With #11 to become #21, the maxillary right lateral incisor would become the right central incisor, the maxillary right canine taking the lateral incisor position.

The aim was to maintain molar Class I and obtain canine Class I on both sides. The incisor, overbite, and overjet were to be corrected using intra-oral fixed appliances only.

Following attention to caries and gingivitis, full arch banding and bonding using 0.022" (MBT prescription) edgewise attachments was carried out.

Revision of the lip repairs for esthetic improvement was to be delayed until after completion of orthodontic treatment.

### Treatment

Initial aligning and leveling with 0.014" NiTi upper and lower archwires were begun in October 2008

and the supernumerary tooth was partially erupted. The malaligned permanent maxillary canine and premolars were continuously corrected by 0.016" NiTi, 0.016" and followed by 0.018" stainless steel archwires (Wilcock Premium Plus).

The panoramic radiograph (Fig. 6), taken in February 2009 shows all four third molars were present. Patient was referred for tooth removal of #48 and prolonged-retention of #55 and in order to facilitate eruption path of #47 and #15, respectively.

In June 2009, all maxillary teeth mesial to the first molars were well-aligned. The occlusal and periapical radiographs (Fig. 7) assessment revealed sufficient alveolar bone height at the level of cemento-enamel junction of #11 and #22. The oral surgeon confirmed that there was no requirement for alveolar bone graft. Mesial movement of #11, across the midline toward the cleft site, was established in November 2009 by nickel-titanium open-coil spring fitting on 0.018" stainless steel archwire (SS) between #11 and #12. Alignment and leveling of the lower arch was achieved by 0.018"x0.025" SS which incorporated reversed curve of Spee to correct deep bite.

Within three months, the activation of open-coil spring and traction by power chain had relocated the #11 with good contact with #22. The same mechanic was then used to mesialize #12 on the same 0.018" SS.

At the end of February 2010, the space closure in lower arch performed by power chain. Malalignment correction of #12 followed by its composite build-up to mimic #11 were achieved in June 2010.

In September 2010, all second molars were bonded with buccal tubes and aligned with 0.018" NiTi archwires. Two months later, overjet reduction and upper dental midline correction were started by #23 retraction into #24 extraction space.

A periapical radiograph of #11, #12 and #22



**Fig. 6** Panoramic radiograph during treatment.

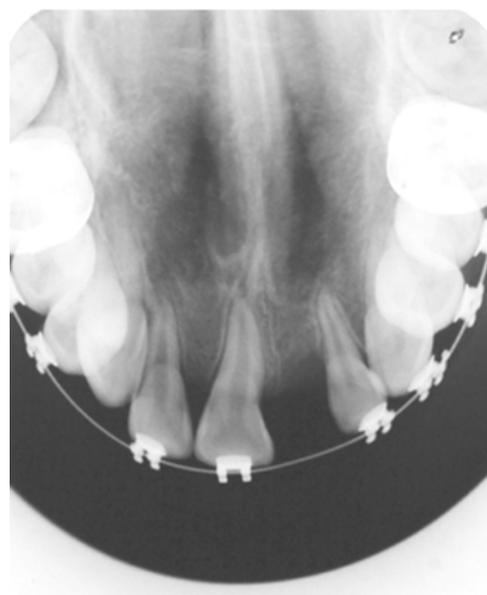
was taken in order to evaluate root axis and also revealed blunt apex of incisors, indicating 1 mm of apical root resorption (Fig. 8). The intact lamina dura with alveolar crest level at cement-enamel junction and deviated midpalatal to the right were noted.

After remaining upper and lower extraction spaces were closed, the last 7 months were used for finishing orthodontic treatment, such as the root paralleling by bracket repositioning and minor wire bending, completion of the deep overbite correction and maintenance for some periodontal tissue re-organization.

A lingual retainer was bonded on #13, #12, #11, #22 and #23, followed by debonding. On the same date in October 2012 after the adhesive removal, vacuum-formed retainers were inserted. Two weeks later, an upper wraparound retainer and a lower wraparound retainer with labial arch soldered to Adam's clasps were inserted and home care instruction given.

## Results

The post-treatment records were comprised extra- and intra-oral photographs, panoramic radiograph, and lateral cephalogram with superimposition of pre- and post-treatment tracing (Fig. 9 through 13 and Table 1). At the end of four years of active orthodontic treatment, the results were detailed as follows:



**Fig. 7** Occlusal radiograph for evaluation of alveolar bone graft requirement.

From clinical examination (Fig. 9 and 10)

- acceptable occlusion with molar CI II subdivision left (half unit), canine slightly CI II on both sides,
- overjet 3 mm, overbite 1 mm, curve of Spee 1 mm,
- upper and lower dental midlines coincided with facial midline,
- all spaces were closed,
- acceptable profile with only slight convexity,
- significantly better lip profile with competent lip seal,
- consonant smile line,
- gingival hypertrophy at the disto-labial of the #21.

From superimposition of lateral cephalometric radiographs (Fig. 13)

- downward growth of maxilla, forward and downward growth of mandible,
- constant maxillary length, increased in mandibular length,



**Fig. 8** The periapical radiograph demonstrated apical root resorption of maxillary incisors.



**Fig. 9** Post-treatment extra-oral photographs. (A) Frontal view in rest position. (B) Frontal view on smiling. (C) Profile view on left side.

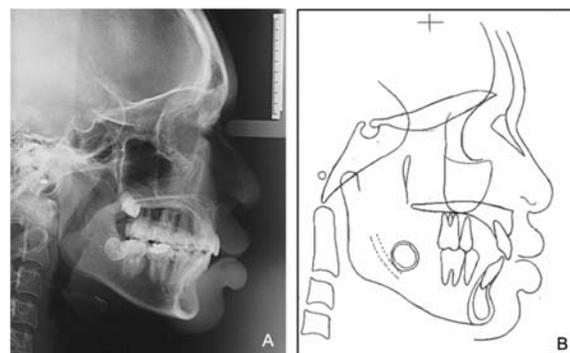
- constant position of dental bases,
- improved inter-incisal angle,
- less retroclined and unchanged position of maxillary incisor as a result of palatal root torquing,
- constant inclination and intrusion of mandibular incisor,
- mesial tip of maxillary molar, mesial and vertical position of mandibular molar with mandibular growth,
- upper and lower lips move downward and



**Fig. 10** Post-treatment intra-oral photographs. (A) Lateral view-right side. (B) Frontal view. (C) Lateral view-left side. (D) Occlusal view-maxillary arch. (E) Occlusal view-mandibular arch.



**Fig. 11** Post-treatment panoramic radiograph.



**Fig. 12** Post-treatment lateral cephalometric radiograph (A) and tracing (B).

**Table 1.** Pre-treatment and post-treatment lateral cephalometric measurements

| Measurements         | Thai norm | Pre-treatment | Post-treatment |
|----------------------|-----------|---------------|----------------|
| <b>Skeletal</b>      |           |               |                |
| SN length (mm)       | 70±4      | 69            | 73             |
| SN-FH (°)            | 7±2.58    | 4             | 3              |
| SNA (°)              | 84±3.58   | 87            | 87             |
| SNB (°)              | 81±3.59   | 77            | 77             |
| ANB (°)              | 3±2.50    | 10            | 10             |
| SN-MP (°)            | 30±5.61   | 31            | 28             |
| UAFH:LAFH (%)        | 45:55*    | 45.5:54.5     | 45:55          |
| PFH:AFH (%)          | 67±5      | 64.4          | 61.4           |
| Mandibular angle (°) | 118±6.13  | 123           | 121            |
| <b>Dental</b>        |           |               |                |
| U1-SN (°)            | 108±6.13  | 78            | 102            |
| U1-NA (°)            | 22±5.94   | 9             | 15             |
| U1-NA (mm)           | 5±2.13    | -4            | 3.5            |
| L1-MP (°)            | 97±5.97   | 100           | 100            |
| L1-NB (°)            | 30±5.61   | 27            | 28             |
| L1-NB (mm)           | 7±2.22    | 6.5           | 5              |
| U1-L1 (°)            | 124±7*    | 151           | 129            |
| <b>Soft tissue</b>   |           |               |                |
| Profile angle (°)    | 168.7±4*  | 172           | 174            |
| Nasolabial angle (°) | 91±7.98   | 85            | 81             |
| U-lip to E-line (mm) | -1±2      | 4.5           | 2.5            |
| L-lip to E-line (mm) | 1.5±2     | 7             | 6.5            |
| Ls to SnV (mm)       | 1-2*      | 6             | 3              |
| Li to SnV (mm)       | -1-0*     | 4             | -1             |
| Pog' to SnV (mm)     | -1-(-4)*  | -7            | -8             |
| U-lip length (mm)    | 23±2.01   | 16            | 24             |
| L-lip length (mm)    | 46±2.28   | 41            | 43             |
| Interlabial gap (mm) | 2±2*      | 3             | 1              |

\* represent Caucasian norm

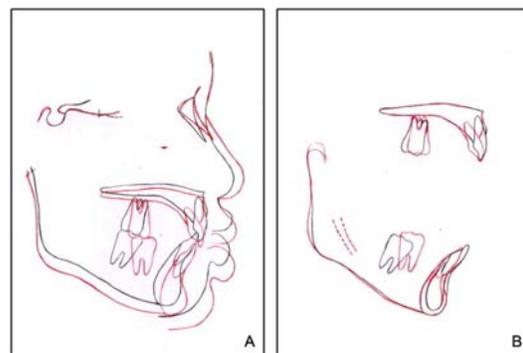
slightly forward.

### Discussion

The orthodontic treatment by moving a maxillary incisor across the midline in the present study started in the mixed dentition, similar to the previous studies<sup>(17-19,21)</sup> that reported successful results in incisor transfer across the midline along with midpalatal suture and dental appearance improvement without prosthesis substitution.

Dental anomaly is more commonly observed in severe forms of oral cleft than mild form<sup>(1,5,25,26)</sup>. This girl with bilateral complete cleft lip and unilateral incomplete cleft of alveolus had dental anomalies related to both cleft sites and apparent congenital absence of #21.

There have been several previous reports of moving a maxillary central incisor across the midline aimed at elimination of abnormal dimensions or shape



**Fig. 13** Illustration demonstrating the effects of the orthodontic mechanics, using superimpositions of pre- and post-treatment cephalometric tracings based on: (A) the SN plane, (B) the internal palatal structure, and the inner contour of the cortical plate at the inferior border of symphysis and mandibular lower border (black and red lines indicates pre- and post-treatment respectively).

of a central incisor and replacement by a supernumerary tooth<sup>(17-19,21)</sup>, or lateral incisor<sup>(22,23)</sup>. The maxillary central supernumerary tooth in those reports exhibited crown and root morphology likeness to the central incisor. On the contrary, the maxillary supernumerary tooth in the present study was extracted due to hypoplastic characteristics.

Gingival hypertrophy at the disto-labial of the #21 (Fig. 10B) required gingivoplasty for normal morphology but the patient refused treatment. Minor relapse might occur, even after the obvious result of a blend of periodontal and sutural connective tissue during orthodontic tooth movement and during maxillary bonded lingual retainer use. Continual recall is necessary to check for any space re-opening and progression of root resorption.

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#### Potential conflicts of interest

None.

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## การเคลื่อนฟันตัดซี่กลางบนขาเข้านเส้นกึ่งกลางในผู้ป่วยเพดานปากปฐมภูมิโหว่รายหนึ่ง

มนเทียร มโนสุดประสิทธิ์, ทัศนีย์ วังศรีมงคล, พูนศักดิ์ ภิเศก, นิสิตา จิตติวัฒนพงศ์

การรักษาทางทันตกรรมจัดฟันในผู้ป่วยเพศหญิงอายุ 10 ปี ที่ได้รับการเย็บปากแหว่งทั้งสองด้านและมีรอยแยกไม่สมบูรณ์ของกระดูกรองรับฟันหน้าบนด้านซ้าย โดยเคลื่อนฟันตัดซี่กลางบนขาเข้านเส้นกึ่งกลางเพื่อแทนที่ฟันตัดซี่กลางซ้ายที่หายไปแต่กำเนิด และเคลื่อนฟันตัดซี่ข้างบนขาเข้าหาเส้นกึ่งกลางฟันให้กลายเป็นฟันตัดซี่กลางขาซ้ายใหม่ ฟันเกินที่มีรูปร่างผิดปกติมีตำแหน่งอยู่ระหว่างฟันตัดซี่กลาง และฟันตัดซี่ข้างบนขาถูกถอนออกระหว่างการเคลื่อนฟันตัดบน ลักษณะด้านข้างของริมฝีปากที่ดีขึ้นอย่างมากเป็นผลจากดึงฟันหน้าบนและล่างเข้าหาช่องว่างถอนฟันกรามน้อยสามซี่

นอกจากนี้ยังพบการทำงานบดเคี้ยวตามธรรมชาติ การเบี่ยงของรอยต่อกระดูกกลางเพดานตามการเคลื่อนของฟันตัดซี่กลางไม่มีการละลายของรากฟันรุนแรง และการแคบลงของรอยแยกกระดูกรองรับฟันที่ให้ประโยชน์ด้านความต่อเนื่องของกระดูกรองรับฟัน ทั้งหมดเป็นผลการรักษาที่น่าพอใจในผู้ป่วยเพดานปากปฐมภูมิโหว่รายนี้

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