Case Report

Management of a Traumatized Maxillary Left Central Incisor by Moving the other Central Incisor across the Midline

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Abstract

A 12-year-old boy who had a bicycle accident was sent to the orthodontic department to resolve his protrusion problem. His maxillary left lateral incisor was missing because of the accident. The avulsed maxillary left central incisor was replanted. However, three month later, it had external root resorption, so it was removed. The other traumatized maxillary right central incisor was moved across the midline to precede the maxillary left central incisor. Orthodontic treatment was completed within 30 months. Then, the patient was referred to the department of periodontology and operative dentistry for esthetic crown lengthening, frenectomy and composite veneers. There was no significant root resorption. The patient and his parents were satisfied with the results.

Keyword: Midline crossing, Root resorption, Traumatized tooth

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Introduction

Traumatic dental injuries were found in one third of Thai children aged 11-13 years old.[1] The severity of injuries varies from crown fracture, crown-root fracture to periodontium injuries or even losing some teeth. To manage the space after losing an upper anterior tooth could be challenging and a multidisciplinary approach may be needed. Treatment options are replanting the tooth, opening space for dental substitution, substituting the central incisor or doing a tooth transplantation.[2] Moving the maxillary central incisor across midline, though rarely being done, might be a good option in some situations. A study in beagle dogs reported a root resorption after moving a central incisor across the midline[3] and its following study showed that removing the mid palatal suture area before moving an incisor worsened the resorption.[4] However, Bosio *et al*, reported a satisfied outcome after moving a central incisor across midline in a patient who lost the maxillary left central incisor and had an ipsilateral canine

impacted.[5] Other reports showed treatments of patient under 12 years old with successful outcomes.[6-8] In this article, the maxillary right central incisor which was moved across the midline had been traumatized. The root resorption was being observed during the treatment. This article will explain the treatment of a patient who had a large overjet by moving the traumatized 11 across the midline to substitute the 21.

Diagnosis and etiology

A 12-year-old boy was referred for orthodontic consultation. His chief complaint was dental protrusion. He had a maxillary left central incisor and a maxillary left lateral incisor avulsed in a bicycle accident eight months ago but only 21 was replanted. 11 was subluxation and had an uncomplicated crown-root fracture with a negative EPT test. Root canal treatments were done within seven days after the accident. However, 21 was diagnosed with replacement root resorption three months after the trauma. The patient had no other medical or dental problems. No other unusual habits were found. Photographs, dental impressions and radiographs were collected during the first visit (Fig. 1, 2, 3, 4).

Figure 1 *Facial and intraoral pretreatment photographs*

For clinical examination, the patient had a mesofacial type and symmetric face with a convex profile. He had a competent lip at rest and upper, lower lip protrusion. When he smiled, 20 % of his upper incisor showed. The upper dental midline was 2 mm deviated to the left facial midline while a lower midline was on the facial center. Intraoral examination showed a bilateral full-cusp Class II molar relationship. 11 was severely protruded and discolored. 22 was clinically missing. Overjet and overbite were 8 mm and 2 mm, respectively. He had mild spacing in both the upper and lower arch.

The panoramic radiograph (Fig. 3A) revealed no fractures of both condylar necks and clear maxillary sinuses. All third molars were forming. The periapical films showed normal periodontal space of 11 and 31 which had root canal treatment done after the trauma (Fig 3B). 21 which was filled with calcium hydroxide, had a sign of external root resorption. The CBCT revealed the distance between the root of 11 and incisive canal was 2.48 mm and 3.39 mm at the distance of opening of canal and a root apex (Fig 5). Pre-treatment cephalometric analysis presented skeletal Class I with orthognathic maxilla and mandible, skeletal deep bite (Fig 4, Table 1). The maxillary and mandibular incisors were protruded and the interincisal angle was acute. Nasolabial angle was also acute and the distance of the upper lip to E-line was large.

The patient was diagnosed with skeletal Class I skeletal deep bite, dental Class II division 1 malocclusion, upper and lower lip protrusion.

Figure 2 Pretreatment dental casts

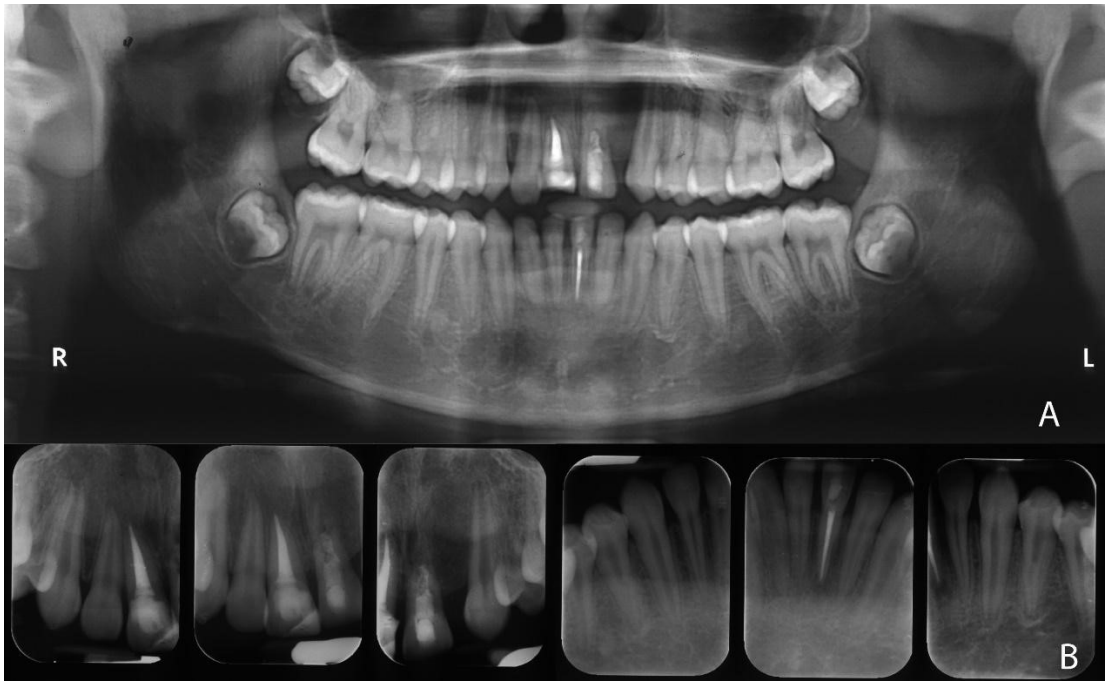

Figure 3 *A pretreatment panoramic radiograph, B pretreatment periapical radiograph of maxillary and mandibular anterior teeth*

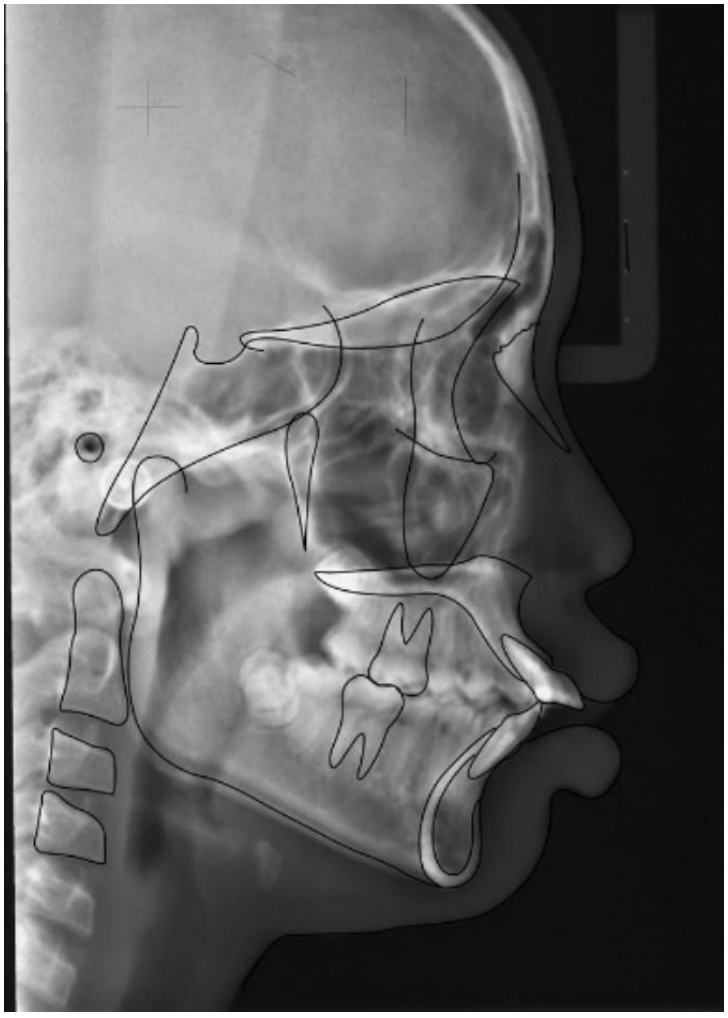

Figure 4 *Pretreatment cephalometric radiograph*

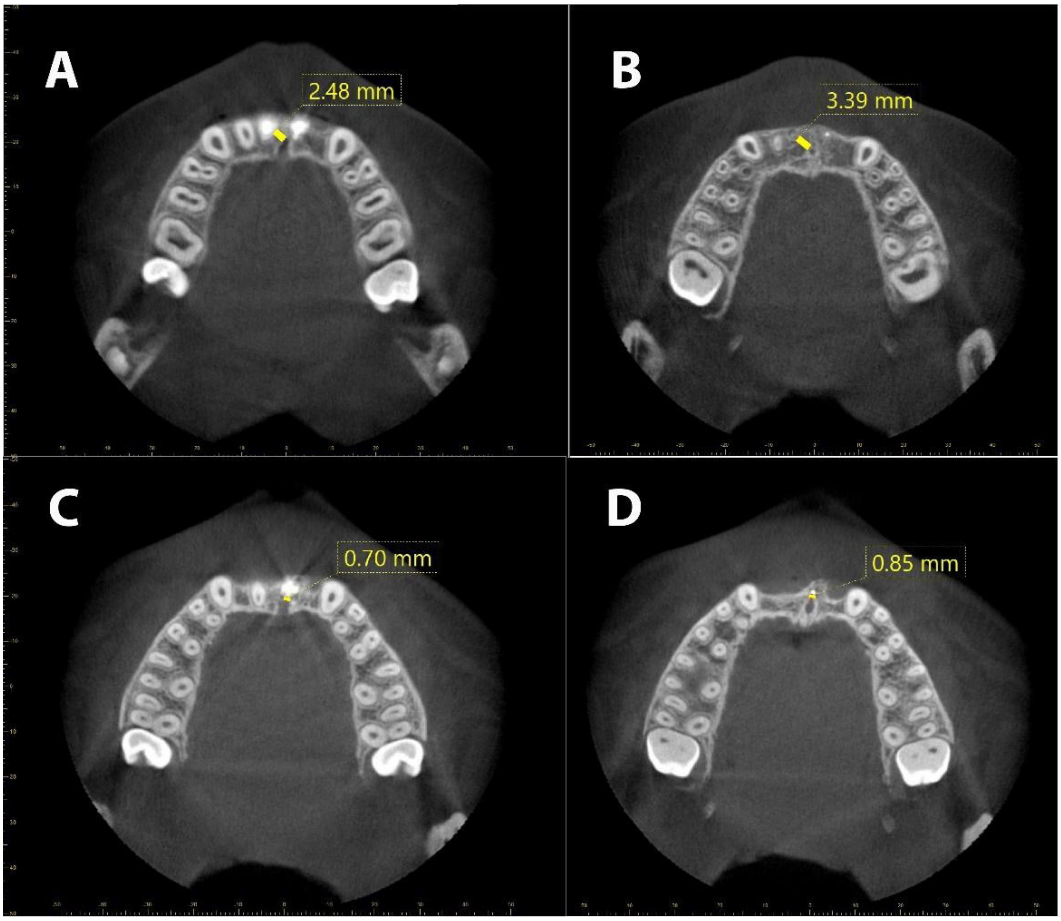

Figure 5 *A pretreatment CBCT revealed the distance between the upper right incisor root and the incisive canal was 2.48 mm at the level of incisive canal opening B 3.39 at the level of root apex C post treatment CBCT, 0.7 mm at the level of incisive canal opening D 0.85 mm at the level of root apex*

Table 1 *Cephalometric values pre and immediate post treatment*

Measurement	Thai norm	Pretreatment	Interpretation	Posttreatment
SNA	79-87	83	Orthognathic Mx	81
SNB	76-82	79	Orthognathic Md	80
ANB	2-6	4	Skeletal Class I	1
Wits	(-5) - (-1)	2	Dental base Class I	-1
FMA	21-29	20	Skeletal deep bite	18.5
UI-NA	24-32	51.5	UI proclination	28
UI-NA (mm)	4-8	15.5	UI protrusion	9.5
LI-NB	26-38	36	LI normal inclination (protrusion tendency)	29
LI-NB (mm)	4-8	10.5	LI protrusion	8.5
IMPA	95-103	108	LI proclination	99.5
UI-LI	110-126	90.5	Acute interincisal angle	121.5
H- angle	10 -18	27.5	Convex profile	23
UL to E-line	-3 - 1	9	Upper lip protrusion	4.5
LL to E-line	0-4	11	Lower lip protrusion	6.5
FCA	5-13	12.5	Normal facial contour	12
NLA	78 - 100	78	Acute NLA	83

Treatment objective

The primary goal of the treatment was to reduce upper teeth protrusion and to improve facial esthetics. Canine Class II malocclusion would be corrected to Class I in order to obtain normal overjet, overbite while maintaining skeletal relationship and reduce upper and lower lip protrusion.

Due to the full cusp Class II molar relationship, two treatment plans were possible, as follows:

1. Extraction of 21 and move tooth 11 across the midline to substitute 21

2. Extraction of both maxillary first premolars and 21 with post treatment dental substitution on maxillary left central and lateral incisors

3. Extraction of 14 and transplant to 21 position

Treatment selected

After discussions with the patient and his parents, the first treatment plan was selected, 11 would be moved across the midline and reshaped to mimic 21. Besides, 12, 13 and 23 would need restorations for better esthetics. The molar relationship would remain in full cusp Class II and the maxillary premolars would function as canines to obtain canine Class I relationship on both sides. The overjet would be reduced to normal. The lower arch would be aligned, and the spaces would be closed. According to this plan, the patient would not need to wear dental prostheses afterwards. The disadvantages of this plan were the risks of root resorption during moving the traumatized incisor across midline, massive restorations and periodontal surgery on the upper anterior region. For the second treatment option, the patient has to lose two other sound teeth and get dental substitution for 21 and 22 during the waiting period for growth cessation before being able to place the implants. Moreover, due to the full cusp Class II canine relationship, two TADs were needed in order to obtain maximum anchorage for maximum overjet reduction. In the third option, 14 will be removed to provide a space for overjet reduction and will be autotransplanted to the 21 position. The success rate of autotransplantation is high especially when premolars are transplanted to maxillary incisor areas.[9] The transplanted tooth can be orthodontically moved within three months after procedure without any sign of root resorption.[10] After transplantation 14 and 23 would need restoration and crown lengthening for better esthetics. The disadvantages of this plan were the patient had to undergo a transplant surgical procedure, endodontic treatment of 14, risk of 14 ankylosis and root resorption which were possible complications after transplantation. However the labial frenum will not be shifted and no implant would be needed.

Treatment progress

21 was removed due to its poor condition. Maxillary teeth were bonded with Ormco® brackets, Roth prescription (slot 0.018 x 0.025 inches). 11 was bonded with a left central incisor's bracket. 12 was bonded with a right central incisor's bracket. Transpalatal arch was banded to the maxillary first molar and bonded to both left and right maxillary first and second premolars in order to reinforce the anchorage for moving the incisor across the midline (Fig. 6).

Figure 6 *Transpalatal arch bonded to maxillary premolars and banded to maxillary molars to prevent arch collapse during the treatment*

Elastomeric chains were used to move the maxillary upper right incisor across midline on 0.017" x 0.025" stainless steel main arch wire. It took seven months to move this tooth to its new position. By shifting 11 across the midline, 12 drifted into the right maxillary central incisors position spontaneously. Reverse L-loops with 0.016" x 0.022" stainless steel wire were used to maintain the overbite and reduce the overjet after all the incisors were in their new position.[11] After debonding, temporary composite resin was applied between 11 and 12 to maintain the space while waiting for the composite veneers. A fixed retainer was placed from the maxillary premolar to premolar (Fig. 7). After completion of restorations, wraparound retainers were delivered in both upper and lower arches.

Six months after debonding, crown lengthening from 14 to 24 and frenectomy were done to enhance the esthetics. Composite veneers were done six months afterwards (Fig. 8). Final restoration would be defined again after the patient reached the age of 20 years old.

Figure 7 *Extraoral and intraoral posttreatment photographs (debonding date)*

Figure 8 *Intraoral pictures after anterior teeth restoration*

Treatment results

After 30 months of orthodontic treatment, the appliances were debonded (Fig. 7). Good occlusion with 2 mm overjet and overbite were obtained. Full cusp Class II molar relationship was maintained. The maxillary first premolars were in the position of canines to mimic canine Class I and no balancing interference was observed. The width of upper canines was reduced on both mesial and distal side to resemble lateral incisors. From lateral cephalometric superimposition, the mandible grew 5 mm forward and 11 mm downward causing the reduction of ANB angle. The upper incisors were retracted for 5 mm by means of controlled tipping. The maxillary molars were moved 2 mm mesially because of the use of Class III elastic. Moreover, mandibular growth carried the upper first molars forward along with the lower first molar without changing the molar relationship. In mandibular arch, lower incisors were tipped 2 mm lingually while lower molars were extruded 3.5 mm without any antero-posterior movement (Fig. 9).

No significant root resorption was found on the right maxillary central incisor (Fig. 10). CBCT showed a shift of median palatine suture according to upper incisal movement (Fig. 11). The distance between the right upper incisor reduced to 0.7 mm and 0.85 mm respectively (Fig. 5). The patient and his parents were satisfied with the results of appearance.

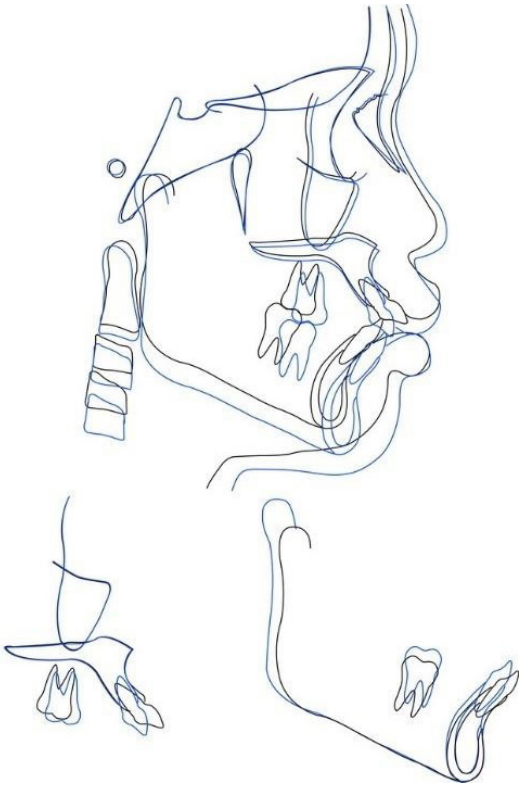

Figure 9 *Superimposition of cephalometric radiograph (initial in black, debonding in blue)*

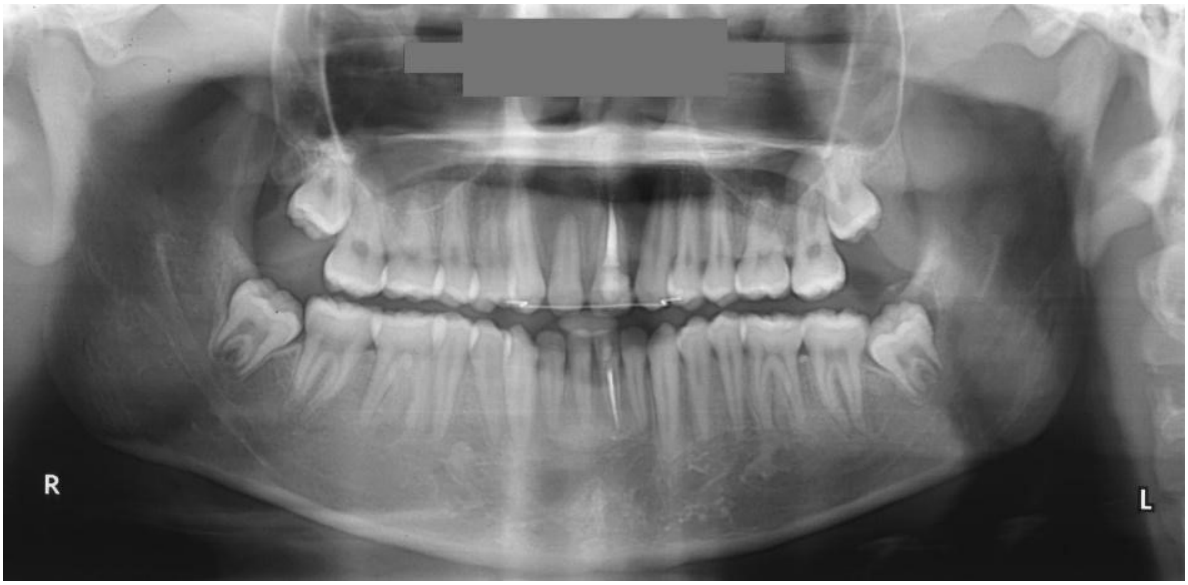

Figure 10 *Post treatment panoramic radiograph*

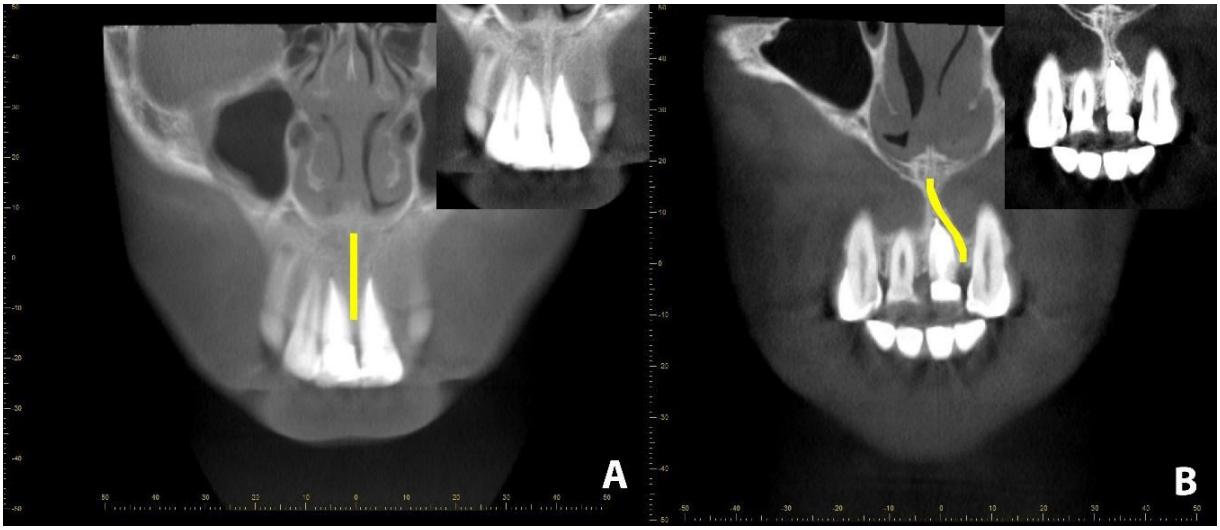

Figure 11 *CBCT of the palatine suture A before treatment B after treatment*

Discussion

To reduce the large overjet in a Class II full cusp patient, removing the tooth in each quadrant to provide the space is one of the general choices. In this case, the patient had one traumatized incisor with poor condition and had lost one tooth in the same quadrant, the tooth from the other side had to be moved to precede the one in poor condition. The important structure in the median line of the palate were the median palatine suture and the incisive canal. The contact of the root and the cortical plate of the palatine canal can cause a root resorption.[12,13] The CBCT prior to the treatment should be done to locate the distance between the incisors apex and the incisive canal. The average distance from the incisive canal to an upper central incisor were 3 mm and 4 mm at the level of the incisive canal opening and the root apex of the maxillary incisor, respectively.[14] The CBCT shows no

contact of both structures (Fig. 5). Moreover, a previous study showed the shifting of the median palatine suture as well as the labial frenum and the incisive papilla when moving the incisor across the midline.[5] It implied that the tooth did not cross the median palatal suture, but the structure remodeled as the tooth was moved. This case also showed the deviation of the suture (Fig. 11).

The traumatized teeth was reported to be more prone to develop root resorption than a normal tooth.[15] If the tooth shows no sign of root resorption at least 4-5 months after the trauma, that tooth will have a lower risk of root resorption.[16] In the study, 11 was traumatized for one year without any sign of resorption. And also there was no significant root resorption detected after the treatment. This suggests that a tooth with a history of trauma can be successfully moved across the midline without significant root resorption.

As the frenum was shifted, the frenectomy had to be done to improve the esthetic. There was a six-month waiting period after debonding before the periodontal surgery and the restorative treatment. In addition, gingival margin, tooth size and shape were attributed to smile esthetics. In this report, the right lateral incisor was moved to substitute the right central incisor. Both maxillary canines were substituted as lateral incisors. Kokich and Kinzer recommended some guidelines for lateral incisor substitution such as bracket placement level, torque and reducing enamel on the distal surface more than on the mesial surface.[17] Using an upside down canine bracket to facilitate the finishing step is also recommended.[18] In this case, the upper canine were bonded without placing brackets upside down because the initial inclination were acceptable. No additional torque in the upper canines was needed at the end. For the smile activeness, shape size and color of canine had influences.[19] The canines were reshaped after being debonded. Direct composite veneers from an upper right premolar to a left premolar were chosen as a final restoration for this patient because of his age. Wraparound retainers were used without a fixed retainer after finishing all the upper restoration.

Conclusion

In adolescent patients, moving a central incisor across the midline can be done even if the incisor was traumatized. CBCT before starting treatment is recommended to avoid contact of an incisor root to the incisive canal. Median palatine suture would be remodeled as an incisor was moved crossed the midline. Frenectomy needs to be performed to enhance the esthetic. Long term stability needs to be investigated.

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