



Case Report

Comprehensive orthodontic treatment in an adolescent patient with Class II Division 1 malocclusion and ankylosed maxillary central incisors

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Received : 11 May 19

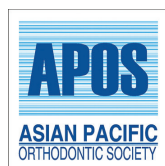
Accepted : 18 July 19

Published : 28 September 19

DOI

10.25259/APOS_52_2019

Quick Response Code:



ABSTRACT

While uncommon in orthodontics, the extraction of central incisors may be indicated when such teeth are of poor prognosis. This report details orthodontic treatment of a 13-year and 5-month-old Chinese female, who presented with Class II/1 malocclusion on a Class II skeletal jaw base relationship. Her maxillary central incisors were ankylosed and had undergone severe external root resorption following a previous traumatic episode. Orthodontic treatment involved removal of the maxillary central incisors and the mandibular first premolars. Pre-adjusted edgewise appliances with MBT prescription were used. To enhance anterior esthetics, prosthetic buildup of the four maxillary anterior teeth was performed before appliance removal. Tight intercuspation of teeth and optimal facial esthetics were achieved at appliance debond and maintained at 2-year follow-up.

Keywords: Trauma, Ankylosed teeth, Dental substitution, Interdisciplinary treatment

INTRODUCTION

The incidence of dental trauma is fairly common among adolescents. A recent survey of 12–15 year olds found that about one in ten have experienced traumatic injury to their maxillary incisors,^[1] with the likelihood of sustaining such trauma being significantly higher in those presenting with a Class II incisor relationship.^[2]

An orthodontist can, therefore, expect to encounter patients who have traumatized their maxillary incisors. It is uncommon to extract the maxillary central incisors in orthodontic treatment. However, when these traumatized teeth present with poor prognosis, they can be candidates for extraction.^[3] Factors to consider include the presenting occlusion, space requirements, and morphology of the anterior teeth. If the decision is made to extract the traumatized maxillary central incisors, orthodontic treatment approach would be to close the anterior space by appropriate dental substitutions. In such cases, these extractions can provide the space required to correct crowding and/or an increased overjet, obviating the need for extracting healthy posterior teeth.^[4]

This case report details the comprehensive orthodontic treatment of an adolescent patient who presented with Class II/1 malocclusion. Her maxillary central incisors were ankylosed and had undergone severe external root resorption.

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CASE HISTORY AND DIAGNOSIS

The patient, a 13-year and 5-month old Chinese female, presented for orthodontic consultation. She had previously avulsed both her maxillary central incisors. Both teeth were replanted, and although initial endodontic therapy was performed, subsequent reviews confirmed that both teeth were ankylosed and had severe root resorption.

Facial analysis showed a symmetric face and a convex profile. She had an acute nasolabial angle with incompetent lips and a lower lip trap. Both the upper and lower lips were protrusive. Intraoral examination revealed an increased overjet of 7.5 mm with a deep and incomplete overbite. There were bimaxillary dentoalveolar protrusion, mild crowding on both dental arches, and a steep curve of Spee in the mandibular arch. The dental midlines were non-coincident. Molar relationship was Class I on the

right side and half unit Class II on the left side [Figure 1]. The maxillary central incisors emitted a dull sound on percussion.

The roots of the maxillary central incisors appeared irregular and shortened in the pre-treatment radiographs [Figure 2]. The periodontal ligament space of both these teeth was also observed to be obliterated. These findings corroborated the clinical diagnosis of ankylosis and external root resorption. The maxillary lateral incisors were unaffected and noted to both have large clinical crowns and long roots.

Lateral cephalogram showed a Class II jaw base relationship ($ANB = 6.6^\circ$) with a mildly prognathic maxilla ($SNA = 85.9^\circ$) and mildly retrognathic mandible ($SNB = 79.3^\circ$) when compared with normative values for Chinese females of the corresponding age.^[5] Both the maxillary and mandibular



Figure 1: Pre-treatment photographs.



Figure 2: Pre-treatment radiographs.

incisors were labially inclined relative to the maxillary and mandibular plane, respectively (U1-MxP = 124.6° and L1-MdP = 102.4°), resulting in a reduced interincisal angle (U1-L1 = 103.8°) [Figure 2].

The patient was diagnosed as having a Class II, Division 1 malocclusion on a Class II skeletal base, associated with dentoalveolar bimaxillary protrusion. Her maxillary central incisors were ankylosed and had severe external root resorption.

TREATMENT PLANNING

Based on the poor prognosis of the maxillary central incisors and favorable morphology of the maxillary lateral incisors, removal of the maxillary central incisors with substitution of the maxillary lateral incisors was deemed suitable.

Bolton tooth size analysis of the anterior teeth and Kesling diagnostic setup [Figure 3] were performed to assess the extent of anterior maxillary deficiency after the proposed dental substitutions. These confirmed the need for restorative buildup of the maxillary anterior teeth.

Therefore, orthodontic camouflage treatment with surgical excision of the ankylosed maxillary central incisors and extractions of the mandibular first premolars was proposed. The Bolton discrepancy will be resolved through composite buildup of the maxillary anterior teeth. This will enhance esthetics of the proposed dental substitutions. Class I molar occlusion and normal incisor relationship will be achieved together with elimination of the lower lip trap, and the results retained with upper and lower removable retainers.

TREATMENT PROGRESS

This case was treated using 0.022" by 0.028" slot pre-adjusted edgewise appliances with MBT prescription. Atraumatic removal of the maxillary central incisors and mandibular first premolars was performed by an experienced Oral and Maxillofacial Surgeon, preserving the alveolar bone ridge at these sites. To maintain anterior esthetics, acrylic pontics were attached to the maxillary archwire on the same day [Figure 4].

After 10 weeks of initial alignment, reciprocal mesialization of the maxillary lateral incisors (on 0.018" × 0.025" stainless steel (SS) archwire) and en masse retraction of the lower arch (first on 0.018" SS archwire, and subsequently on 0.018" × 0.025" SS archwire) were performed. Class II intermaxillary elastics were commenced a further 6 weeks into treatment. As the maxillary space closed, the acrylic pontics were slenderized. Eventually, the pontics were removed and the anterior space distributed in preparation for the planned composite buildups.

The maxillary lateral incisors were intruded to move their gingiva margins superiorly to mimic those of the central incisors. Likewise, the maxillary canines were extruded to move their gingiva margins inferiorly. To further mimic the lateral incisors, palatal root torque was applied to reduce the buccal prominence of the canines. Enameloplasty was carried out to flatten the cusps and reshape the distal surfaces to enhance the esthetics of the dental substitution. For the first premolars, buccal root torque was applied to reproduce the buccal prominence of the maxillary canines [Figure 5]. Finally, composite buildup (Filtek Z350 XT, 3M, Maplewood, MN, USA) of the four anterior teeth was performed just before appliance debond.



Figure 3: Kesling setup (maxillary central incisors and mandibular first premolars removed).

After 18 months of orthodontic treatment, Class I incisor and molar relationships with good buccal segment interdigitation were achieved [Figures 6 and 7]. Post-treatment functional occlusal assessment showed bilateral group function with no working or non-working side interferences on lateral excursion and no posterior interferences on protrusion. Soldered Hawley retainers were applied to both dental arches following removal of the fixed orthodontic appliances.



Figure 4: Maxillary central incisor pontics placed immediately after surgical removal of teeth to maintain anterior esthetics.

TREATMENT RESULTS

The post-treatment radiographs and cephalometric superimposition are shown in Figures 8 and 9, respectively. Cephalometric measurements are shown in Table 1.

Skeletal

The patient displayed favorable vertical mandibular growth, and this contributed to the correction of the deep bite through relative intrusion. There were insignificant changes to both the mandibular plane angle and the ANB value at the end of treatment.

Dental

The proclined maxillary central incisors were excised, and the maxillary lateral incisors which replaced those teeth were finished at 106.9° and 112.5° with respect to the SN plane and maxillary plane, respectively. The lower incisor angulation with respect to the mandibular plane was normalized and reduced from 102.4° to 99.1° . The interincisal angulation was correspondingly normalized to 119.6° from 103.8° .

Soft tissue

The soft-tissue facial outline showed a decrease in convexity from pre-treatment to post-treatment. The distance of upper



Figure 5: Mid-treatment photographs; after special finishing and detailing of the anterior teeth, and before composite buildup of the anterior teeth.



Figure 6: Post-treatment photographs.

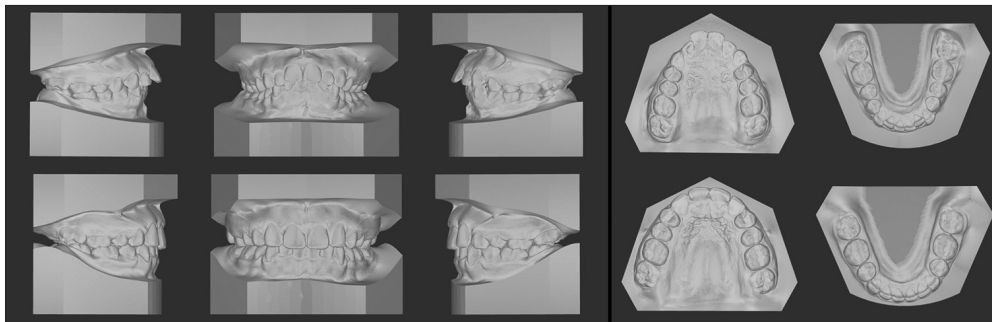


Figure 7: Pre-treatment (above) and post-treatment (below) study models.



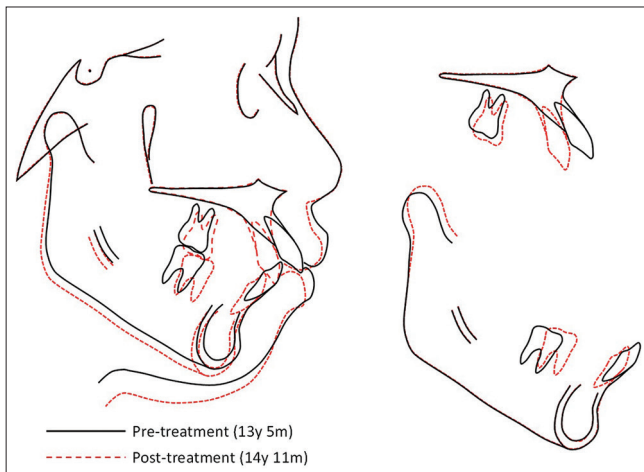
Figure 8: Post-treatment radiographs.

and lower lip to Ricketts E line was reduced by 3.6 mm and 2.9 mm, respectively. In addition, the nasolabial angle was

normalized and lip competence achieved. The lower lip was positioned at the incisal third of the upper incisors at the

Table 1: Cephalometric measurements.

Variable	Pre-treatment (13 years 5 months)	Post-treatment (14 years 11 months)	Change
Skeletal			
SNA (°)	85.9	85.4	-0.5
SNB (°)	79.3	78.7	-0.6
ANB (°)	6.6	6.7	0.1
Wits appraisal (mm)	-7.6	-6.7	0.9
SN mandibular plane angle (°)	34.3	34.3	0.0
Frankfort horizontal mandibular plane angle (°)	31.1	31.2	0.1
Maxillary mandibular plane angle (°)	29.1	28.8	-0.3
Total anterior face height/total face height (%)	56.8	57.5	0.7
S-N (mm)	63.9	64.0	0.1
Ar-Go (mm)	36.2	37.5	1.3
Go-Me (mm)	67.4	67.6	0.2
Ar-Me (mm)	91.6	91.7	0.1
Dental			
Upper incisor to SN plane angle (°)	119.4	106.9	-12.5
Upper incisor to maxillary plane angle (°)	124.6	112.5	-12.1
Lower incisor to mandibular plane angle (°)	102.4	99.1	-3.3
Lower incisor to Apog line (mm)	8.4	4.4	-4.0
Interincisal angle (°)	103.8	119.6	15.8
Soft tissue			
Upper lip to Ricketts E line (mm)	4.6	1.0	-3.6
Lower lip to Ricketts E line (mm)	7.9	5.0	-2.9

**Figure 9:** Pre-treatment and post-treatment cephalometric superimposition.

end of treatment, thereby improving the stability of overjet correction.

Satisfactory upper anterior esthetics, tight intercuspation of teeth, and optimal facial esthetics were achieved at appliance debond and maintained 2-year post-treatment [Figure 10]. The patient was very pleased with the overall result.

DISCUSSION

It is a challenge to treat adolescents with severely compromised maxillary central incisors. Treatment approaches that may be considered include dental implants, fixed or removable prosthesis, autotransplantation, and orthodontic space closure. Given suitable conditions, orthodontic management by substitution of the lateral incisors for the missing or extracted central incisors not only produces good results but can limit the extent of prosthodontic intervention.^[4]

The present case report shows that the extraction of compromised maxillary central incisors can provide the space required to correct crowding and increased overjet, obviating the need for extracting healthy posterior teeth. In addition, with comprehensive planning, superior esthetics and patient satisfaction can be achieved. The following are some considerations that were useful in the treatment of this case.

Pre-treatment

Clinical and radiographic assessment of this case revealed poor long-term prognosis of the maxillary central incisors. The maxillary lateral incisors were found to be healthy, with long roots and large crowns and hence suitable for substitution as central incisors. The patient also presented



Figure 10: 2-year post-treatment photographs.

with crowding in the upper dental arch and an increased overjet. These factors are indications for this approach of treatment.^[4]

A Bolton tooth size analysis of the anterior teeth should be performed to assess the extent of anterior maxillary deficiency after the proposed dental substitutions. In addition, a Kesling set up will help determine the feasibility of the orthodontic plan.

Ankylosis is a possible sequela when teeth have been traumatized. Care should be taken to excise the affected teeth atraumatically to maximally preserve the alveolar bone ridge. This will facilitate optimal esthetics and predictable orthodontic tooth movement in the affected area.

During treatment

Acrylic pontics should be used to preserve anterior esthetics after excision of the maxillary central incisors. This gives the patient a socially acceptable smile in the initial stages of treatment. These pontics should be cleared of occlusal contact, and the patient warned not to incise with these “teeth.” These pontics are gradually slenderized as space closure is carried out.

Light reciprocal forces can be used to redistribute the maxillary space for eventual composite buildups and to

normalize the maxillary incisor inclinations. This should be done on rectangular stainless steel archwires so as to maintain optimal torque and tip of the anterior teeth.

Special finishing and detailing of the anterior teeth will help to enhance the esthetics and functional occlusion of the final outcome. The gingival margins of the maxillary lateral incisors are typically inferior to that of the canines. Therefore, the lateral incisors should be intruded to move their gingiva margins superiorly to mimic those of the central incisors. This not only improves the smile esthetics but also allows for an increased bulk of composite resin to be bonded, which decreases the likelihood of failure at the tooth-restoration interface. To further enhance esthetics, surgical gingival contouring may be considered at a later stage. Similarly, the canines should be extruded to move their gingival margins inferiorly. Palatal root torque may be added to reduce their buccal prominence, which facilitates their camouflage to lateral incisors. Finally, buccal root torque may be added to the first premolars to reproduce the buccal prominence of the maxillary canines. This also brings the palatal cusp of these teeth superiorly, minimizing any occlusal interferences.

Post-treatment

Surgical gingival contouring and fixture of fixed prosthesis (such as veneers or crowns) on the anterior teeth may be

considered to further optimize esthetics. This should be carried out at an age when the patient is assessed to have stable gingival levels.

CONCLUSION

The extraction of compromised maxillary central incisors can provide the space required to correct crowding and increased overjet, obviating the need for extracting healthy posterior teeth. Optimal function and esthetics can be achieved and maintained following treatment.

Acknowledgments

The author is grateful to Drs. Tan Hwee Hiang and Tan Tzee Jen (Private practice, Singapore) for their supervision and guidance in the treatment of this case. Dr. Lim Wanyi (School Dental Service, Health Promotion Board) was the referring paediatric dentist, and Dr. Intekhab Islam (Faculty of Dentistry, National University of Singapore) performed the atraumatic removal of the maxillary central incisors.

Declaration of patient consent

The author certifies that all appropriate patient consent forms have been obtained. In the form, the patient has given her consent for her images and other clinical information to be reported in the journal. The patient understands that her name and initials will not be published and due efforts will

be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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How to cite this article: Lau MW. Comprehensive orthodontic treatment in an adolescent patient with Class II Division 1 malocclusion and ankylosed maxillary central incisors. *APOS Trends Orthod* 2019;9(3):190-7.