Case Report

Chair time saving method for treatment of an impacted maxillary central incisor with 15-month follow-up

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ABSTRACT

Maxillary permanent incisors have a major role in facial esthetics. Impaction of them has great adverse effect on smile and causes serious concerns in patient and parents. Physical barriers (e.g., overretained primary teeth, supernumerary teeth, and pathologic lesions), space problems, developmental abnormalities, altered eruption sequence, trauma, palatal clefts, and genetics can act as etiologic factors. Currently, the conventional technique to treatment of impacted teeth consists of a combined orthodontic and surgical approach, to guide the impacted teeth in a constant position and surrounded by normal hard and soft tissues. Treatment is challenging because of some limitations such as patient’s age, cooperation, anchorage, and mechanotherapy possibilities. Hence, sophisticated treatment planning is crucial. A 9-year-old girl with horizontally impacted maxillary left central incisor treated with surgical exposure and closed orthodontic forced eruption with 2 × 4 partial setup fixed appliances. Force was applied with 0.014 inch nickel–titanium wire as elastic overlay and handmade ligated bracket. To save chair time in each appointment, the overlay was activated by twisting of ligature wire extensions around it. After 16-month treatment, impacted incisor emerged in oral cavity, with accepted alignment and inclination. Handmade ligated bracket with ligature wire extensions is useful for the treatment of impacted teeth. Due to easy activation of overlay in this method, chair time become short in each appointment.

Key Words: Forced eruption, impacted tooth, incisor

INTRODUCTION

Impacted teeth are those that cannot erupt into the oral cavity while more than two-thirds of their root is formed.[1]

Under confident anatomical conditions, trauma or infective processes involving the deciduous teeth can cause problem for permanent tooth eruption, when the permanent tooth is not appear in the oral cavity in the physiological eruption timeframe, the reason is ectopic positioning. A tooth is considered “impacted” when it fails to erupt in the oral cavity within the expected developmental window.[2]

It seems that, in eruption timing, root formation as a physiologic age index is more important than chronologic age. Physical obstacles (e.g., supernumerary teeth),[1] pathologic lesions, dense overlying bone and fibrous gingiva, space problems, developmental abnormalities,[3] structural

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Most frequently impacted teeth are the third molars (20%–30%) because they are the last teeth to erupt in the oral cavity, after that maxillary canines with palatal dislocation, mandibular second premolars (0.3%), and maxillary central incisors (0.1%).[2,8,9]

Maxillary permanent incisors have major role in facial esthetics. Several treatment options have been developed for impacted teeth, for example, autotransplantation, extraction, and replacement with prosthesis or space closing with orthodontic movement of adjacent teeth.[1,4] The best choice is orthodontic and surgical intervention to bring these impacted teeth into proper position because its benefits in long-term esthetic, function, and stability.[1]

This article attempts to report treatment stages of closed forced eruption in a 9-year case with horizontal impaction of left central incisor, with new handmade ligated bracket with ligature wire extensions and 0.014 inch nickel–titanium (Ni–Ti) wire as elastic overlay. Due to easy activation of overlay in this method, chair time become short in each appointment.

**MATERIALS AND METHODS**

A 9-year-old girl was referred to orthodontic department. The chief complaint was concern about the unerupted maxillary left central incisor.

**Clinical evaluation**

No history of disease was reported. She had balanced facial proportions but impaired smile esthetic due to hallow space in anterior region of dental arch [Figure 1].

Intraoral evaluation revealed Class I molar relationship, normal overjet and overbite, and carious upper primary molars. The crown bulging of impacted left upper incisor was apparent and palpable at apical of mucogingival line.

**Radiographic evaluation**

The panoramic view [Figure 2a] confirmed the horizontal position of impacted maxillary left central incisor because its crown and root had nearly same height from occlusal plane. The lateral cephalometric [Figure 2b] assessment confirmed horizontal position of impacted incisor. The root had buccal deviation relative to normal crown root inclination.

**Treatment plan and progress**

Surgical exposure and closed orthodontic forced eruption with 2 × 4 partial setup fixed appliances were planned. The Combined technique allows the traction of the impacted teeth to the correct position in the alveolar ridge.[10] The patient was referred to the dentist to restore the carious teeth.

**Orthodontic preparation**

018 slot orthodontic brackets and buccal tubes (American Orthodontics, Master Series, Wisconsin, USA) were bonded to the upper permanent incisors and first molars. Wire sequence was 0.016 inch Ni–Ti and then 0.016 inch stainless steel arch wire (American Orthodontic, Sheboygan, Wisconsin, USA). On recent wire, Ni–Ti open coil (G & H Wire Co., Indiana, USA) was used to provide proper space.[4] Then, 0.017 × 0.025 inch stainless steel arch wire was inserted as stiff and base arch wire to consolidate dentition.[11] The same Ni–Ti open coil was maintained to keep proper space.

**Surgical exposure**

After local anesthesia, partial thickness labial flap was raised and an orthodontic bracket was bonded on the labial surface of impacted incisor. A new handmade ligated bracket used in this study. A 0.012 inch ligature wire was twisted around the bracket wings two times [Figure 3] and its extensions were directed around left lateral incisor bracket. Then, the flap was repositioned and sutured.

**Orthodontic forced eruption**

Based on the force analysis of the impacted tooth position, treatment prioritized three orthodontic
movements: Extrusion, verticalization, and lingualization. After a week, orthodontic traction was initiated with a 0.014 inch Ni–Ti wire as elastic overlay [Figure 4]. The overlay was activated to verticalize and expose the tooth crown in the oral cavity, extrusive force vector passes from buccal of center of resistance due to bonding the bracket in the buccal surface of the tooth, so clock-wise rotation of tooth had been predicted and the lingualization movement accrued.[11]

At each monthly appointment, the Ni–Ti overlay was deflected 2 mm apically, and the ligature wire extensions twisted toward it as activation. After 4 months, the impacted incisor emerged into oral cavity. Hence, its bracket was repositioned into proper position 0.014, and after that 0.016 Ni–Ti arch wire was fully engaged into all brackets. The crowns alignment had been achieved. In this time, patient missed four appointments due to her father illness. After 4 months, the inclination of left central incisor was acceptable. Therefore, the alignment continued with a 0.016 × 0.022 inch Ni–Ti and stainless steel wire (American Orthodontic, Sheboygan, Wisconsin, USA). After 2 months, all the brackets removed [Figure 5]. Alignment after 15-month follow-up was seen in Figure 6.

RESULTS

After 16-month treatment, impacted incisor emerged in oral cavity, with accepted alignment and inclination. The smile arc is consonant and the patient is satisfied with the result [Figure 5].

DISCUSSION

It is strongly recommended that all teeth that have not erupted 6 months after the normal eruption time should be examined radiographically to assess any possible cause for the delayed eruption.[12] Early diagnosis and interception in these cases is the best approach for their management.[4] When more than three-fourth of root is completed and the tooth does not emerge to oral cavity, it can be considered as impacted, especially if its antimere has erupted more than 6 months ago. The longer impaction time, the weaker prognosis is expected.[4] Evaluation of mechanotherapy possibilities to provide enough space and anchorage should be considered when forced eruption is planned. In this case, presence of teeth #11 and #22 can act as anchorage for extrusion of tooth #21. The early interception permits the epithelial root sheath to be redirected and offers the chance for the developing root to adapt to the correct spatial relationship of the aligned crown.[4]

Figure 2: Pretreatment radiographs: (a) Panoramic radiograph; (b) lateral cephalometric radiograph.

Figure 3: Bracket with 0.012 inch ligature wire that was twisted around the wings.

Figure 4: Orthodontic traction with a 0.014 nickal–titanium wire as elastic overlay on stiff base arch wire.

Figure 5: Posttreatment intraoral photographs.
The aim of treatment of impacted tooth is a proper alignment in the dental arch, in a stable position, with a sufficient keratinized gingiva. The surgical and orthodontic technique allows the traction of the impacted teeth to the correct position in the alveolar ridge.\[10\]

In this case, extrusive force vector passes from buccal of center of resistance, so clock-wise rotation of tooth had been predicted. This type of tooth movement is favorable in this case because it brings the crown to line of occlusion root near the normal inclination.

The surgical techniques used to expose impacted anterior maxillary teeth are apically positioned flap, closed eruption, and closed flap.\[13\] The more extensive surgery, the more adverse side effects such as gingival recession, bone loss, and reduced width of keratinized gingiva.\[14\] These complications have negative effect on esthetic result. In this case, the position of crown was apical to the mucogingival line but enough keratinized tissue was there, so we used closed eruption technique. In this approach, more esthetic results will be predicted.\[15\] Therefore, the function has been recognized, besides position and esthetic tooth in the oral cavity, and the integrity of the periodontium and surrounding structures was maintained.\[11\]

The method of traction used in this paper has several advantages. The Ni–Ti arch wire has long range of action due to high springiness and low load-deflection rate. The 0.012 inch ligature wire has been twisted around deflected Ni–Ti overlay to produce force. In the next visit, the Ni–Ti overlay has been deflected again between two tags of ligature wire. This kind of activation is very simple and fast so it needs short chair time. The less manipulation during activation causes less patient pain, discomfort, and less probability of ligature wire disruption or debonding on impacted tooth.

CONCLUSION

The use of overlay as an easy technique to traction of the upper incisor has enabled, professional, and predictable result, minimizing side effects in orthodontic arch.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient’s parents have given consent for images and other clinical information to be reported in the journal. The patient’s parents understand that name and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial or non-financial in this article.

REFERENCES


