Orthodontic Approach to Dilacerated Central Incisor Localized Horizontally on the Anterior Nasal Spine: A Case Report

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ABSTRACT

The purpose of this paper was to present a case of surgical exposure of a horizontally impacted permanent maxillary left central incisor followed by fixed orthodontic treatment to eruption in a 9-year-old boy with a 2-mm overjet and 2-mm overbite who had sustained a traumatic injury to his primary maxillary central incisors when he was 6-years-old. Panoramic, occlusal, and cepholometric radiographs showed the affected tooth's crown to be positioned horizontally, and a CT scan showed the impacted central incisor's crown to be located below the anterior nasal spine and its apex to be located parallel to the palatal plane. A treatment plan was devised that included surgically exposing the impacted teeth and applying extrusive forces in the direction of the occlusal plane to bring about eruption. After 22 months of treatment, the central incisor erupted into the oral cavity. The patient now possesses the confidence to smile and enhanced self-esteem.

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The term "dilaceration," first used by Tomes,[1] is defined as a deviation in the linear relationship between a crown and its root.[2,3] The crown of a dilacerated incisor is usually dislocated forward, with the palatal surface turned in a vestibular direction and the incisal surface turned upward towards the anterior nasal bone while the root remains in its normal position.[4] Etiologically, dilaceration is generally believed to result from mechanical trauma to the calcified portion of the tooth during its formation.[5] Smith and Winter[6] attributed dilaceration of a permanent incisor to traumatic injury of its primary predecessor. If the trauma occurs after the crown is complete, the crown may be displaced relative to the root, and root formation may stop, leaving a permanently shortened root. More frequently, however, root formation continues, but at an angle to the traumatically displaced crown. If distortion of the root position is severe enough, it is almost impossible for the crown to assume its proper position.[7,8]

After investigating 41 cases of dilacerated incisors and finding trauma to account for only 9 (22%) of them, Stewart[2] concluded that the anomaly was most likely due to syndromes[3] and ectopic development of the tooth germ.[9-10] Trauma, however, would seem to be a more likely factor in cases where the dilacerated tooth is located anteriorly.[12] Following a traumatic incident, it is advisable to keep a patient under observation and to consult an orthodontist at an early stage regarding noneruption of teeth.

The purpose of this case report was to describe the successful alignment of a dilacerated central incisor in a young patient through proper surgical and orthodontic management, thereby avoiding the need for an implant or prosthesis.

DIAGNOSIS

A 9-year-old boy was referred for orthodontic consultation regarding an unerupted permanent maxillary left central

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incisor. According to the patient's history, he had sustained a traumatic injury to the primary maxillary central incisors when he was 6-years-old.

Extraoral examination showed a straight profile with good facial symmetry (Figure 1a-b). Intraoral examination showed the patient to be in mixed dentition with a Class II molar relationship, a 2-mm overjet, and a 2-mm overbite (Figure 1c-f) and arch length discrepancies of 3-mm in both maxillary and mandibular arches.

Intraoral periapical, occlusal, and cepholometric radiographs were taken to identify and locate the left central incisor (Figure 1g-i). A lateral cephalometric radiograph showed the maxillary left central incisor to be positioned horizontally and dilacerated, with an angle of approximately 90° between the root and crown. A CT scan confirmed this diagnosis and helped to determine the tooth's exact position (Figure 1j). The crown of the impacted central incisor was located below the anterior nasal spine and its apex was located parallel to the palatal plane. The crown's labial aspect was palpable high in the sulcus.

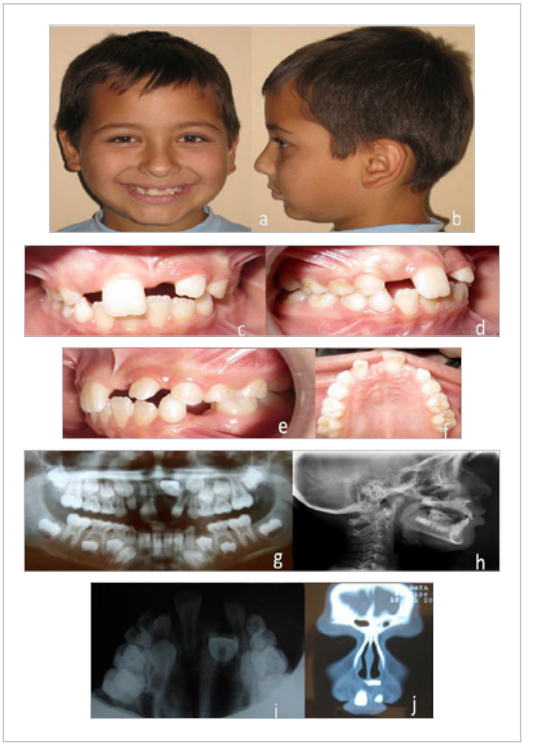

Figure 1. (a–b):Pre–treatment extraoral views. (c–f) Pre–treatment intraoral views. (g–j) Pre–treatment radiographs and CT.

TREATMENT ALTERNATIVES AND OBJECTIVES

The patient and his parents were presented with the following 3 treatment alternatives:

1. Extraction of the impacted central incisor and future restoration with a bridge or implant after completion of growth.
2. Extraction of the impacted central incisor and closure of the space, followed by prosthetic restoration, substituting the lateral incisor for the central incisor.
3. Surgical exposure followed by orthodontic opening of the space and traction of the impacted dilacerated central incisor into proper position.

The aim of the surgical/orthodontic option was to guide the impacted incisor into proper alignment with the adjacent teeth in order to recreate a complete anterior dentition. Given that the tooth apex was still open, it was believed that root formation would continue and that proper crown and root alignment could be achieved without root damage, thereby maintaining the vitality and integrity of the root of the dilacerated tooth.[17] The treatment, however, ran the risk of failure for several reasons, the most likely being resorption or ankylosis.

After being told the risks and benefits of each treatment option, the patient's parents decided on surgical exposure and orthodontic traction of the dilacerated tooth, despite the uncertain prognosis.

TREATMENT PROGRESS

To bring the impacted maxillary left central incisor into the dental arch, a flap was elevated and the tooth was exposed. A bracket was bonded to the labial surface of the impacted tooth, and a maxillary 016 Ni-Ti archwire was attached for initial levelling. To improve anchorage during traction of the impacted tooth, a modified Nance appliance was attached to the maxillary first molars (Figure 2a-c). Following this, a 0.016-inch stainless steel wire with an open coil spring in the position of the left central incisor was used to create adequate space for aligning the impacted incisor. Since traction in a forward-downward direction may result in the exposure of an unerupted incisor in too high a gingival position, a bracket with a ligature wire tied to it was bonded to the incisor's palatal side (Figure 2d-f) to direct it into the periodontal tissue, allowing it to erupt as closely as possible to the alveolar bone crest and gingival margin.

The wound healed in 2 weeks, and traction was initiated with a force of approximately 90 g applied using an elastic chain or ligature wires. To maintain the effective forces, the elastic/wires were cut shorter with the tooth's downward movement. A cepholometric X-ray was taken every 16 weeks to monitor progress and check for side effects such as radicular resorption or ankylosis (Figure 2f).

After 14 months, the tooth was clinically palpable. Traction continued until the impacted tooth was exposed in the oral cavity, which occurred after 16 months (Figure 3a). After 22 months, the incisor reached alignment in the occlusal plane, the palatal button was removed, and a bracket was bonded to the labial surface.

Following orthodontic treatment to open a space for the erupted tooth, a gingivectomy was performed in the area of the maxillary canine to secure normal vertical

Figure 2. (a–b) Surgical phase. (c–d)Intraoral views after surgical phase. (e–g) Radiographs after surgical phase.

Figure 3. (a) Fixed orthodontics treatment phase. (b) Fraenectomy and gingival recontouring phase. (c–d) Post-treatment extraoral views. (e–f) Post-treatment radiographs. (g–i) Post-treatment intraoral views.

tooth proportions (Figure 3b). Treatment resulted in a harmonious smile, to the satisfaction of the patient and his parents (Figure 3c-d). Follow-up visits were scheduled at 4-month intervals to control for vitality of the dilacerated tooth and the stability of the results.

TREATMENT RESULTS

The impacted maxillary left central incisor was successfully brought into alignment through orthodontic traction. Reasonable root length, good periodontal health, and physiological mobility were achieved, with no root resorption or ankylosis and only slight gingival recession (Figure 3e-f). Satisfactory alignment and overall aesthetics were attained, with adequate exposure of the anterior segment at rest and during smiling. An ideal overbite and overjet and adequate incisal space were also obtained (Figure 3g-i). The patient now possesses confidence to smile and enhanced self-esteem (Figure 3d). Treatment was completed in 22 months, although the patient is still scheduled for long-term follow-up to monitor treatment success.

DISCUSSION

Conflicting opinions exist regarding appropriate treatment of dilacerated teeth. In fact, there is no agreement regarding the appropriate use of the term, with some authors considering any dental element presenting an anomalous curvature of the root to be dilacerated.[13,14] Others limit the definition of dilaceration to cases showing a marked angle between crown and root.[15]

The successful alignment of an impacted tooth depends on a number of factors, including the position and direction of the impacted tooth,[16] the degree of root completion,[17] the degree of dilaceration,[18] and the availability of space for the impacted tooth.[19] Although numerous reports have shown that impacted teeth can be brought into proper alignment in the dental arch,[19-22] there are few reports on the mechanical eruption of severely dilacerated impacted teeth,[2,16] and those related to a severely dilacerated maxillary incisor are even rarer.[6] This may be due to the clinical difficulties involved in bringing a dilacerated tooth into position, which would most likely lead most patients to choose extraction and prosthetic treatment instead.

In presenting a successful case of a dilacerated maxillary incisor, Lin[19] stated that the success rate of eruption of an impacted dilacerated tooth depends on the degree of dilaceration, stage of root formation, and the tooth's position. Holland[20] recommended that the axis of rotation of the impacted tooth be no greater than 90° if mechanical eruption is to be attempted. In the present case, the degree of dilaceration between root and crown was 90°, with the root positioned above the alveolar bone, and with a 230° angle between the long axis of the crown and the palatal plane.

Although orthodontic traction can be used to bring an impacted tooth into the proper position, thus achieving

good esthetics and an acceptable bone height, the complexity of surgical/orthodontic procedures has made extraction the first choice of treatment for severely dilacerated, impacted teeth. Moreover, combined surgical/orthodontic therapy requires a long treatment period, and complications may include ankylosis, nonvital pulp, root resorption, periodontal problems, and unsatisfactory esthetic outcomes.[23] To avoid these sequelae, particular attention must be paid to the surgical technique and the direction of traction. In our case, the use of the closed-eruption technique and the application of continuous light force before the complete formation of root apices were the most significant contributing factors in the successful relocation of the impacted dilacerated maxillary central incisor.

As Vermette et al.[24] noted, the surgical technique used has implications for gingival recession. Early crown exposure may lead to loss of the enamel organ. This is believed to produce the epithelial attachment,[25,26] which, consequently, may not develop around the exposed tooth, causing gingival recession. This case used the closed-eruption surgical technique, in which an attachment is placed on the impacted tooth, the flap is then returned to its original location, and natural tooth eruption is induced. The closed-eruption technique is strongly recommended when a tooth is impacted in the middle of the alveolus or close to the nasal spine.[27]

When neighboring teeth are used as anchorage, traction in the right direction may be difficult to achieve, and root absorption of the anchoring teeth may occur.[28] In this case, a modified Nance appliance was attached to the maxillary first molars that served as anchors in order to prevent root resorption.

Anterior tooth transplantation should also be considered as an alternative treatment option for unerupted dilacerated incisors. Transplantation has the inherent potential for bone induction and re-establishment of a normal alveolar process. It also offers the advantage of immediate esthetic improvement through a single, simplified surgical procedure followed by quick and simple orthodontic therapy, which makes it possible for the developing root to adapt to its new position.[23]

Transplantation of a premolar to replace a missing maxillary incisor is indicated mainly for young individuals, since the most successful procedure involves transplanting the tooth before its root has been fully formed so that revascularization can occur and pulp vitality can be preserved.[30] In a study of 33 transplanted teeth examined over a mean follow-up period of 26 years,[29] survival and success rates were reported to be 90% and 79%, respectively, and the authors concluded that the long-term outcome for autotransplanted teeth with partially developed roots is favorable when compared to other types of treatment for missing teeth.[29] Except for pulp obliteration, no clinical or radiographic differences have been found between transplants and natural incisors,[30] and patients have responded favorably in terms of treatment perceptions.[31]

Compared to other methods, orthodontic traction to bring the tooth into the proper position provides improved esthetics and enables and maintains acceptable bone height and better periodontal results at a lower cost. In our case, despite the favorable presentation of transplantation in the literature, the decision was made to treat the impacted maxillary incisor by surgical exposure combined with orthodontic traction because the tooth was present, the patient was still growing, and the root was still forming.

The clinical management of a horizontally located impacted incisor can present a challenge to the orthodontist. Following orthodontic traction, it is important to conduct long-term follow-up to monitor the stability and periodontal health of the incisor. In our case, a severely dilacerated impacted tooth was successfully brought into alignment through conventional treatment with a combination of surgery and light-force orthodontic traction. No signs of relapse have been evident over a follow-up period of 24 months.

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