Case Report

Multidisciplinary approach to a traumatized unerupted dilacerated maxillary central incisor

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ABSTRACT
A patient with an impacted dilacerated maxillary left central incisor is presented. The 8-year-old girl also presented with protrusion of teeth and lips, posterior crossbite, anterior open bite, thumb-sucking habit, and transposition of the maxillary left lateral incisor and canine. The treatment consisted of a multidisciplinary approach, including surgery, orthodontics, endodontics, and prosthodontics. The dilacerated incisor was surgically exposed, tractioned, endodontically treated, and restored. Four premolars were extracted to correct the protrusion. The outcome was the accomplishment of a balanced and functional occlusion, resulting in a pleasant smile. (Angle Orthod. 2012;82:739–747.)

KEY WORDS: Trauma; Incisor; Orthodontics; Multidisciplinary

INTRODUCTION
Traumatic injuries in small children have been a major concern in terms of the consequences they might have for the permanent teeth. A study in Brazilian children aged until 3 years of age showed a prevalence of 16.3% of traumatic injuries, and falls represented the most common etiology for dental injuries (58.3%). Intrusion was the dental injury in 12.5% of the cases. The most frequently affected teeth were the maxillary central incisors (86%). In 12.5% of the cases recorded, the parents did not remember the age of the child at the time of trauma. These injuries may have serious consequences for permanent teeth and require complex and lengthy treatment.

One of the consequences of traumatic injuries with regard to the deciduous incisors is the dilaceration of the crown or root of the underlying developing succedaneous permanent incisors. This happens as a result of the close anatomical relationship between the developing permanent tooth germ and the root of the deciduous central incisor. Intrusion, specifically, causes substantial damage, and the extent of the disturbance of the developing germ is related to the stage of germ development and to the intensity, severity, and direction of the impact. This is the case because of the nature of intrusion, which displaces the deciduous incisor deeper into the alveolar bone.

Dealing with impacted dilacerated teeth is not an easy task. Careful planning is required when moving an impacted tooth with orthodontic traction because of the risks involved. However, patients usually want to retain and align the impacted teeth into proper position even after orthodontists suggest several treatment plans. These treatments are complex and may involve several other specialists, such as surgeons, prosthodontists, endodontists, periodontists, and general practitioners.

The purpose of this article is to present a case in which a multidisciplinary approach was used to treat a mixed dentition in which there was an unerupted dilacerated maxillary permanent central incisor.

CASE REPORT
The patient was an 8-year-old girl in good physical health who came to a private clinic for an orthodontic visit with a complaint about the delay in the eruption of her maxillary left central incisor. Her parents mentioned that she had experienced a trauma at the age of 4 years, during which the deciduous maxillary left central incisor was intruded. The trauma had occurred as the result of a fall, and because the parents did not
seek emergency treatment at the time, no actions were taken, but the traumatized tooth exfoliated prematurely. Medical records and examination did not reveal any general medical pathology or medical history of great importance. The girl presented with a thumbsucking habit.

**Diagnosis**

Facial analysis revealed an increase in the lower third of the face and labial protrusion. Intraoral examination showed a constriction in the maxillary arch, posterior crossbite, anterior open bite, lack of space for the unerupted central incisor as a result of drifting of the adjacent teeth, and midline deviation (Figure 1). The patient was in early mixed dentition and had an Angle Class I molar relationship. A protuberance could be observed through palpation of the alveolar mucosa below the nasal spine.

On panoramic, periapical, and occlusal radiographs (Figures 2–4), a dilaceration on the root of the maxillary left central incisor and open apices of both central incisors were observed. Radiograph findings revealed no pathology in the periapical area. The diagnosis of root dilaceration was then accomplished radiographically. It was also possible to determine, with the aid of radiographs, that the crown of the unerupted incisor was positioned in the vestibular sulcus, under the labial frenulum, with its incisal border facing up and its palatal surface facing forward. The lateral cephalometric radiograph confirmed protrusion of the anterior teeth and consequent lip protrusion (Table 1).

**Treatment Objectives**

The aims of treatment included the following: expansion of the maxillary arch, recovering its ideal form and creating space for the maxillary left central incisor; cessation of the sucking habit; surgical exposure and forced eruption of the maxillary left central incisor, bringing it into proper alignment with the adjacent teeth and bringing all its supporting tissues together, thereby avoiding gingival recession; reduction of the protrusion of anterior teeth; and achievement of a balanced and functional occlusion.

Other therapeutic options to solve the problem of the impacted dilacerated incisor could include surgical removal and prosthetic or implant rehabilitation; surgical removal and autotransplantation of a premolar; or...
surgical removal and closure of the space left (prosthetically changing the maxillary left lateral incisor into a central incisor). However, the elected and most conservative and convenient treatment would involve trying to maintain the dilacerated central incisor, bringing it to the maxillary arch, despite the challenge it might present to the orthodontic mechanics.

Treatment options were discussed with the parents of the patient and the uncertain prognosis was presented. They accepted to proceed with the suggested treatment plan of surgical exposure and orthodontic traction of the dilacerated incisor.

The treatment was planned in two phases. In the first phase, the impacted tooth was to be brought into alignment in the maxillary arch, after which a new prognosis would be rendered. If the maxillary left central incisor could then be correctly positioned and was likely to be maintained in that position, the four first premolars would then be extracted so that the protrusion of teeth and lips could be corrected in this second phase. The premolars would then be left in a first moment as a possible solution—autotransplantation or mesial movement of posterior teeth—if traction of the impacted incisor proved not to be possible as a result of ankylosis or any other reason.

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**Figure 4.** Pretreatment occlusal radiograph showing the dilacerated impacted incisor.

**Figure 5.** Occlusal photograph of the Haas-type expander with a fixed grid to inhibit the sucking habit.

**Treatment Progress**

A rapid palatal expansion was performed using a Haas-type appliance, with the maxillary first molars banded and a fixed grid in the anterior region (Figure 5) to eliminate the thumb-sucking habit. The appliance was activated twice a day until the posterior crossbite was overcorrected (Figure 6) and was maintained for additional 6 months as a “retainer” of the expansion.

The surgical procedure was then performed. A full-thickness mucoperiosteal flap was made to gain access to the impacted incisor (Figure 7). A cleat with an extension of ligature wire was bonded onto the lingual surface of the tooth (Figure 8). The flap was replaced. Force was applied after tissue healing in order to erupt the incisor. This was done through an elastomeric chain connecting the ligature wire to the rail in the appliance used for expansion, which generated a force of approximately 60 cN. Once the incisal border of the incisor forced its way against the gingival tissue and appeared in the oral cavity, the cleat on the lingual surface was replaced with one on the vestibular surface, and the application of force remained the same until the tooth was close to its place in the dental arch (Figure 9). Then the expansion appliance was removed and standard edgewise brackets were bonded to the teeth, including the dilacerated incisor, to continue to extrude it into the arch. At this time it was possible to observe a yellow-brownish discoloration on the vestibular surface of the dilacerated tooth, probably due to the trauma in the primary dentition.

Next, a new orthodontic challenge was presented, as a transposition of the maxillary left lateral incisor and the maxillary left canine was discovered with the eruption of the canine (Figure 10). This transposition could not be predicted or visualized in the radiographs obtained before the beginning of treatment (Figure 2). Orthodontic treatment was conducted with the correction of the
transposition and the conveyance of the canine to its place in the arch (Figure 11). This first phase of the treatment took 24 months (Figure 12).

The maxillary left central incisor was then submitted to endodontic treatment and apicoectomy (Figure 13), as the apex of the root was very prominent in the vestibular portion of the alveolar bone and the tooth had yet to be better positioned, thus moving the apex further forward. When the success of this procedure was verified, with no side effects—such as radicular resorption or ankylosis—on the dilacerated tooth, and when it became clear that this tooth could be maintained in position, the need for autotransplantation of a premolar into the area of the incisor was ruled out.

Then the second phase of orthodontic treatment was performed, with the extraction of the four first premolars and the retraction of the anterior teeth to diminish the protrusion of the patient (Figures 14 and 15), which enhanced the patient’s facial profile (Figure 16). A maxillary Hawley retainer and a mandibular lingual bar were placed after debonding. The panoramic radiograph taken at the end of treatment showed no signs of resorption on the dilacerated incisor, and its periapical area proved to be in good condition (Figure 17).

A composite restoration was performed on the vestibular surface of the dilacerated incisor to enhance esthetics, which were compromised as a result of the yellow-brownish discoloration (Figure 18). The second phase of the treatment took 26 months. Total treatment time was 50 months.

RESULTS

By the end of treatment, the aims of the patient’s treatment had been achieved. The maxillary arch acquired its ideal form after expansion, the posterior crossbite was corrected, and the sucking habit had ceased.

Figure 6. Intraoral photographs taken 6 months after expansion: (a) right side and (b) left side. The posterior crossbite was corrected with the expansion, and the anterior open bite was corrected with the interruption of the sucking habit by the fixed grid in the appliance.

Figure 7. Surgical exposure of the impacted incisor.

Figure 8. Periapical radiograph showing a cleat with an extension of ligature wire bonded onto the lingual surface of the impacted tooth.
The dilacerated incisor was surgically exposed, forced to erupt by orthodontic forces, and brought into proper alignment with the adjacent teeth. The endodontic treatment and apicoectomy of this tooth were successfully performed, and there were no signs of radicular resorption or periapical lesion. The gingival margins were adequate, and no loss of attachment was found on the facial surface of the dilacerated tooth. Probing did not show periodontal damage. The tooth presented good periodontal health and reasonable root length.

The facial profile of the patient was esthetically improved by the reduction of the protrusion of anterior teeth and the mandibular growth (Table 1). A balanced and functional occlusion was achieved, resulting in a pleasant smile.

DISCUSSION

Parents of children who suffer a dental trauma at an early age should be informed of the possible consequences to the corresponding permanent teeth, and they should be prepared for the necessity of treatment, which may be lengthy, as developmental disturbances occurring in permanent dentition after a trauma in primary dentition can cause esthetic and functional problems. Deciduous teeth that are traumatized should not be replanted, as this procedure is likely to cause more damage to the permanent teeth than benefits to the dentition. If trauma in the deciduous teeth is not classified as avulsion, the teeth must be followed up clinically and radiographically in the long term, so that sequelae of the permanent teeth can be treated as early as possible. In addition, in cases in which the apex of the intruded tooth is in contact with the permanent tooth germ, the deciduous tooth should be extracted as soon as possible. In the case presented in this article, no action was taken, as the parents of the patient did not seek treatment after the trauma.

Trauma in primary dentition, especially traumatic intrusion, may result in dilaceration of the developing permanent tooth and brown discoloration in its crown, as in the case presented. Alterations to the process of eruption or retention of the permanent tooth may also occur.

The decision to begin the treatment in the mixed dentition in the case presented was made because there was the possibility that the progression of root dilaceration could be avoided by the early reposision of the dilacerated tooth while the root was not yet completely formed.

There are currently contrasting opinions on therapeutic choices for cases of dilacerated teeth, and many actions have been taken in cases involving impacted dilacerated maxillary central incisors, depending on the conditions and the choice of the professionals involved. Ak et al. have surgically removed the permanent incisor and constructed an esthetic fixed appliance with the crown of the extracted tooth, which should be replaced by an implant later when the patient ceases to grow. Extraction of the impacted central incisor, closure of the space, and alignment of the lateral incisor in place of the central incisor also comprise a possible alternative.
Czochrowska et al. have combined surgical removal of the impacted tooth with autotransplantation of a premolar. In addition, the extraction of the dilacerated tooth combined with the transposition of the canine into its place has been described.

However, several authors have opted for orthodontic traction, even though it may require a longer treatment time and despite the fact that many disadvantages, such as ankylosis, nonvital pulps, root resorptions, root exposure, and loss of attachment, have been associated with this method. According to Kuvvetli et al., if the condition is diagnosed early, if the stage of root development and the shape of the crown are appropriate, and if the patient complies with the long and difficult procedures involved, the forced eruption of the tooth can be accepted as the best treatment option, since the patient’s own tooth must necessarily bring about better functional and esthetical results, as it is the most biocompatible choice. The disadvantage is that, obviously, considering the treatment time and its complexity, a high level of cooperation is required. Macías et al. also assert that forced eruption of impacted teeth must always be considered in young patients because this technique can lead to suitable results at the periodontal, occlusal, and esthetic levels at an earlier stage and more definitely than with other treatment options.

As in the case presented by Kocadereli and Turgut, the surgical closed approach was taken in this case, in which a cleat with an extension ligature wire was bonded to the lingual surface of the unerupted tooth and the flap was replaced. The choice for the closed-eruption

Figure 11. Intraoral photographs of different phases of the correction of the transposition and the conveyance of the canine to its place in the arch. (a) Left side; (b) frontal view; and (c) left side.

Figure 12. Intraoral photographs by the end of the first phase of treatment showing (a) right and (b) left sides; (c) occlusal view of the upper and (d) lower arches.
technique was made because the apically positioned flap technique tends to create more gingival recession and results in more non-esthetic sequelae.\textsuperscript{13,17} In the present case, no gingival recession was observed on the labial surface of the dilacerated incisor, and it was positioned with the maintenance of its periodontal and periapical health.

Apex exposure is also a main concern when positioning a dilacerated tooth like the one in the case presented, which can prevent professionals from maintaining the tooth because of its poor prognosis.\textsuperscript{4,7} When positioned, the prognosis for the dilacerated tooth may depend on both the seriousness and position of the dilaceration as well as on the formation of the root.\textsuperscript{4,9} After positioning the affected tooth in the case presented in this article, the necessity of endodontic treatment and apicoectomy became evident as a result of the close relation of the apex to the alveolar bone and because of the need to further move it in that direction. According to Jafarzadeh and Abbott,\textsuperscript{18} dilacerated teeth pose a number of diagnostic, management, and prognostic challenges to dental practitioners. However, Uematsu et al.\textsuperscript{5} reported a case in which endodontic treatment and apicoectomy were necessary and which showed a good long-term periodontal stability.

Protrusion of teeth and lips are often corrected with the extraction of the four first premolars. That was the choice for the patient in this article. SNA and SNB angles increased from the initial to the posttreatment times, likely as a result of growth, since the patient was only 8 years old during the initial evaluation.

In growing patients it is often possible to save dilacerated impacted teeth with a multidisciplinary approach.\textsuperscript{9} A multidisciplinary therapy is important in complex cases in which prognosis is difficult.\textsuperscript{19} The treatment of the case presented was complex, requiring...
a multidisciplinary approach that included surgery, orthodontics, endodontics, and prosthodontics.

**CONCLUSIONS**

- Considering the many risks and consequences involved, a multidisciplinary approach is essential when orthodontically moving an impacted dilacerated permanent incisor. This is the best approach when the patient and parents are willing to comply.

Dilacerated incisors may be tractioned successfully, although it is a compromised treatment.

**REFERENCES**


**Figure 15.** Tracings of the pretreatment and posttreatment cephalometric radiographs.

**Figure 16.** Extraoral photographs of the facial profile (a) before and (b) after treatment, showing the enhancement in esthetics and the reduction in the protrusion of the lips.

**Figure 17.** Posttreatment panoramic radiograph showing no lesion on the dilacerated tooth.