Impaction of both maxillary central incisors and a canine

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This case report describes the treatment of a 14-year-old adolescent patient who had 2 impacted maxillary central incisors with distoangular root dilacerations. He also had an impacted maxillary left canine, with the crown completely overlapping the root of the lateral incisor, and insufficient space. The general dentist referred this patient because the maxillary central incisors had still not erupted 2 years after extraction of the retained deciduous incisors. A unilateral expander with a modified vestibular arch and an attachment spring on the right side was used to correct the posterior crossbite on the right side and improve the positions of the teeth. The expansion appliance was also applied as a high anchorage device to move the central incisors and the left canine into position during the initial stages. After this phase, fixed appliances were used to redistribute the space in the anterior maxillary region to create enough space for repositioning the impacted teeth. This procedure restored the normal appearance of the maxillary arch, with good periodontal health and without evidence of root resorption, apart from the distoangular root dilacerations of the 2 maxillary central incisors. (Am J Orthod Dentofacial Orthop 2012;142:374-83)

Eruptive disturbances are alterations of normal tooth eruption, including accelerated, delayed, failed, or deviated in the direction of tooth eruption, and can be related to general or local etiologic factors. An impacted central incisor is usually diagnosed during the mixed dentition, because maxillary central incisors usually erupt before the canines, when a child is between 8 and 10 years of age.

The principal local factors involved in this anomaly are supernumerary teeth, odontomas, and trauma. Dilaceration can be a sequel of trauma and is associated with maxillary central incisor eruption failure. The dilaceration can be mild, moderate, or severe and can alter the eruptive pathway of the tooth, causing impaction.

The purpose of this case report is to describe the treatment of a patient with both maxillary central incisors impacted with distoangular root dilacerations. The maxillary left canine was also impacted, and a unilateral posterior crossbite was present on the right side.

DIAGNOSIS AND ETIOLOGY

A 14-year-old boy was referred by his dentist because neither maxillary central incisor had erupted 2 years after extraction of both retained central and left lateral deciduous incisors (Fig 1). He had a permanent dentition, and his chief complaint was an unesthetic smile because of the unerupted maxillary central permanent incisors (Fig 2).

The patient was physically healthy and had a history of dental trauma when he was 7 years old. However, there was no mention of any tooth displacements or intrusion injuries. The facial photographs showed a concave profile and a retruded upper lip with an obtuse nasolabial angle (Fig 2). There were no gross asymmetries. This patient had no parafunction or dysfunction, and the examination and history disclosed no temporomandibular joint disorders.

Both maxillary central incisors were impacted and lacked adequate space for proper eruption because of the drift of adjacent teeth into the unoccupied spaces (Figs 2-4). The maxillary dentition exhibited a narrow asymmetric dental arch with a unilateral right posterior crossbite (from the right lateral incisor to the right first molar), which was due to lingual tipping and a slight mandibular functional shift. There was significant...
dental crowding in the maxillary arch, with a Class II molar relationship on the right side and a Class I relationship on the left side. No crowding was present in the mandibular arch, even though the mandibular right canine was malpositioned. Overjet and overbite were $-2.3$ and $-5.5$ mm, respectively.

The radiographs showed 2 impacted maxillary central incisors with root dilacerations and an impacted maxillary left canine (the incisal tip of the canine overlapped the root of the lateral incisor) (Fig 4). The cephalometric analysis showed a normal skeletal pattern with normal inclination of the mandibular incisors and proclination of the impacted incisors contributing to the acute interincisal angle (Figs 5 and 6; Table).

TREATMENT OBJECTIVES

The following treatment objectives were established for this patient: (1) correction of the posterior crossbite and attainment of adequate space for positioning the impacted central incisors, (2) distal positioning of the right canine to improve its relationship, and (3) fixed appliances to gain adequate space for repositioning the impacted teeth and to create a stable functional occlusion.

TREATMENT ALTERNATIVES

Three treatment alternatives were developed: (1) extraction of the unerupted central incisors and restoration with a bridge or implants later when growth had ceased; (2) extraction of the unerupted central incisors with autotransplantation after orthodontic space opening; and (3) orthodontic space opening, uncovering and traction of the impacted teeth, and alignment of these teeth into their proper positions.

TREATMENT PLAN

The treatment plan consisted of 2 stages. The first phase involved unilateral expansion (due to the right crossbite). The second stage involved fixed appliances allowing redistribution of the space in the anterior maxillary region to create enough space for the traction of the impacted teeth and their alignment to obtain a good final occlusal relationship.

TREATMENT PROGRESS

In the first stage, a unilateral expansion appliance with a modified vestibular arch and an attachment spring was placed to improve the transverse maxillary constriction, the lingual tipping, and the slight functional crossbite (Fig 7). After the crossbite correction, a Class I molar relationship was obtained on the right side (Fig 8, C).

Immediately after the active phase of expansion therapy, a closed-eruption technique was used to bond a bracket on the right central incisor and a button attachment on the vestibular surface of left central incisor and the left canine (Fig 8, A). A 0.010-in ligature wire and elastics were attached and replaced every day to apply light forces in the vertical and distal directions, respectively (Fig 8, B). The expansion appliance was removed when the impacted teeth appeared in the arch and the maxillary left canine was distal to the root of the lateral incisor. After that, brackets (0.022-in slot) were placed on all maxillary and mandibular teeth.

During maxillary arch alignment and leveling with nickel-titanium archwires, a T-spring (0.016-in steel arch) was placed on the 2 central incisors to improve their positioning (Fig 8, D). Once the maxillary arch was in a relatively rigid stabilizing wire (0.018 × 0.025-in stainless steel), and adequate space for the 3 teeth had been obtained (by activating the open-coil spring), a nickel-titanium auxiliary archwire was engaged into the central incisors and eventually into the canine when it had moved to a more distal position (Fig 9, A). When the canine was close to the dental arch, detailing occlusal bends were made in the 0.0018 × 0.025-in stainless steel main archwire to adjust the alignment of the canine (Fig 9, B). After the maxillary left canine was moved into the dental arch, root positioning was achieved with sequential rectangular steel archwires (0.18 × 0.025-in and 0.019 × 0.025-in with tip-back posterior control).

In the mandibular arch, the primary alignment and leveling were achieved with a sequence of 0.014- and 0.018-in nickel-titanium archwires, which were later replaced by rectangular nickel-titanium archwires (0.016
A multiloop edgewise archwire was placed 3 months before finalization of the orthodontic treatment to improve the intermaxillary occlusion (Fig 9, C).

The active treatment took 24 months. Photographs, dental casts, and panoramic and cephalometric radiographs were gathered at the end of the treatment, and impressions were taken to create a maxillary circumferential retainer (Figs 10-13). A lingual bonded retainer was placed on the mandibular incisors and canines.

TREATMENT RESULTS

The impacted teeth were positioned into proper alignment with the assistance of direct traction, producing a complete anterior dentition with good alignment of the gingival margins and a nice smile. The upper lip retrusion was improved. Bilateral Class I canine relationships and ideal overjet and overbite were obtained on both sides (Figs 10 and 11). The final radiographs showed intact roots, proper root alignment, and no root problems with the central incisors, the right lateral incisor, and the left canine, except for the dilacerations that were already present (Figs 1 and 4). The left lateral incisor had some apical root resorption probably caused by the initial canine position and the orthodontic force application (Fig 12).

The cephalometric analysis at the end of the treatment showed that the patient maintained a good skeletal relationship and improvements in the overjet and overbite relationships (Figs 13 and 14; Table) from the treatment and also from the favorable growth (Fig 15). One year after the orthodontic treatment, the dental occlusion and the smile remained stable (Fig 16).

DISCUSSION

Impacted maxillary central incisors in a child pose a disturbing esthetic dilemma, by virtue of their location. It is important to properly inform the patient and the
Parents of the possibility of failure before extensive treatment is undertaken to save the severely impacted teeth.10

Traumatic dental injury to a deciduous tooth or a bone fracture can damage the underlying permanent tooth germ; this could disturb its development and increase dental anomalies such as significant root dilaceration.5 Our patient had dental trauma when he was 7 years old, but there was no mention of dental displacement or intrusion. But even if this had happened at the age of 7 years, it would have been too late to create root dilaceration. Also, the integrity of the roots of the deciduous incisors (Fig 1) and the vitality of the permanent teeth did not suggest that the trauma caused the change in the axial inclination of the unerupted teeth, as demonstrated by Kolokithas and Kaakasis.11

At 12 years of age, the maxillary right and left central deciduous incisors were present with intact roots. This means that the dilacerations were probably due
to the obstructed eruption that was aggravated by retention of the deciduous teeth. However, 2 years after extraction of the deciduous teeth, spontaneous eruption of the central permanent incisors did not occur, so the main reason for the impactions seems to be the root dilaceration. This is supported by previous studies showing that the success rate of an impacted dilacerated tooth depends on the degree of dilaceration, the position of the tooth, and the amount of root formation.\(^8,12\)

Other studies have shown that damage to the tooth follicle during extraction of the supernumerary tooth resulted in impaction of permanent teeth.\(^13,14\) If supernumerary teeth are extracted when the incisors are immature, damage to their developing roots could result in dilaceration, which might then prevent eruption.\(^15\) However, as already stated, there was no history of surgical intervention before the age of 12 years. This fact was corroborated by the first panoramic radiograph done at this age showing the persistence of the maxillary right and left central deciduous incisors and the left lateral deciduous incisor. Therefore, the possible causes of the dilacerated roots of both the central incisors could have been the ectopic development and abnormal positions of the tooth buds. Stewart\(^16\) studied 41 cases of root dilaceration and reported that only 22% of the patients had a history of trauma, and also proposed that root dilaceration was more likely caused by ectopic development of the tooth germ.

Apart from the dilacerations in this patient, the position and orientation of the impacted teeth were not too unfavorable, but the amount of root formation was not ideal. The best time for treatment of eruptive disturbances is in the early stages,\(^2,15,17\) because the maturity of the dental root influences eruptive movements and supports the conservative management of the unerupted incisor.\(^15\) However, failure to erupt the impacted teeth might occur and could be due to ankylosis or external root resorption.\(^10,18,19\)

The surgical approach for uncovering impacted teeth is commonly directed at exposure of the crown and bonding of a button, attachment, or bracket to permit light mechanical forces.\(^1,14,20\) These forces should be light to prevent bracket debonding, tooth ankylosis, gingival recession, or cant of the maxillary occlusal plane.\(^21\) In this patient, the improvement in the position of the impacted teeth was facilitated by the high anchorage provided by the expansion appliance. In the second stage of treatment, a nickel-titanium auxiliary archwire exerted light and continuous forces to erupt the impacted teeth gradually without side effects.

The closed-eruption technique is considered a good surgical choice for unerupted teeth to enhance the long-term esthetic and periodontal status.\(^22,23\)

### Table. Cephalometric analysis before and after treatment

<table>
<thead>
<tr>
<th>Cephalometric measurement</th>
<th>Norm</th>
<th>Before treatment</th>
<th>After treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMIA (°)</td>
<td>67 ± 3</td>
<td>61.4</td>
<td>63.8</td>
</tr>
<tr>
<td>FMA (°)</td>
<td>25 ± 3</td>
<td>27.2</td>
<td>24.5</td>
</tr>
<tr>
<td>IMPA (°)</td>
<td>88 ± 3</td>
<td>91.4</td>
<td>91.9</td>
</tr>
<tr>
<td>SNA (°)</td>
<td>82 ± 2</td>
<td>83.2</td>
<td>86.9</td>
</tr>
<tr>
<td>SNB (°)</td>
<td>80 ± 2</td>
<td>81.4</td>
<td>84.3</td>
</tr>
<tr>
<td>ANB (°)</td>
<td>1-5</td>
<td>1.8</td>
<td>2.7</td>
</tr>
<tr>
<td>Ao Bo (mm)</td>
<td>2 ± 2</td>
<td>-7.0</td>
<td>-5.9</td>
</tr>
<tr>
<td>UI/NA (°)</td>
<td>22 ± 2</td>
<td>32.3</td>
<td>20.2</td>
</tr>
<tr>
<td>Occlusal plane (°)</td>
<td>8-12</td>
<td>14.0</td>
<td>12.3</td>
</tr>
<tr>
<td>Z-angle (°)</td>
<td>75 ± 5</td>
<td>80.9</td>
<td>74.2</td>
</tr>
<tr>
<td>Posterior facial height (mm)</td>
<td>45</td>
<td>48.7</td>
<td>58.5</td>
</tr>
<tr>
<td>Anterior facial height (mm)</td>
<td>65</td>
<td>76.4</td>
<td>80.4</td>
</tr>
<tr>
<td>Index post ant</td>
<td>0.69</td>
<td>0.67</td>
<td>0.7</td>
</tr>
<tr>
<td>Overjet (mm)</td>
<td>2.5 ± 2.5</td>
<td>-2.3</td>
<td>4.0</td>
</tr>
<tr>
<td>Overbite (mm)</td>
<td>2.5 ± 2.5</td>
<td>-5.5</td>
<td>3.2</td>
</tr>
<tr>
<td>Interincisal angle (°)</td>
<td>126 ± 10</td>
<td>120.3</td>
<td>133.0</td>
</tr>
</tbody>
</table>

* Ao Bo, Sagittal disparity between Ao and Bo, orthogonal projections of A and B on the occlusal plane; index post ant, relationship between the anterior vertical facial height and posterior vertical facial height.
Evaluation of the treatment outcome showed good periodontal support and normal gingival contours with adequate width of keratinized attached gingiva and no periodontal bone loss. This resulted in adequate crown lengths, which contributed positively to the patient’s smile line. The closed-eruption technique used in this patient seemed to be a good surgical choice. However, when the initial position of an impacted central incisor is high in an area of unattached gingiva, an excisional technique could be necessary to expose the tooth.
these cases, once the impacted tooth erupts, a secondary periodontal procedure might be necessary to augment the keratinized attached gingiva.20

Recent case reports have shown that unerupted teeth could be properly positioned with surgical-orthodontic traction1,8,12,20,24,25 or through autotransplantation or intra-alveolar surgical uprighting.26-28 If root dilaceration is significant and oriented labially or involves neighboring teeth,5 endodontic treatment and apicoectomy have been suggested instead of extraction. In this patient, apart from the distoangular root dilacerations of the 2 maxillary central incisors at the end of the treatment, surgical-orthodontic traction of the 3 teeth was considered the best alternative.

CONCLUSIONS

The treatment of 2 impacted maxillary central incisors, an impacted left canine without sufficient space, and the additional problems of root dilaceration and posterior crossbite presented a clinical challenge. A closed-eruption technique and the sequential traction of the impacted teeth with light orthodontic forces along with palatal expansion were effective approaches to successfully bring the teeth into occlusion.

REFERENCES


Fig 11. Posttreatment dental casts.

Fig 12. Posttreatment panoramic x-ray.

Fig 13. Posttreatment cephalometric radiogram.

Fig 14. Pretreatment and posttreatment cephalometric tracings superimposed on the sella-nasion plane at sella.

Fig 15. Posttreatment cephalometric tracing.

Fig 16. Dental occlusion and smile 1 year after orthodontic treatment.