Correction of 2 Impacted Dilacerated Maxillary Central Incisors with Collaborative Surgical and Orthodontic Treatment

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Recommended Citation
DOI: 10.30036/TJO.201803_30(1).0006
Available at: https://j.tjo.org.tw/tjo/vol30/iss1/6

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INTRODUCTION

The prevalence of impaction of maxillary central incisor was reported as 0.06%~0.2%.\textsuperscript{1,2} Due to its location and age of eruption, impacted maxillary central incisor should be managed as early as possible in concerning of dental esthetics and occlusion. Two major etiologies are related to the impaction of maxillary central incisor: (1) trauma, which may lead to root dilacerations or tooth ankylosis; (2) pathological obstruction to tooth eruption, such as supernumerary tooth or odontoma.\textsuperscript{3-6}

When facing these cases, the variation of treatment methods depends on the position and angulation of the impacted teeth. One of the most common treatment methods of tooth impaction is forced eruption. In adult individuals, temporary anchorage devices (TADs) could be used to reinforce the anchorage and to prevent the side effect during orthodontic traction. In children, the transpalatal arch (TPA) can be applied as the anchorage to avoid buccal tipping of the molars during the partial arch orthodontic traction and dental movement. This article demonstrated a case report, combined surgical and orthodontic treatment with the aid of TPA for anchorage control as applying force on impacted dilacerated maxillary central incisors.
CASE REPORT

Extraoral findings

A 9-year-old girl was referred from private dental clinic due to uneruption of two maxillary central incisors. The extraoral examination demonstrated that her facial proportion (UFH: MFH: LFH) was about 1:1:1:1. She had convex facial profile with competent lip posture. Her nasolabial angle was almost in 90 degree. Her upper lip was protrusive relative to the esthetic line. Her lower lip was coincide with the esthetic line (Figure 1).

Intraoral findings

The patient was in early mixed dentition. Only four first molars, bilateral upper lateral incisors and lower four incisors were erupted. Her primary canines to primary second molars were all existed. Two maxillary central incisors were still not erupted and the residual root of the upper left primary central incisor was still retained. Besides, patient had high caries incidence. (caries: 54, 55, 61, 64, 65, 74, 75, 84, 85). The bilateral molars relationship were in Angle’s Class I relation. The anterior openbite was noticeable due to partial eruption of upper lateral incisors and no show of the 2 central incisors (Figure 1).

Radiographic findings

The panoramic radiograph revealed 11, 21 tooth impaction. Teeth 53, 54, 55, 61, 63, 64, 65, 73, 74, 75, 83, 84, 85 were existed (Figure 2).

The lateral cephalometric analysis demonstrated skeletal Class I jaw relation with hyperdivergent facial pattern. Lower incisor was retroclined (Table 1). The impacted central incisors were visible in radiographs. The 2 incisors were labially impacted and in horizontally displaced position. The crowns axis inverted about 90 degrees from normal, and the height of the incisal tips located just below the floor of the nose (Figure 2).

Figure 1. Pre-treatment extraoral and intraoral photographs.
Figure 2. Pre-treatment panoramic and lateral cephalometric radiographs.

Table 1. Pre-treatment cephalometric analysis.

<table>
<thead>
<tr>
<th></th>
<th>Norm</th>
<th>Pre-Tx</th>
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<tbody>
<tr>
<td><strong>Skeletal</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SNA°</td>
<td>82.9 ± 3.4</td>
<td>83</td>
</tr>
<tr>
<td>SNB°</td>
<td>80.1 ± 3.1</td>
<td>79</td>
</tr>
<tr>
<td>ANB°</td>
<td>2.8 ± 1.9</td>
<td>4</td>
</tr>
<tr>
<td>A-Nv (mm)</td>
<td>-1.1 ± 3.0</td>
<td>-1</td>
</tr>
<tr>
<td>B-Nv (mm)</td>
<td>-7.6 ± 4.2</td>
<td>-8</td>
</tr>
<tr>
<td>Pog-Nv (mm)</td>
<td>-8.6 ± 4.8</td>
<td>-8</td>
</tr>
<tr>
<td>SN-MP° (Me-Go)</td>
<td>21.1 ± 4.8</td>
<td>40</td>
</tr>
<tr>
<td><strong>Dental</strong></td>
<td></td>
<td></td>
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<tr>
<td>L1 to NB mm</td>
<td>6.0 ± 1.9</td>
<td>5</td>
</tr>
<tr>
<td>L1 to MP° (Me-Go)</td>
<td>98.1 ± 5.2</td>
<td>89</td>
</tr>
<tr>
<td><strong>Soft Tissue</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U lip to E-line</td>
<td>1.4 ± 2.1</td>
<td>3</td>
</tr>
<tr>
<td>L lip to E-line</td>
<td>3.1 ± 2.3</td>
<td>0.5</td>
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</table>
Diagnosis

The patient was diagnosed as a skeletal Class I jaw relation with hyperdivergent facial pattern, Angle’s Class I malocclusion with two impacted maxillary central incisors.

Treatment objectives

The treatment objectives were to: (1) surgically locate the impacted teeth and provide the orthodontic traction on the teeth; (2) achieve acceptable overbite and overjet after the force eruption of central incisors; (3) create a stable functional occlusion; and (4) establish adequate attached gingiva and symmetric gingival margins for both maxillary central incisors. Treatment alternative was to surgically remove the two impacted central incisors and maintain the space. Future prosthesis with a bridge or implants will be planned when facial growth is completed.

Treatment plan

After discussing the possible treatment alternatives, the treatment goal was to preserve the teeth and bring them into proper position. The dental development has not reached to full permanent teeth dentition, the treatment was applied in 2 stages. The first stage included 2x2 methods with TPA after surgical exposure and closed eruption technique was performed. The second stage involved excisional gingivectomy and orthodontic traction to move the impacted teeth into proper position.

Treatment progress

Dental caries treatment and maxillary left primary central incisor extraction were arranged before orthodontic treatment. The total treatment course was summarized in Figure 3. In May 2014, her bilateral maxillary lateral incisors and first molars were bonded with fixed edgewise appliance (OPA-K system, 0.022” slot), NiTi wire was used for leveling. A piece of open coil spring was inserted between 12-22 to regain the space for 2 maxillary central incisors.

The flap operation and surgical exposure was arranged on August 2014. The closed eruption technique was performed to move the incisors downward (Figure 4). A TPA was delivered to reinforce the orthodontic anchorage. The archwire was changed to 0.016*0.022 SS in October 2014. During this stage, extrusion step on archwire mesial to 12, 22 brackets was performed to increase the range of traction activation. And a reverse NiTi wire was applied as an accessory wire for correction of the intruded upper lateral incisors (Figure 5).

Figure 3. Flow chart of treatment progress.
On March 2015, the cone-beam computed tomography (CBCT) image was taken for further evaluation. The impacted teeth localized in the body of the premaxilla. The apical third of 11, 21 were both dilacerated upward. In addition, tooth 11 showed more acute crown-root angle than the tooth 21 (Figure 6).

On May 2015, excisional gingivectomy was performed and the teeth 11, 21 were then bonded after dental crowns were exposed. An overlay double wire of 0.014 NiTi was inserted at the anterior region. A section of power chain was applied on 12-11, 21-22 for 11, 21 reposition (Figure 7). After 8 months of traction, teeth 11, 21 were gradually brought into proper position. The total treatment duration was 1 year 8 months.

After 20-month of treatment, both impacted maxillary central incisors were leveled into proper
alignment. And a fixed retainer of a section of 0.0175-in multistrand wire were bonded on teeth 12 to 21 (Figure 8). In the next step, full mouth orthodontic treatment could be initiated in full permanent dentition.

**Treatment results**

After 20-month treatment, the impacted maxillary incisors were exposed and brought into alignment. The treatment was not completely finished yet. The full mouth orthodontic treatment would be expected much easier in full permanent dentition.

The exposed incisors had acceptable gingival contour. In radiographs, the previously impacted incisors had demonstrated dilacerated roots in the alveolar bone (Figure 6). During the orthodontic traction, the root formation continued, while the angulation of the root curvature decreased as the crown angulation was gradually corrected. Thus the labial root prominence was not palpable underneath the alveolar mucosa. There were no evident root resorption, the teeth were asymptomatic, and pulp testing presented vital teeth (Figure 9).

![Figure 8. Completion of treatment (2016/01/16).](image)

![Figure 9. Post-treatment panoramic radiograph.](image)
DISCUSSION

Root dilacerations were common causes of maxillary central incisors impaction. Previous studies have reported several potential etiologies. The most widely accepted cause is trauma. However, traumatic injuries cannot account for all cases of root dilaceration, especially for those in deciduous teeth. Idiopathic developmental disturbance was proposed as other possible etiology in patients without trauma history.

In this case, both of her impacted maxillary central incisors showed dilacerated roots. The diagnostic tools including panoramic radiograph, lateral cephalogram and CBCT. Orthodontic traction combined with surgical exposure was the primary choice for management of dental impaction. The collaborative treatment including three phases: pre-surgical orthodontic treatment, surgical exposure and bonding, and post-surgical orthodontic treatment. In pre-surgical orthodontic treatment, anchorage management is the most important preparation. As most of these cases were among 8 to 10 years of age, extraoral anchorages like J-hook, headgear or intraoral anchorage such as TPA and Nance appliance would be the substitution of TADs. In the second phase of surgical exposure, which can be classified into three methods-excisional gingivectomy, apically repositioned flap technique and closed eruption technique.

The excisional gingivectomy is suitable for a tooth with adequate attached gingiva and sufficient tooth structure that could be exposed. If the width of attached gingiva is not sufficient, an apically positioned flap technique is recommended. When impacted tooth located in high position that above the mucogingival junction or deep in the alveolus, closed eruption technique is recommended for esthetic and periodontal concern.

In this case, high position of the 2 impacted maxillary central incisors was noted. Two stages surgical exposure of the crowns were performed. In the beginning, the space was regained for impacted teeth. After the flap operation for closed eruption, TPA was placed as anchorage device. With few months of orthodontic traction, the impacted incisors was near the level of the height of attached gingiva, the excisional gingivectomy was then performed and the new brackets were rebonded on the impacted teeth. The original angulation of impacted maxillary incisors were 140 degrees larger than the normal angulation. Thus, the lingual crown torque was applied on incisors during orthodontic traction.

The two impacted maxillary central incisors were repositioned into proper alignment by using two stages of surgical exposure and well controlled orthodontic traction. Previous studies have indicated that the more bone removal during surgical exposure, the greater bone loss after orthodontic treatment. With this two stages method, more alveolar bone volume can be preserved and enhance the long-term prognosis.

In a 2-year follow-up study, the treated labially inverse impacted maxillary central incisors could proceed continued growth similar to the mature contralateral incisors; the alveolar bone height was a relatively stable. The prognosis of the treatment depends on the severity of dilaceration, the vertical position and angulation, and status of root formation of the impacted tooth. A dilacerated tooth with an obtuse bending angle, a closer position to the alveolar crest, and an incomplete root formation has a better prognosis for orthodontic traction.

CONCLUSION

The impacted maxillary central incisors should be corrected as early as possible. When facing highly positioned impacted teeth, closed eruption technique followed by excisional gingivectomy or apically positioned flap technique in a later stage can be applied for more bone preservation and adequate attached gingiva width. As for anchorage preparation, intraoral devices like TPA or Nance appliance may be the ideal anchorage preparation in young patients.
Dilacerated Impacted Maxillary Incisors

REFERENCE