ABSTRACT

Delayed eruption of permanent upper incisors is a cause for concern to patients. It causes aesthetic, function and speech problems. This case report describes a technique of managing impacted dilacerated maxillary central incisors using removable appliances over one and a half year. It is a simple, operator-friendly and economical treatment option with favorable result.

Keywords: impacted, dilacerated maxillary incisor, removable appliances

INTRODUCTION

Upper incisors play an important role in smile aesthetics, function and speech. Although unerupted maxillary central incisors are uncommon, with incidence report of 0.13% to 2.6%, missing incisors can affect patient’s facial and dental appearance. This in turn may lead to psychosocial difficulties, thus making early detection and management essential.
Intervention and monitoring of delayed eruption of maxillary incisors are indicated when the contralateral tooth has erupted for more than six months, failure of both of the central incisors to erupt for more than one year after the lower incisors have erupted, or when there is a departure from the normal eruption sequence 11.

Several causes of delayed eruption of permanent maxillary incisors include trauma, pathological obstructions, tooth agenesis, tooth malformations, lack of space or may be syndrome-related 12. Supernumeraries and odontomes contribute to 40% of failure of maxillary incisors to erupt13, whilst impaction accounts for about 0.3% 14.

One of the reasons for incisor impaction is unfavourable root formation, also known as dilaceration15. Occurring in both deciduous and permanent dentitions, dilaceration is defined as an angulation, deviation, sharp bend or curve in the linear relationship of the crown to its root 16. Two theories are associated with this malformation: The first proposes trauma to the deciduous predecessors causing dilaceration of the underlying developing permanent tooth 17–21, and the second suggests the ectopic development of the tooth germ as the causative factor22.

Management of dilacerated impacted incisors involves surgical exposure, followed by orthodontic traction to facilitate eruption. Traction of impacted teeth has been successfully achieved using removable appliances (RAs)23–25, special springs and fixed appliances (FAs)26–29. Severely dilacerated incisors are commonly extracted.

Here, we present a case where a dilacerated permanent maxillary central incisor was treated using surgical exposure, followed by orthodontic traction with upper removable appliances (URAs).
Figure 1: (a-c) Pre-treatment extra-oral photographs

Figure 2: (a-e) Pre-treatment intra-oral photographs.
**Figure 3:** Pre-treatment panoramic radiograph.

**Table 1:** Cephalometric tracing

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pre treatment</th>
<th>Malay Norms (Mohammad H.A 2011)</th>
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<tbody>
<tr>
<td>SNA</td>
<td>86.3</td>
<td>83.7</td>
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<td>SNB</td>
<td>83.88</td>
<td>81.2</td>
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<td>ANB</td>
<td>2.14</td>
<td>2.5</td>
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<tr>
<td>Frankfort Mandibular Plane Angle</td>
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<tr>
<td>Frankfort Mandibular Incisor Angle</td>
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<tr>
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<td>Interincisal angle</td>
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<tr>
<td>Mandibular Incisor Na</td>
<td>31.06</td>
<td>-</td>
</tr>
</tbody>
</table>

**Figure 4:** Pre-treatment cephalometric radiograph.

**Figure 5:** Pre-treatment periapical radiograph.
CASE REPORT

AJ, a 10-year old Iban boy, was referred from Kapit Government Dental Clinic (KP Kapit) to the Sibu Orthodontic Unit. He was concerned with the appearance of his front tooth. The medical history was unremarkable, and there was no history of dental trauma.

Presenting in the mixed dentition, AJ had a Class I occlusion on a Class I skeletal pattern complicated by clinically missing upper left central incisor (UL1), mildly crowded upper and lower arches with average overjet and overbite (Figure 1). There was a 9mm of space present between the upper right central incisor (UR1) and the upper left lateral incisor. The UR1 had not crossed the midline (Figure 2). UL1 was palpable in the labial vestibule.

A panoramic radiograph confirmed the presence of a complete permanent dentition and an unerupted UL1 (Figure 3). The periapical and lateral cephalometric view radiographs revealed an impacted and possibly dilacerated UL1 (Figures 4 & 5). The root was not fully formed. Routine cephalometric analysis confirmed the Class I skeletal base (Table 1). The tooth was considered favourable to be aligned.

Treatment aims

The aims of the treatment are:
- to surgically expose UL1;
- to orthodontically align UL1 into occlusal plane;
- to achieve Class I incisor relationship;
- to maintain the upper centre line.

Treatment plan

- Surgically expose the impacted UL1 by open exposure technique;
- Orthodontic traction and alignment of UL1 using upper removable appliance.
**Figure 6**: Orthodontic traction of UL1 with cantilever spring.

**Figure 7**: Orthodontic traction with bracket on the labial surface of UL1.

**Figure 8**: 4 months into treatment, UL1 has extruded close to occlusion.

**Figure 9**: (a-b) Composite button placed as replacement for bracket.

**Figure 10**: Periapical radiograph post-treatment showed dilacerated root of UL1.
Figure 11: (a-e) Second URA to close residual spaces.

Figure 12: (a-b) Start and end of treatment photographs.
Treatment Progress

Alginate impressions were taken for URA fabrication during consultation appointment. In the next visit, surgical exposure of the UL1 was performed under local anaesthesia. The coronal 1/3 was exposed and the gingiva surrounding the crown was sutured back with 4-0 black silk. A bracket was then bonded onto the lingual surface of UL1, with a looped 0.010-inch stainless steel ligature wire attached to it.

The first upper removable appliance (figure 6) was fitted on this visit, with the following design:

- Spring (0.7 mm) with a single-helix labial arm extended from the interdental area of the upper left deciduous canine and upper left deciduous first molar;
- Jackson’s clasp (0.7 mm SS) on the upper right lateral incisor
- Adam’s clasps (0.7 mm SS) on the second deciduous molars;
- Full palatal coverage heat-cured acrylic baseplate.

The labial arm of the spring was inserted into the ligature wire loop on the lingual bracket of UL1 for extrusion of UL1. Orthodontic traction was started immediately post-surgical by activating the spring 2-3mm inwards and downwards from incisor edge of UL1. (Figure 6). AJ was advised to wear the upper removable appliance full time, other than during cleaning and playing sports. The upper removable appliance was prescribed for 12 months. AJ was advised to remove the upper removable appliance for cleaning daily.

Due to logistic reasons, AJ’s 4-weekly reviews were conducted in KP Kapit, under the care of general dental practitioners (GDP). The spring arm was activated at every visit. Progress photos were taken and the orthodontist was updated through the phone at every visit.
One month review showed significant eruption of UL1 with good wound healing. The bracket was then repositioned during the same visit onto the labial surface (Figure 7). The activated spring was placed above the bracket for further extrusion and alignment (Figure 8).

During one of the follow-ups, the bracket was dislodged at Kapit district clinic. A composite button was bonded in to replace the missing bracket (Figure 9).

Once the UL1 has reached the occlusal plane, in our case after 12 months, a second upper removable appliance was issued. The goal of this appliance was to retract the UL1 and close the remaining gaps (Figure 11). This upper removable appliance was used for 6 months. The design consisted of:

- Labial bow (0.7 mm SS) extending from the upper right deciduous canine to the upper left deciduous canine;
- Adam’s clasps (0.7 mm SS) on the first permanent molars;
- Full palatal coverage heat-cured acrylic baseplate.

**Treatment Outcome**

A successful outcome has been achieved after one and a half years of treatment. An acceptable facial appearance associated with a Class I incisor relationship was obtained, along with coincident dental centrelines and ideal overjet and overbite. The patient was not concerned with the slightly higher gingival margin of the UL1 (Figure 12).

Post-treatment periapical radiograph showed normal periodontal support with dilacerated root (Figure 10). The UL1 responded positively to vitality tests.
DISCUSSION

The central incisor is the most frequently retained incisor\(^3\), thus a delay in the eruption of the permanent successor warrants an investigation. Early identification of impacted incisors and the causative elements involved is critical for their effective management. Factors which determine the success of aligning impacted teeth include the position and direction of the teeth, the degree of root completion, the degree of dilaceration, and the space available\(^3\). In AJ’s case, the tooth in question was of good prognosis. The UL1 was palpable in the vestibule, the root had not fully formed, sufficient space was present and the dilaceration was not severe. A dilacerated tooth has a higher chance of being repositioned if it is more occlusally-positioned in the alveolar bone, has an obtuse crown-root angulation and if the root formation is incomplete\(^2\). Based on these criteria, it was deemed possible to move the UL1 into occlusion.

Currently, there are no documented Iban cephalometric values available. Therefore, Malay norms\(^3\) were used in the cephalometric analysis, as this population is the closest to AJ’s facial features.

The use of removable appliances in the management of dilacerated impacted central incisor is not something new. There are several case reports reporting extrusion of impacted tooth using removable appliances\(^2\)–\(^5\). Each case report gave a different appliance design with successful outcome. Most of the cases reported include patients of age 9-10 which lies in the mixed dentition period. In the transitional dentition, it is deemed more suitable to use removable appliances as its anchorage is not as tooth dependent as fixed appliances\(^3\). This is especially the case when teeth are getting loose or exfoliating.
Only 1/3 of the crown was uncovered during the surgical exposure, maintaining bone support. It has been suggested that the avoidance of cemento-enamel junction during the surgical procedure aids in the maintenance the gingival level\textsuperscript{34}. A palatal approach was used while exposing the UL1 in order to preserve the integrity of labial gingival level \textsuperscript{35}. The bracket was later bonded on the labial aspect of the UL1, once it has been further extruded and tilted downwards. Suturing the gingiva surrounding the crown with 4-0 black silk prevented gingival overgrowth. Despite the efforts to preserve and maintain gingival level, our case still ended up with a higher gingival margin in comparison to the contralateral tooth. This could be due to the abnormal crown root angulations as the root of dilacerated tooth might be more labial compared to the contralateral central incisor.

The active component of the first URA was a labial arm spring. This design permitted easy activation and force control. Only 2-3mm activation was done each time, as light movements caused significantly less bone loss than heavy movement during the traction of impacted teeth\textsuperscript{34}, protecting the periodontal health. A full palatal coverage baseplate was prescribed, fully utilising the palatal vault, reinforcing the anchorage demands for the vertical movement of UL1. The second upper removable appliance aided in residual space closure, and acted as a post-treatment retainer. Due to the limited torque on the labial bow and compliance burn out, the second phase of the treatment progressed slower than it could have been. AJ’s oral hygiene had deteriorated by the end of the treatment, evident by the erythematous gingival margins.

The state of Sarawak is part of Borneo Island of Malaysia. The land mass of Sarawak is 124,450 square kilometres\textsuperscript{36}. Comparatively, the land area of Peninsular Malaysia is 130,598 square kilometres \textsuperscript{36}. The 2010 census placed the population of Sarawak as approximately 2.5 million\textsuperscript{37} whilst the Peninsular was populated by nearly 22.5 million people\textsuperscript{38}. This low population density translates to 20 Sarawakians per km\textsuperscript{2}, making
centralised treatment a challenge. Currently, there are five orthodontists in Sarawak, out of a total of 85 employed under the Ministry of Health. This disparity does not improve the situation. Work commitments and a lack of perceived need for urgent care have been associated as the main causes for delays in the utilisation of the government dental services. AJ’s orthodontic reviews were held in KP Kapit, instead of the orthodontic unit in Sibu. This alternative was preferred, as the only mode of transport from Kapit to Sibu was by a 3-hour motor-driven boat ride. By delegating this part of the treatment to the local dental officers, a continuation of care was made possible. AJ’s case was managed by one orthodontist and two GDPs, this is due to transfer of the former GDP to other clinic, therefore his case was taken over by another GDP in the same clinics.

CONCLUSION
Alignment of dilacerated teeth can be carried out satisfactorily within a basic clinical setup, using simple mechanics with correct case selection. In rural areas, removable appliances may be considered a better alternative to fixed appliances. With relatively less burden of care compared to fixed appliances, removable appliances allow the patient to be treated by the local general practitioner, as the orthodontist monitors remotely. This reduces the costly time and funds incurred by the patient, without compromising the quality of treatment provided.

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