Australian Dental Journal
The official journal of the Australian Dental Association

AUSTRALIAN DENTAL ASSOCIATION INC.

Australian Dental Journal 2015; 60: 536–539

doi: 10.1111/adj.12251

Multidisciplinary treatment for a patient with traumatically intruded permanent canine and premolar

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ABSTRACT

When selecting treatment for traumatically intruded teeth, various factors should be evaluated including the degree of intrusion, pulp vitality, patient's age and maturity of the tooth. Treatment options consist of surgical repositioning, orthodontic extrusion and spontaneous re-eruption. This study describes a case of a 22-year-old male with traumatically intruded maxillary canine and first premolar that was treated comprehensively by an orthodontist, endodontist and prosthodontist two months after injury.

Keywords: Decision-making, intrusion, luxation, orthodontic extrusion, trauma.

(Accepted for publication 12 November 2014.)

INTRODUCTION

Various reports regarding the diagnosis and treatment of traumatically intruded teeth have been published, including a series of evidence-based treatments and/or the findings of clinical experience. According to the Dental Trauma Guidelines published by the International Association of Dental Traumatology,[1] traumatically intruded teeth (<3 mm) should be allowed to erupt, with the application of surgical repositioning or orthodontic extrusion before the onset of ankylosis if no movement is observed after 2–4 weeks. However, there are currently no definitive diagnostic criteria for traumatically intruded teeth, including whether surgical repositioning or orthodontic extrusion should be selected more than four weeks after injury. A review article of the relationship between the timing and success of orthodontic repositioning of traumatically intruded teeth[2] reported a high rate of success with respect to orthodontic extrusion, either immediately or later. However, there are conflicting results regarding treatment outcomes based on the time interval between intrusive injury and surgical reposition.[3–5]

The prognosis of the intruded tooth after surgical reposition or orthodontic extrusion should be considered in the decision-making process with respect to the repositioning of traumatically intruded teeth. Previous reports have suggested that there is insufficient evidence showing the superiority of surgical repositioning versus orthodontic treatment.[6–9] Meanwhile, Andreasen *et al.* reported that orthodontic extrusion appears to result in a slight reduction in the risk of defects in marginal periodontal bone healing compared with surgery for reposition.[6] However, most previous reports have described injured incisors, and the prognosis of traumatically intruded canines and premolars remains unknown. In addition, there were few reports about the comprehensive treatment after extrusion of traumatically intruded teeth. The aim of this report was to present a case of orthodontic and prosthetic treatment in a patient with orthodontic extrusion of traumatically intruded canine and premolar two months after injury.

CASE REPORT

A 22-year-old male patient with a dental injury following a traffic accident was referred to Osaka University Dental Hospital two months after the accident. He sought dental treatment for fractured maxillary incisors and an intruded maxillary left canine and first premolar caused by the accident. He was unable to visit the dental hospital immediately after the accident because his hip joint had also been injured. As a result of the accident, the upper right and left central incisors and left lateral incisor were fractured and the upper left canine and first premolar were displaced (Fig. 1). In addition, the patient displayed an increased overbite and there was little vertical clearance between the maxillary and mandibular incisors.

The patient reported pain on percussion and palpation of the upper right and left incisors. A negative response for all examined maxillary incisors and the left canine and first premolar was obtained on thermal and electric pulp testing. Panoramic radiograph revealed that the maxillary left canine was dislocated upward and the periodontal ligament space of the maxillary first premolar had widened (Fig. 2). In addition, a root fracture of the maxillary left central incisor was observed, and an alveolar bone fracture (avulsion fracture) in the maxillary anterior region was noted on CT images (Fig. 3).

Fig. 1 Pretreatment intraoral photograph.

Fig. 2 Pretreatment radiograph.

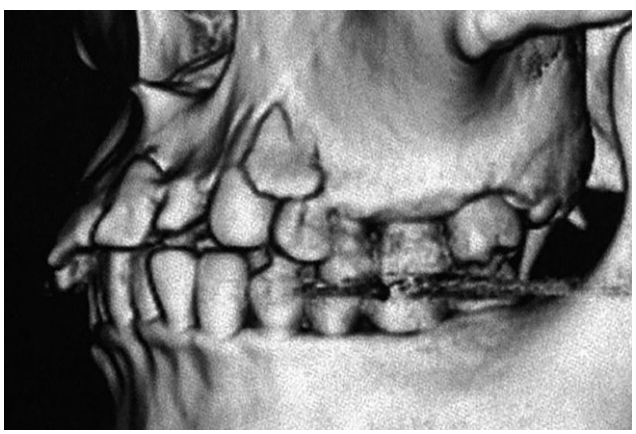

Fig. 3 Pretreatment CT image.

Before administering orthodontic treatment, the upper left central and lateral incisors were extracted due to root fracture. A lingual arch appliance with springs was placed in the maxillary arch to move the maxillary left canine and first premolar into the correct position (Fig. 4). Four months after extrusion of the maxillary left canine and first premolar, the lingual arch appliance was removed and a removable bite raising appliance was placed to create an interocclusal space. The maxillary left canine and premolars were fixed with a bonded wire for retention. At the same time, root canal treatment of the maxillary left canine and first premolar was performed to treat pulp necrosis. A preadjusted edgewise appliance was placed in the mandibular arch, and a temporary anchorage plate (SMAP; Super Mini Anchor Plate, Dentsply-sankin, Tokyo, Japan) were placed for intrusion of the mandibular incisors. Five months after intrusion of lower incisors, the overbite was reduced. Accordingly, the upper removable bite raising appliance and fixed wire were removed. A preadjusted edgewise appliance was placed and a sectional archwire was installed in the maxillary arch. At the completion of detailing, all appliances were removed (Fig. 5). Removable wrap-around retainers with temporary artificial teeth for the maxillary anterior segment were

Fig. 4 Treatment progress with respect to orthodontic extrusion of the maxillary canine and premolar.

Fig. 5 Post-treatment intraoral photograph.

placed. The total active orthodontic treatment period was 18 months. The vertical position of the maxillary left canine and first premolar was maintained during the retention period, and the alveolar bone levels in the maxillary left canine and first premolar increased with alignment (Fig. 6). Following completion of the orthodontic treatment, bone grafting was performed by the oral surgeon, and two implants were placed in the maxillary anterior segment by the prosthodontist. A bonded splint was refitted to the maxillary canine and premolar because the patient could not wear the removable retainer during the prosthetic treatment. After the prosthetic treatment, the bonded splint was removed and the patient finally achieved a stable and satisfactory occlusion (Fig. 7). At the end of the treatment, extraction of the third molars was suggested as they were horizontally impacted (Fig. 8).

DISCUSSION

When determining a treatment plan for traumatically intruded teeth, it is necessary to take into account the prognosis of each tooth. The three most important factors affecting the prognosis of intruded teeth are root development, the patient's age and the degree of intrusion.[10] In the current case, the traumatically intruded teeth were all permanent teeth; therefore, we selected a treatment plan based on the degree of intrusion. Andreasen *et al*. reported that a deeper degree of intrusion significantly increases the risk of root resorption.[10] In addition, the likelihood of tooth ankylosis increases with the severity of intrusion.[11,12] According to the Dental Trauma Guidelines published by the International Association of Dental Traumatology,[1] the degree of intrusion was within 3–7 mm, with no root resorption upon presentation to the orthodontic department in this case, so an orthodontic traction of the intruded teeth was considered to be appropriate. However, the patient was seen in our hospital two months after injury. Therefore, surgical repositioning of the intruded teeth[4,11] was also proposed as a treatment option due to the possibility of tooth ankylosis. Because the intruded teeth in this case exhibited slight mobility and no high-pitched sounds were noted on percussion, the probability of ankylosis was considered to be low.[13,14] A recent review article on the relationship between the timing and success of orthodontic repositioning of traumatically intruded teeth[2] reported a high rate of success for orthodontic extrusion either immediately or later. However, most previous reports have described incisors, and the prognosis of traumatically intruded canines and premolars is unknown. The current report demonstrated successful orthodontic extrusion of intruded canine and premolar, with attention to the likelihood of tooth ankylosis. In most previous case reports, orthodontic extrusion of traumatically intruded teeth was performed according to the sectional archwire technique.[15,16] In the present case, a lingual arch appliance was used to prevent side effects taking into consideration the ankylosis. In addition, the premolar rest was attached to the lingual arch appliance, as the patient exhibited a deep bite, in order to prevent further intrusion of the upper molar, which would have made the overbite deeper (Fig. 2). As a result, orthodontic extrusion of the traumatically intruded teeth was completed successfully without intrusion of the upper molars (Fig. 5).

The prognosis of traumatically intruded teeth should be assessed with a particular focus on loss of periodon-

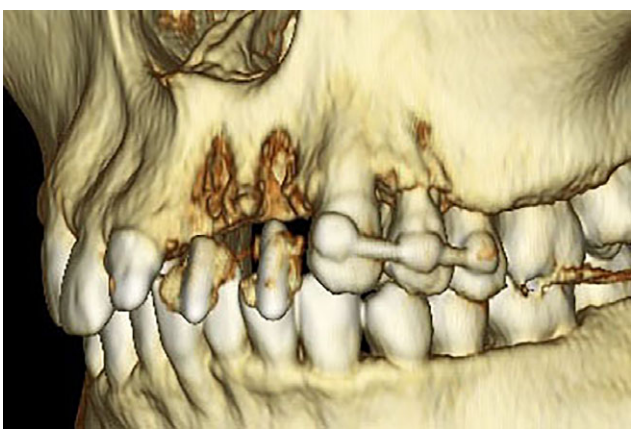

Fig. 6 Two-year retention CT image.

Fig. 7 Two-year retention intraoral photograph.

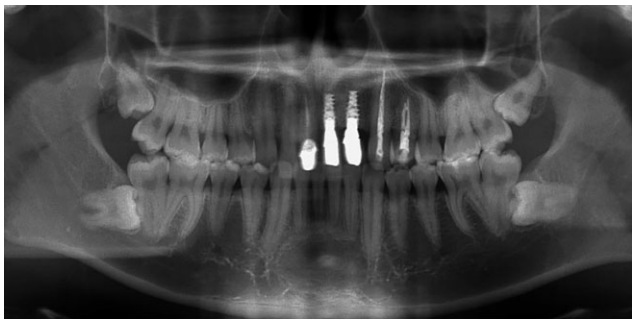

Fig. 8 Two-year retention radiograph.

tal alveolar bone, pulp necrosis and root resorption. Andreasen and Pedersen[17] reported the loss of marginal bone support in 31% of intruded incisors. Although an alveolar bone fracture of the maxillary anterior segment was observed on the patient's initial visit in this case, bone healing occurred around the maxillary left canine and premolar following orthodontic extrusion (Fig. 6). Andreasen *et al.* reported that orthodontic extrusion appears to result in a slight reduction in the risk of defects in marginal periodontal bone healing compared with surgical repositioning.[6] Meanwhile, various authors have reported that no firm conclusions can be drawn between the outcomes of orthodontic extrusion and surgical repositioning.[8,9,18]

In the mature tooth, pulp necrosis develops in approximately 40% of traumatically intruded teeth.[17] In addition, root resorption has been reported as a complication of intrusive injuries in 70% of mature teeth.[17] Previous researchers have suggested that early endodontic root canal treatment prevents inflammatory root resorption.[17,19,20] In the present case, pulp necrosis of the intruded teeth was observed; however, performing endodontic treatment immediately after the injury was considered to be difficult because the maxillary left canine severely intruded into the sinus. Therefore, root canal treatment was performed after orthodontic extrusion. No further root resorption of the maxillary canines or premolars was observed during the periods of orthodontic treatment and retention (Fig. 8).

CONCLUSIONS

Although two months had passed after the accident at the time of the patient's initial visit to our orthodontics department, orthodontic repositioning of the traumatically intruded canine and premolar was successfully performed in this case, with no significant root resorption and a good prognosis. The current patient was able to achieve a favourable appearance and occlusion with multidisciplinary treatment.

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