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Management of maxillary alveolar bone fracture and severely intruded maxillary central incisor: report of a case

CASE REPORT

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Abstract – An 11-year-old male who injured his maxilla and right maxillary central incisor and lip during a fall was presented to our hospital. His lower lip and upper gingiva were lacerated with swelling and epistaxis, and he had a maxillary alveolar bone fracture and severe intrusion of the right maxillary central incisor, which had penetrated the floor of the nasal cavity with avulsion. Under local anesthesia, we repositioned the incisor and bone segment and fixed them with a titanium micromesh plate and self-tapping screws and splints. The incisor was also treated by root canal 3 days after the operation and was restored with a crown. We performed root canal filling 1 month later. Five months later, the plate and screws were removed. In prognosis of our case, no symptoms of inflammatory root resorption or ankylosis have observed for more than 1 year and 6 months of follow up based on both clinical and radiographic findings.

Maxillofacial trauma and traumatic dental injuries often occur because of falls, sports activities, traffic accidents, etc. The types of injuries vary greatly and depend on the type and location of the force exerted during the injury (1). Although subjects aged 6–12 years old are especially prone to injuries leading to the intrusion of teeth, intrusive luxation of permanent teeth is a relatively rare traumatic dental injury. The extent of intrusion of permanent teeth in about 5% of intrusions is over 11 mm (2).

We report the case of an alveolar bone fracture and severe intrusion of a central incisor. The aim of this report is to describe and discuss the management of a pediatric patient with a maxillary alveolar bone fracture with severe and total intrusion of the right maxillary central incisor and the prognosis of our treatment.

Case report

A healthy 11-year-old male fell from the top of a slope at his school and injured his maxilla and right maxillary central incisor and lower lip. The patient presented to our hospital by his parent and teachers. There was no contribution of his general medical history to the injury, and an examination revealed no evidence of nerve injury. Clinical examinations were carried out, and extraoral findings revealed a lower lip laceration with swelling and epistaxis. The intraoral examination of hard and soft tissues revealed a severe intrusive luxation of the right maxillary central incisor with all of the labial alveolar bone segment, which was dissociated with the labial side by the maxillary alveolar bone fracture and an avulsed and lacerated upper gingiva around the incisor, and the intruded tooth was displaced over 10 mm (Fig. 1a). The result of pulp sensitivity test with a pulp tester revealed a positive response with the right maxillary lateral incisor, deciduous cuspid, and left maxillary central incisor. The right maxillary canine was impacted. An orthopantomogram (Fig. 1b) and periapical radiograph (Fig. 1c) were examined. The orthopantomogram revealed that the dislocated right maxillary central incisor had penetrated the floor of the nasal cavity; the periapical radiograph

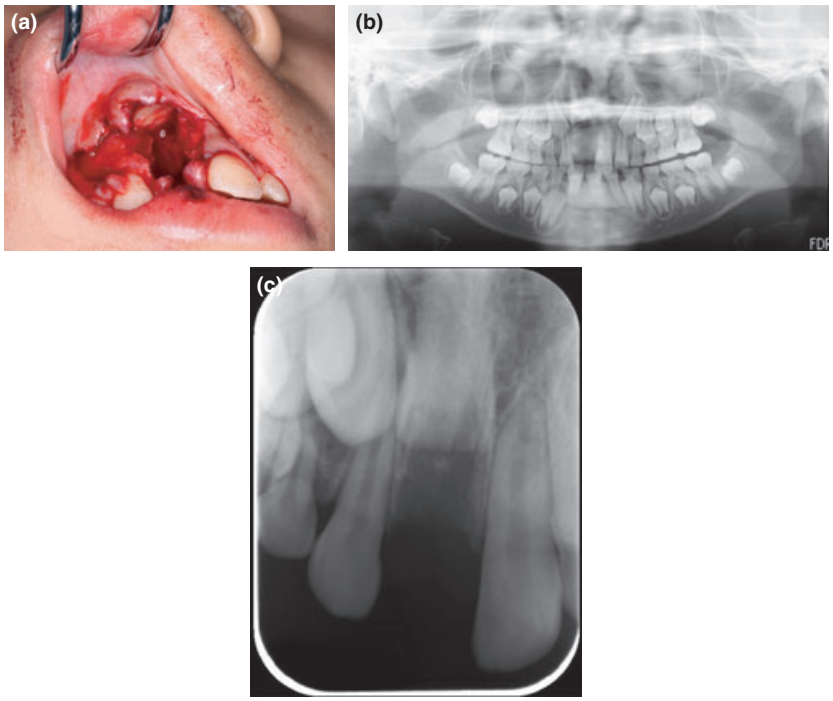

Fig. 1. (a) The initial intraoral view showing the appearance of the lower lip laceration with swelling and the severe intrusive luxation of the maxillary central incisor with an avulsed and lacerated upper gingiva around the tooth. (b) The initial orthopantomogram. The dislocated right maxillary central incisor had penetrated the floor of the nasal cavity. (c) The initial periapical radiograph. The dislocated right maxillary central incisor had intruded into the nasal cavity, but the right maxillary lateral incisor and canine and left maxillary central incisor were not dislocated.

revealed that the right maxillary lateral incisor and canine and left maxillary central incisor were not dislocated.

We elevated the intruded tooth slowly, repositioned it in the space using an open reduction technique with the alveolar bone, and fixed it with a titanium micromesh plate (Jeil Ti Mesh^{TM}; Jeil Medical Co. Ltd., Seoul, Korea) of 2×1 cm and three self-tapping screws (Jeil auto screw micro^{TM}; Jeil Medical Co. Ltd.) of 1.4×4 mm (Fig. 2). An open reduction technique was performed, so that the dislocated labial alveolar bone segment was put back in the bone loss space of the repositioned central incisor and fixed with a micromesh plate. Two screws were placed on the distal side of the tooth, and another screw was placed on the proximal side. The lacerated gingiva with counterincision was sutured by interrupted black silk sutures under local anesthesia. Following this procedure, the tooth was fixed with a splint and 4-META/MMA-TBB (Super-Bond C & B^{TM}; Sun Medical, Kyoto, Japan), a self-cure adhesive resin cement, and was treated by a root canal. The patient was administered cephem antibiotics (cefditoren pivoxil 300 mg day^{-1}) orally for 9 days. Two days after the surgery, the epistaxis disappeared spontaneously, and root canal treatment was initiated 3 days after the operation. The root canal filling (Vitapex^{TM}; Neo Dental Chemical products Co. Ltd., Tokyo, Japan) was performed (Fig. 3), and a crown was restored with composite resin (Clearfil MAJESTY^{TM}; Kuraray Medical Inc., Tokyo, Japan) at 1 month after the operation.

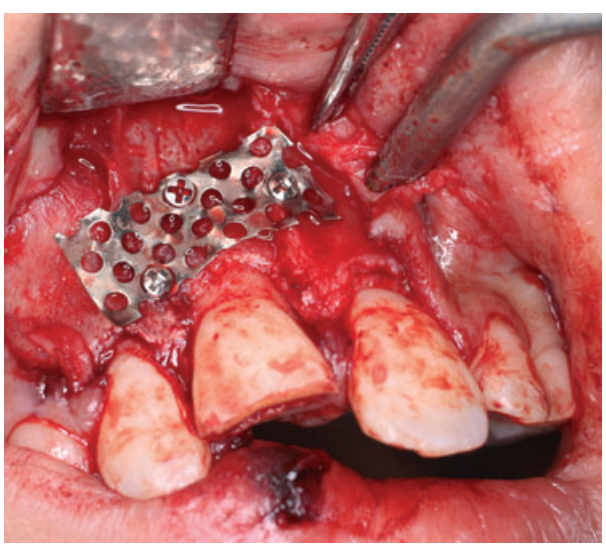

Fig. 2. Taken at the day of operation, the intrusive luxation of the maxillary central incisor was repositioned, and an open reduction was performed. The bone segment and tooth were fixed with a titanium micromesh plate and three microscrews.

After 5 months, the plate and screws were removed under local anesthesia. The labial alveolar bone of the intruded tooth showed continuity of ossification with little marginal bone loss and no signs of infection. At the 1-year follow-up examination, the alveolar bone and tooth were asymptomatic and no signs of inflammatory

Fig. 3. Taken at 1 month postoperatively, the periapical radiograph shows the fixation with titanium micromesh plate and three screws and a splint, and the root canal filling.

Fig. 5. The periapical radiograph taken at 1 year and 7 months postoperatively showed no signs of inflammatory root resorption.

root resorption or ankylosis, such as a metallic percussion sound, were observed by clinical and radiographic examinations (Fig. 4). The patient has been followed up for more than 1 year and 6 months since his operation, and he has remained asymptomatic. Moreover, there were no signs of either inflammatory root resorption or ankylosis except for some slight marginal bone loss (Fig. 5).

Fig. 4. The periapical radiograph taken at 1 year postoperatively showed no signs of inflammatory root resorption.

Discussion

With regard to the epidemiology of pediatric dental and maxillofacial trauma patients, Qudah & Bataineh (3) reported that 70% of their 227 pediatric patients were male, with the peak incidence rate occurring in the 10- to 12-year-old age group. Accidental falls were the most frequent causes of dental and maxillofacial trauma (4). However, with regard to the types of injuries, intrusive luxation of permanent teeth was rare (5) and reportedly occurs in only 3% of all traumatic cases involving permanent teeth and 5–12% of dental luxations (6). In our case, the patient, who was an 11-year-old male, fractured his maxillary alveolar bone with an intrusive luxation of the right central incisor, which penetrated the floor of the nasal cavity. According to the literature, the type of injury that occurred in our case, which consisted bone fracture and intrusive luxation of the incisor, was considered to be quite severe and the poor prognosis such as inflammatory root resorption.

For the treatment of intrusive luxation of permanent teeth (7), recommended options consist of re-eruption, orthodontic extrusion, and surgical repositioning with fixation as splint. Andreasen & Andreasen (8) described that the treatment of choice for traumatically intruded permanent teeth with complete root formation should be the orthodontic repositioning rather than the surgical repositioning. They also described that the tooth should be sufficiently repositioned within 2–3 weeks to perform the endodontic therapy. In our case with a severe intrusion, the teeth were surgically repositioned and fixed. Root canal treatment was initiated 3 days after the operation. The dislocated right maxillary central incisor had penetrated the floor of the nasal cavity, and because the incisor did not undergo re-eruption and orthodontic

extrusion, the root canal treatment was able to be initiated 3 days after the operation, providing endodontic access with adequate timing. Nelson-Filho et al. (9) reported that surgical repositioning combined with endodontic treatment constitutes a viable and lasting alternative treatment for intrusive luxations, based on 10-year follow-up data.

Regarding the treatment of maxillary alveolar bone fractures and the type of fixation, various treatments for fixation have been reported, including wiring, splints, miniplates, and screws (10–12). In the present case, we used a titanium micromesh plate and self-tapping screws on an 11-year-old patient for 5 months. The type of fixation has pros and cons compared to using wiring or orthodontic braces or splints. Aizenbud et al. (12) reported that the pros are that the fixation provides stable three-dimensional reconstruction, enables precise anatomic reduction and fixation under direct vision, and promotes primary bone healing. However, the cons are the potential growth restriction, damages to primary teeth and permanent tooth germs, creation of artifacts on CT scans or MRI, the possibility of pain and early or late infection, and the need for the removal of the hardware materials after complete healing. Morales et al. (10) also described that there are concerns over potential future growth restrictions, stress shielding, and corrosion; however, the effects of rigid fixation on craniofacial growth are not completely understood. They also mentioned that the removal of permanent plating systems is recommended after 2–3 months in children younger than 10 years. In our case, because of the labial alveolar bone segment, which was dissociated with the labial side by the fracture, complete bone healing required an extensive amount of time without the fixation of the bone segment, rather than fixation at a safe distance from the fixation points for the teeth. Furthermore, we removed the plating system after 5 months of fixation to avoid permanent dentition. The patient has remained asymptomatic. The treatments used for this case may not be applicable to all pediatric cases.

Regarding the prognosis, Al-Badri et al. (13) reported a higher prevalence of resorption in cases of more severe intrusion over 5 mm of permanent incisors. Closed apices have the lowest survival rate, because of root resorption, than any other apices, such as opened or parallel. They also reported that closed apices root resorption occurred up to about 10 months after injury, and the prevalence of the inflammatory root resorption has been reported to reach a plateau after that. Furthermore, Neto et al. (14) also reported that inflammatory root resorption accounted for 40% of sequelae to the intrusive luxation of permanent incisor, and the risk of inflammatory root resorption of surgically repositioned teeth was increased 1.5-fold compared to non-surgical cases. In our present case, the dental pulp was removed 3 days after reduction, and root canal filling was performed to prevent inflammatory root resorption. The patient has remained asymptomatic, and there were no signs of inflammatory root resorption or ankylosis over 1 year and 6 months after injury. Our finding suggested that the present case was able to avoid the above-described sequelae even though we performed surgical treatment owing to the severely intruded tooth.

In conclusion, we surgically repositioned a maxillary alveolar bone fracture with a severe intrusive luxation of the right maxillary central incisor by using titanium micromesh and screws. After the operation, it was necessary to continually examine the patient to determine whether or not sequelae occurred from the severe intrusion.

Conflict of interest

The authors declare that there are no conflicts of interest associated with the present report.

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