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Management of intrusive luxation of maxillary incisors with dens in dente: a case report

CASE REPORT

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Abstract – Intrusive luxation is one of the most severe types of dental traumatic injuries. The risk of occurrence of pulpal necrosis and inflammatory or replacement resorption is high. In an attempt to prevent or delay the appearance of such lesions, endodontic intervention is required soon after the occurrence of trauma. A 17-year-old boy reported to the Department of Conservative dentistry and Endodontics, KLE VK Institute of Dental Sciences, Belgaum, 2 days after a fall from a bicycle. Clinical and radiographic examination revealed an intrusive luxation of the left maxillary central incisor and lateral incisor. There were complicated crown fracture with the right maxillary central incisor and uncomplicated crown fracture with the left maxillary central incisor. Also, all the incisors showed the presence of Oelhers type II Dens-in-dente. The management was hence challenging. Immediate surgical repositioning was performed and the teeth were stabilized with a composite resin splint. Endodontic therapy was initiated with the right maxillary central incisor, and the canal was sealed with calcium hydroxide dressing. After 3 weeks, pulp sensitivity was repeated with the maxillary left central and lateral incisors. The result was negative. Considering the incidence of pulp necrosis and root resorption in intruded teeth with complete root formation, they also were dealt in a similar manner as the maxillary right central incisor. The splint was removed after 1 month. After 6 months of calcium hydroxide therapy, there was a satisfactory apical and periodontal healing. At this stage, the teeth were obturated and the fractures were restored with composite resin. A 1-year follow up revealed a satisfactory clinical and radiographic outcome.

Dental Trauma is a common injury, especially in children (1). Luxation injuries account for 15–61% of traumas in permanent teeth. The primary etiologic factors are bicycle injury, sport accidents, falls, and fights. From the stand point of therapy, anatomy, and prognosis, five different types of luxation injuries are recognized as Concussion, Subluxation, Extrusive luxation, Lateral luxation, and Intrusive luxation. The factors establishing the type of lesion seem to be the force and direction of the impact (2).

Intrusive luxation of permanent teeth is a rare dental injury when compared with other types of luxation injuries. It comprises of 3% of all traumatic injuries in the permanent teeth (3) and 5–12% of dental luxations (4). By definition, an 'Intrusion' is an axial displacement of the tooth into the alveolar socket (5). The displacement results in the damage to the alveolar bone, the periodontal ligament, the cementum, and the pulp. Healing subsequent to trauma is complex. Complications include pulp necrosis, inflammatory root resorption, dentoalveolar ankylosis, loss of marginal bone support, calcification of pulp tissue, paralysis or disturbance of root development, and gingival retraction (6–8).

The incidence of pulp necrosis for intruded teeth with open apices was shown to occur between 63% and 68% and 100% for teeth with closed apices (7). Depending on the severity of intrusion, the frequency of replacement resorption in intruded incisors ranges from 5% to 31% (7, 9, 10) and appears to be more in mature than in immature teeth (10). Although 97% of all inflammatory resorption are arrested after long-term Calcium hydroxide therapy, there is no effective treatment for replacement resorption (11).

Although the optimal treatment for traumatically intruded permanent incisors has not yet been determined, three treatment options have been reported. They are waiting for spontaneous re-eruption, which is indicated in immature permanent teeth, surgical repositioning, and orthodontic repositioning for mature teeth (2). However, difference of opinion exists concerning the choice of treatment. The best method would be the one with the least risk of replacement resorption. Also, little information exists as to the possible influence of treatment on the development of the most severe complication following trauma.

This paper aims to report and discuss the management of traumatically intruded mature permanent maxillary incisor teeth by surgical repositioning.

Case report

A healthy 17-year-old male patient reported to the Department of Conservative Dentistry and Endodontics, KLE V. K. Institute of Dental Sciences, Belgaum, 2 days after a fall from a bicycle. The patient complained of

injury to his upper front teeth and pain and sensitivity with them.

After general, medical, and trauma history was recorded from the patient and his father, clinical examination was carried out. Extra-oral examination for hard and soft tissues revealed no signs of injury, swelling, changes in the color of the skin, and asymmetry of the face and head. Inspection of the nostrils revealed no perforation. The facial bones and mandible were palpated to assess the mouth opening, and there was no abnormality seen. Lips showed no signs of injury.

Intra-oral examination of hard and soft tissues (Fig. 1) revealed a severe intrusion (7 mm) apically; labial rotation and an uncomplicated crown fracture of the mesio-incisal edge of the maxillary left central incisor. There was a moderate (3 mm) intrusion apically of the left lateral incisor. Complicated crown fracture involving the mesio-incisal angle of the maxillary right central incisor was also seen. The gingiva in relation to these teeth was lacerated.

Palpation along buccal vestibule revealed a displacement of the cortical plate in relation to the maxillary left central and lateral incisors. On percussion, a high metallic sound was elicited with the left central incisor, confirming the intrusion. There was grade II mobility with right central incisor and grade I with the left lateral incisor, but the left central incisor was firm in the bone. Pulp sensitivity test with electric pulp tester elicited a negative response with the left central and lateral incisors and a delayed response with the right central incisor.

Occlusal radiograph (Fig. 2) revealed a complete root formation in all the incisors and complicated crown fracture with the right central incisor. The incisal edge of the intruded left central incisor was located at the level of the cervical third of the crown of the left central incisor. There was widening of the periodontal ligament space, mesial to the root apex of the left central incisor. There were no root fractures associated with these teeth. All incisors exhibited Oelhers type II Dens-in-dente (Dens invaginatus) (12). Also, an impacted supernumerary tooth apical to incisors was seen. A radiograph of lips was taken to rule out any foreign body impaction or fragments of fractured teeth.

Fig. 1. Intra-oral frontal view showing the intrusive luxation of left maxillary central and lateral incisors, complicated crown fracture with right maxillary central incisor and soft tissue laceration around them.

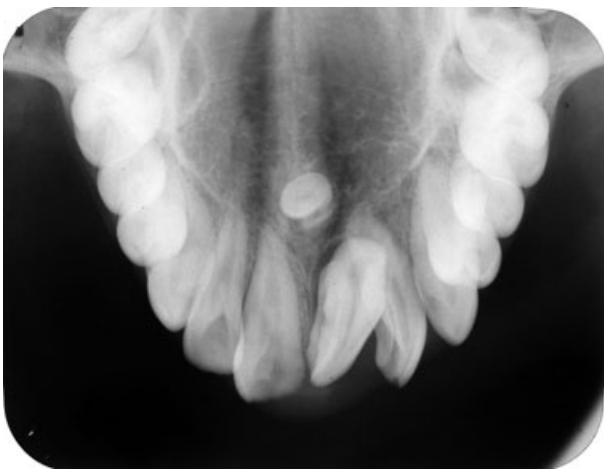

Fig. 2. Initial occlusal radiograph showing the intrusion of the left maxillary central incisor, complicated crown fracture of the right maxillary central incisors, widening of the periodontal ligament space, and the presence of a supernumerary tooth apical to the incisors. All the incisors show Dens-in-dente.

Treatment

Considering the age and economic background of the patient and the severity of intrusion and apical development of the roots, an immediate surgical repositioning was planned with the left maxillary incisors. After local anesthesia (Lignocaine with 1:80000 adrenaline), the intruded teeth were slowly elevated and repositioned in their place, and the occlusion was checked. The patient and his father confirmed the final position of the teeth and occlusion. Care was taken not to exarticulate the teeth out of their sockets. The buccal cortical plate was then manipulated to its original position and the lacerated gingiva was sutured by interrupted black silk sutures. Teeth were immobilized in this position by a 21 gauge stainless steel orthodontic wire and an acid etch composite resin (Filtek Z350; 3M-ESPE, St. Paul, MN, USA) technique.

As the patient had reported 2 days after the injury, pulp capping or partial pulpotomy was not considered with the exposed maxillary right central incisor, as the incidence of pulp necrosis increases with a treatment delay of more than 24 h (13, 14). Hence, root canal therapy was initiated. As this tooth exhibited a type II Dens-in-dente, gaining access was challenging. The invaginations are invariably wider and extend further apically, hence care was taken to ensure that the lesion was fully exposed and was fully incorporated into the root canal system during preparation using a tungsten carbide round bur (15). Working length was estimated using Root ZX (J Morita, Osaka, Japan). The root canal was instrumented using hand files by step-back method and copious irrigation with 3% Sodium Hypochlorite (Vishal Dentocare Pvt Ltd, Sarkhej, Ahmedabad, India). The canal was dried and an intra-canal medicament of Calcium Hydroxide-Iodoform paste (Metapex; Meta Biomed Ltd, Cheongju city, Chungbuk, Korea) was

filled. The access cavity was sealed with temporary cement (Cavit; ESPE/3M). No treatment was carried out to the impacted supernumerary tooth, as there were no signs of resorption or cystic changes; and also it did not interfere with the repositioning of the intruded teeth.

The patient was discharged with a prescription of Amoxicillin 500 mg thrice daily for 5 days, Diclofenac sodium 50 mg twice daily for 3 days, and Chlorhexidine mouthwash (Cholhex; Dr.Reddys' lab, Hyderabad, Andhra Pradesh, India) twice daily for 10 days.

After 1 week, suture removal was carried out. The patient was instructed to eat carefully and encouraged to maintain good oral hygiene. After 3 weeks, the splint was removed and the pulp sensitivity with the maxillary left central and lateral incisors was re-assessed. It was found to be negative. Considering that in teeth with completely formed apices, the incidence of pulp necrosis is 100% (7), and this may initiate inflammatory root resorption. Endodontic therapy was initiated with these teeth in a similar manner as described for the right maxillary central incisor, because even these teeth exhibited a type II Dens-in-dente.

The patient was followed up every month for 6 months. Calcium hydroxide was changed at the 3 months interval. Follow-up radiographs at 1, 3 and 6 months (Fig. 3) revealed adequate apical and periodontal healing in relation with the incisor teeth. No changes were seen with the impacted supernumerary tooth. Soft tissue healing around the intruded teeth was adequate. At this time, the calcium hydroxide paste was removed and the canals were irrigated with 2% Chlorhexidine solution (Dentochlor, Ammdent, Mohali, Punjab, India). Finally, the root canals were dried and the teeth were obturated with gutta-percha and zinc oxide eugenol sealer by a combination of lateral and warm vertical compaction technique. The fractured mesioincisal edges of the central incisors were restored with composite resin (Filtek Z-350; 3M/ESPE) (Fig. 4).

At the 1-year recall, the teeth were asymptomatic and showed no signs of resorption, clinically and radiographically (Fig. 5). The patient is being followed for the last 16 months showing the success of the treatment.

Fig. 3. Intra-oral periapical radiograph showing calcium hydroxide intra-canal medicament after 6 months. Adequate periapical healing is seen around the roots of the incisors.

Fig. 4. Intraoral view at 1-year recall showing adequate healing of the soft tissue and the restoration of the fractured incisors with composite resin.

Discussion

The rare occurrence of intrusion of permanent teeth has resulted in a minimal amount of data documenting the epidemiological information and clinical, radiographic appearance of this type of injury (2). Furthermore, very few clinical reports have been published to document the prognosis of these injuries as well as the effect of treatment (7, 16–19).

It was previously believed that the stage of development of the root was the determining factor for prognosis of intruded teeth (2). Currently, the severity of intrusion seems to be the most critical factor establishing the survival of the pulp and tooth. Some studies have demonstrated that intrusions of up to 3.0 mm have an excellent prognosis, whereas incisors with severe intrusion >6.0 mm present unfavorable prognosis because of the occurrence of inflammatory resorption and pulp necrosis (16, 20).

Current dental literature suggests different treatment approaches for the management of intrusive luxation injuries. There is no consensus reached on the optimal treatment of the intruded permanent teeth. The recommended treatment options include: Allowing spontaneous reerruption of the tooth (Passive repositioning), Immediate surgical repositioning and fixation, and Orthodontic repositioning (Active repositioning) (2).

Spontaneous re-eruption in permanent teeth is recommended for teeth with immature apices because of the

Fig. 5. Intraoral periapical radiograph at 1-year recall showing adequate periapical healing around the incisors.

high potential for eruption (2, 8). Kenny et al. (21) and Humphrey et al. (9) have criticized the term spontaneous eruption, which according to them is unpredictable and pathological rather than developmental, as it would be in normal eruption.

Orthodontic repositioning, another option for management has been suggested as a possible alternative, which might allow for remodeling of bone and the periodontal apparatus. Andreasen and Andreasen (2) have considered this option as the treatment of choice for both mature and immature permanent teeth. The Royal College of Surgeons of England suggests orthodontic extrusion for the management of mildly (< 3.0 mm) or moderately (3–6 mm) intruded incisors with complete roots (22). The disadvantages of this technique have been reported as long treatment time and retention period, strict patient compliance, and higher treatment costs (9, 23).

Kinirons (24) and Skieller (25) recommend careful and immediate surgical repositioning. The Royal College of Surgeons of England (19) suggests that severely intruded (> 6 mm) teeth with complete apex be repositioned surgically and appropriate tissue repair carried out. According to Ebeleseder et al. (17), an advantage of the surgical technique is that it may be easily performed; moreover, it returns the adjacent tissues to the original anatomic situation to allow repair and further allows fast and adequate endodontic access. Surgical repositioning is also indicated in cases of multiple intrusions or intrusive luxation associated with nasal sinus invasion (26). Cunha et al. (27) agreed that immediate and careful surgical repositioning of permanent teeth with complete root formation and severely intruded presents with several advantages and few disadvantages. However, the inadvertent exarticulation during repositioning and the possibility of additional damage to the periodontal ligament may lead to an increased risk of ankylosis. Therefore, the disadvantages of the surgical procedure would be more dependent on the professional's care and skill than on the procedure itself (17).In our case, as the intrusion was severe (7 mm), the root development was complete, and the economic condition of the patient was poor, we considered immediate surgical repositioning.

The potential complications expected after intrusive injuries include pulp necrosis, inflammatory root resorption, replacement resorption (Ankylosis), and loss of marginal bone. Pulp necrosis is the most common complication after luxation injuries (7) and occurs in almost all intrusions of fully formed permanent teeth (2, 3). Andreasen et al. reported a 63% incidence of pulpal necrosis in a sample of 24 intruded teeth with an open apex, while 100% incidence was found among 37 intruded teeth with a closed apex (7). This study supports the findings by Skeiller who was the first to report 100% pulp necrosis in intruded incisors with complete root development (25). Similar findings have been reported by other studies (18, 28). Owing to the high incidence of pulp necrosis, prophylactic extripation of the pulp has been recommended to prevent other complications (2).

Root resorption is a common healing complication following intrusions. Inflammatory root resorption and replacement root resorption are classified as invasive or progressive root resorption (19, 29). The slower replacement root resorption consists of ankylosis and replacement of the root by alveolar bone. Following intrusion, external root resorption (both types combined) has been reported and cited to be between 28% and 66% (3, 7, 16, 25, 30). Andreasen and Pedersen reported a total incidence of 86% of external resorption (38% inflammatory, 24% surface, and 24% replacement resorption). They also found a higher incidence of resorption in teeth with closed apices (70%) than in those with open apices (58%) (7). Reports have shown that repositioning surgically did not affect the risk of root resorption compared to other treatment modalities and that resorption is more likely due to the severity of injury and the root development rather than to the surgical procedure itself (20, 26, 27).

Loss of marginal bone support has been reported in 31% of intruded permanent incisors (7). Andreasen et al. reported that the increasing age and root development increased the risk of marginal bone loss. Furthermore, the lateral incisor appeared to have an increased risk of marginal bone loss. Also, gingival laceration and number of intruded teeth had an influence. 'No repositioning' gave significant better healing in comparison with orthodontic repositioning and also had a more favorable outcome than surgical repositioning (26). However, in another study, it was observed that the risk of marginal bone loss was greater in teeth treated conservatively than in those that were repositioned surgically or orthodontically, because if the tooth is resited in its original position and the normal relationship between the tooth

and the bone is reestablished, marginal bone loss is minimized (18).

Calcium hydroxide has been shown to arrest inflammatory resorption with a high degree of success. According to Cvek (11), calcium hydroxide paste should be maintained in the root canal for 1–6 months before obturation with gutta-percha points. In our case, we applied calcium hydroxide-iodoform paste after tooth preparation and maintained it for 6 months to allow healing. Studies by Ebeleseder et al. (22) support that this dressing be kept for 6–9 months. Tronstad (29) suggested that the alkaline pH of calcium hydroxide may be a factor in arresting root resorption by inhibiting osteoclastic activity and by stimulating the repair process of the tissue.

Andreasen et al. studied the effect of treatment delay on 140 teeth and found that treatment delay, i.e. before and after 24 h, had no effect upon healing, except a slight worsening of marginal bone loss (26). In our case though there was delay of 2 days from the time of injury and the patient reporting for treatment, the healing obtained was uneventful with both clinical and radiographic success.

Conclusion

In this case, considering the age and economic background of the patient; the severity of intrusion and apical development of the roots surgical repositioning offered a viable method of managing intrusive luxated maxillary teeth. There were no signs of resorption in relation to the roots of the incisors and the periapical area. However, it can be ascertained at this time that a long-term follow up (>5 years) of such cases is necessary.

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