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Immediate Surgical Repositioning Following Intrusive Luxation: A Case Report and Review of the Literature

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Abstract

This report presents a case of severe intrusive luxation of mature maxillary lateral incisor in a 10-year-old boy. The intruded tooth was immediately repositioned (surgical extrusion) and splinted within 2 h following injury. Tetracycline therapy was initiated at the time of repositioning and maintained for 10 days. Pulp removal and calcium hydroxide treatment of the root canal was carried out after repositioning. Splint was removed 1 month later. Definitive root canal treatment with gutta percha was accomplished at the second month recall. Clinical and radiographic examination 28 months after the surgical extrusion revealed satisfactory apical and periodontal healing.

Intrusive luxation is one of the most severe form of traumatic injuries in which the affected tooth is forced to displace deeper into the alveolus. As a consequence of this type of injury, maximum damage occurs to the pulp and all supporting structures. An intrusion, depending on its severity, may produce catastrophic injury to the alveolar bone, shear and destroy periodontal ligament (PDL) cells and the ligament itself, and crush the apical neurovascular system (1-3).

Intrusion injury has a rarer occurrence in permanent dentition when compared with other types of luxation injuries. It comprises 3% of all traumatic injuries in the permanent dentition (4) and 5–12% of dental luxations (5, 6). Pulp necrosis, inflammatory root resorption, ankylosis, loss of marginal bone support, pulp canal obliteration, paralysis or disturbance of radicular development and gingival retraction may occur as a consequence of an intrusive luxation (7-9). Prevalences of complications including pulp canal obliteration, external root resorption and loss of supporting bone were reported to be 6–35%, 1–18% and 10%, respectively (10).

The incidence of pulp necrosis for intruded teeth with open apices was shown to occur between 63% and 68% (7, 8), and 100% for teeth with closed apices (8). Research has demonstrated a direct relationship between pulpal necrosis and the apical diameter of the intruded tooth. Intrusively luxated teeth with apical diameters ≤ 0.7 mm have a significantly greater pulpal necrosis rate than do intruded teeth with apical diameters ≥ 1.2 mm (11). This case report aims to report and discuss the results of the management of traumatic injury in which a permanent lateral incisor severely intruded.

Case report

The patient was a healthy, 10-year-old boy who was brought to the Pediatric Dentistry Clinics after a fall injury occurred at school 1 h earlier. Clinical examination revealed that the injury had resulted in 7 mm intrusion and uncomplicated crown fracture of maxillary permanent left lateral incisor (Fig. 1). Subluxation of maxillary left central incisor was also noted. There was no additional injury to alveolar bone, teeth and surrounding soft tissues except for a minor laceration on the vestibular gingiva.



Figure 1 Preoperative panoramic radiograph of intruded permanent maxillary left lateral incisor.

Because of the severity of intrusion and completed root development, immediate surgical repositioning of lateral incisor was planned. Prior to surgical operation, the patient was given doxycycline (100 mg, oral). After the administration of local anesthesia, the stuck tooth was initially luxated. An elevator was used for this purpose. Following careful and very gentle elevation, the tooth was brought into a position so that its crown could be grasped with a forceps. After bringing it into its

original place, the lateral incisor and central incisor were splinted using 0.9 mm fishing line and acid etch-composite resin technique.

Endodontic treatment of lateral incisor was commenced at this visit. Extirpation of the pulp was followed by root canal instrumentation, irrigation with 5.25% solution of sodium hypochlorite and drying. Calcium hydroxide mixed with sterile saline was applied to the canal and packed with an absorbent paper point. The access cavity was sealed with zinc phosphate cement (**Fig. 2**).



Figure 2 Following surgical extrusion and splinting of the tooth, endodontic therapy was initiated with calcium hydroxide.

Before leaving the clinic, the patient was prescribed antibiotics (doxycycline, 100 mg, b.i.d., calculated from $4.4 \text{ mg kg}^{-1} \text{ day}^{-1}$) for 10-day use (**10**), analgesics and mouthrinse (chlorhexidine gluconate 0.12%). He was encouraged to maintain good oral hygiene. His follow-up visits were also scheduled.

At his visit to the clinic, 3 weeks later, the patient reported discomfort with his left central incisor during occlusion. The tooth presented mild sensitivity to the cold test, but it was highly sensitive to percussion. Development of pulp necrosis of the tooth was decided. Endodontic therapy with calcium hydroxide was initiated after pulp removal under local anesthesia. At this session, the splint was removed. Both teeth were asymptomatic at the second month recall and calcium hydroxide dressings were removed. After step-back preparation and irrigation, the root canals of incisors were dried and obturated permanently with gutta percha points and sealer. The fractured incisal edge of lateral incisor and the endodontic access cavities were restored with composite resin (**Fig. 3**).



Figure 3 Definitive endodontic treatment of the permanent central and left incisors was carried out at postoperative second month.

The patient was seen in the clinic at 6-month intervals. Twenty-eight month after the traumatic injury, clinical examination revealed that the left lateral incisor had normal periodontal contour and physiologic mobility. No periapical tenderness was observed. In the radiographic examination, however, healing without signs of root resorption was evident (**Fig. 4**).



Figure 4 Satisfactory and uncomplicated healing is evident after 28 months.

Discussion

The most severe form of luxation injury, intrusion, not surprisingly, yields the poorest prognosis and requires more complex treatment. There is no consensus reached on the optimal treatment of intruded permanent teeth (**10, 12, 13**)

The recommended treatment options for intruded teeth include:

1. Allowing spontaneous re-eruption of the tooth (**9, 10, 14, 15**)
2. Immediate surgical repositioning and fixation (**16, 17**)

3. Orthodontic repositioning (extrusion) (18-20)

Spontaneous re-eruption of primary teeth following an intrusion injury is usually expected. For the permanent teeth, however, waiting for spontaneous re-eruption is indicated for immature teeth because of their high potential for eruption (9, 10, 21). At this point, studies related to traumatic injuries of teeth should bear in mind that one-third of primary teeth (22) and 63% of permanent teeth (8) that were followed-up for re-eruption have developed pulp necrosis.

Orthodontic extrusion is another option for the management of intruded permanent teeth. It has been suggested as a possible alternative which might allow for remodeling of bone and the periodontal apparatus (23). Successful treatments of cases using this technique have been reported in the literature (24-26). Andreasen and Andreasen (10) have considered this option as the treatment of choice for most of the cases involving mature and immature permanent teeth. However, the guidelines of the Royal College of Surgeons of England (RCSE) related to this issue (12), suggest orthodontic extrusion for the management of mildly (<3 mm, RCSE category 1) or moderately (3–6 mm, RCSE category 2) intruded incisors with complete root. Orthodontic extrusion of RCSE category 2 teeth with incomplete apex has also been suggested as an alternative.

Turley et al. (18), in an animal experiment, examined the effect of orthodontic extrusion and observation for re-eruption on intruded dog teeth. They concluded that when the injury to the tooth was severe, orthodontic extrusion had little effect on repositioning of the injured tooth but resulted in undesirable movement (intrusion) of the anchorage teeth. However, when the injury was less severe, orthodontic forces facilitated repositioning of the affected tooth. The disadvantages of orthodontic extrusion have been reported as long treatment time and retention period, strict patient compliance and higher treatment costs (25, 27).

Kenny et al. (2) and Humphrey et al. (27) have criticized the term 'spontaneous eruption' which, according to them, gives a falsely optimistic impression as tooth movement after injury is both unpredictable and pathological rather than developmental, as it would be in normal eruption. Another term that these authors have opposed to is 'orthodontic repositioning'. They state that the traction forces used to move intruded incisors exceed those of conventional orthodontic treatment, and severely intruded teeth do not have a functional PDL, a prerequisite for orthodontic movement. These terms imply that an intruded tooth will return to its original location with time or that it can be moved there by the same mechanics and with the same predictability as conventional orthodontic treatment, neither of which is necessarily true (2).

Surgical extrusion of teeth has been strongly opposed by some authors because it may increase the risk of external root resorption, sequestration and loss of marginal bone support (8, 10, 28). Findings of a study by Kinirons and Sutcliffe (29) has indicated that full surgical repositioning of severely intruded teeth was not associated with an increased experience of root resorption or marginal sequestration of bone. Kenny et al. (2) have stated that the amount of intrusion is the critical determinant of pulp and tooth survival. Support for this view has come from the studies by Al-Badri et al. (1), Humphrey et al. (27), Kinirons and Sutcliffe (29) and Ebeleseder et al. (30). The long-term prognosis of an intruded

tooth seems to be positively related to the degree of apical closure and root development i.e. the best prognosis is seen in teeth with complete root formation (29).

The amount of intrusion and stage of root development has led to the treatment approach in the presented case. Together with the immediate surgical repositioning and splinting, endodontic therapy with calcium hydroxide following repositioning was also initiated after pulp removal. As the risk of pulp necrosis increases with the extent of injury to the pulp and PDL and in teeth with complete root formation (8), prophylactic extirpation of the pulp has been recommended to prevent other complications arising from the pulp necrosis (13). It has been established that appropriate, timely removal of a necrotic pulp followed by conventional root canal treatment will prevent inflammatory root resorption, whereas failure to remove a necrotic pulp stimulates inflammatory root resorption (2).

Before the surgical procedure has begun, the patient was given oral doxycycline. This therapy was maintained for 10 days postoperatively. Doxycycline is a broad-spectrum antibiotic which is derived from tetracycline. Tetracycline has been widely used in the treatment of periodontal disease because of its sustained antimicrobial effects. Recently, tetracycline has been shown to possess anti-resorptive, as well anti-microbial, properties; specifically, it has a direct inhibitory effect on osteoclasts and collagenase (31, 32). Thus, if these drugs were found to be as effective as penicillin drugs in limiting bacterial contamination after a traumatic injury and, in addition to this, they possessed an anti-resorptive effect, they might replace penicillin as the systemic antibiotic of choice after this type of injury has occurred (33). As the patient was not susceptible to tetracycline staining because of his age, this drug was preferred in the presented case.

According to Andreasen (7), the time interval from injury to repositioning of displaced teeth appears to be related to root surface resorption. Thus, teeth treated within 90 min after injury show a very low frequency of root resorption compared with teeth treated at a later time. In this case, the elapsed time for repositioning of the tooth was approximately 2 h. This has reduced the duration of intimate contact of the root with alveolar bone. It has been reported that compression of the root against alveolar bone and delay in mechanical repositioning facilitated replacement root resorption in the intruded position (27).

A normal PDL space around most of the tooth was evident at postoperative 28 month. The clinical outcome was favorable in a growing child and, in the authors' opinion, it has been related to the patient's quick referral to the clinic. In a relatively short period of time, the intruded tooth could be repositioned properly. However, immediate removal of pulp and tetracycline therapy might have contributed to the outcome which should be further investigated in larger case series.

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