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Traumatic intrusion of permanent teeth: 10 years follow-up of 2 cases

CASE REPORT

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Abstract – Intrusive luxation is a kind of traumatic injury characterized by an axial displacement of the tooth toward the alveolar bone. Its main causes are bicycle accidents, sports/recreational activities, and falls or collisions. Treatment strategies include waiting for the tooth to return to its position, immediate surgical repositioning, and repositioning through dental traction by orthodontic devices. In order to decide which treatment to follow, the degree of root formation, the patient's age, and intrusion severity should be taken into consideration. This study aimed to report a 10-year follow-up of two patients that suffered permanent incisor (PI) traumatic injury who had a similar root development (incomplete rooting) but different results. In the first case, the treatment of choice was follow-up. The patient showed gingival alteration and root resorption of tooth 21. Calcium hydroxide therapy and root canal filling were performed twice because of not attending callback. After finishing the endodontic treatment, follow-up visits showed no abnormalities. In the second case, the treatment of choice was watch and wait to the teeth 11 and 21. After 7 months spontaneous eruption of both teeth was detected. Radiographic examination showed atypical root formation and almost completely pulp canal obliteration, 8 years later. In the follow-up, visit after 10 years was observed complete crow and pulp canal obliteration. It was concluded that PI intrusion treatments are good intervention alternatives, as they proved to be successful after a 10-year follow-up period.

Intrusive luxation is a type of recognizable luxation represented by a deeper axial displacement of the tooth toward the alveolar bone (1). Traumatic intrusion of permanent teeth is a rare injury, which, in prior studies, has been found to represent up to 2% of all traumas affecting permanent dentitions (2). The main causes of intrusive injuries in permanent teeth include bicycle accidents, sports and recreational activities, and falls or collisions (3, 4). The consequences of intrusive luxation may include pulp necrosis, inflammatory radicular resorption, dento-alveolar ankylosis, loss of marginal bone support, pulp tissue calcification, paralysis or disturbance of radicular development, and gingival retraction (5, 6).

The direction of the impact is one factor that should be considered when approaching intrusive luxation diagnoses. A strict axial impact striking the incisal edge forces an axial displacement of the tooth. If the force occurs in the axial-labial or axial-lingual direction, the tooth may be displaced in the apical-labial or apical-lingual direction. Moreover, tooth displacement commonly results in labial bone plate fracture (2).

Treatment decisions should consider clinical and radiographic signs and symptoms. Strategies to approach this injury consist of: waiting for the tooth to return to its primary position (passive repositioning), immediate surgical repositioning, and repositioning with dental traction by orthodontic devices (active repositioning) (1, 7–9).

According to Andreasen et al. (2), published clinical reports that have documented either the prognosis of these injures or treatment effect are scarce. The present study reports on a 10-year follow-up of two cases of traumatic intrusion of permanent incisors in two different patients with similar root development but with different outcomes.

Case report 1

A 6-year-old boy was referred to the Pediatric Clinic of the School of Dentistry at the Federal University of Pelotas, Brazil, 1 day after trauma in 1995. The patient had fallen and hit his permanent upper central incisors on a stone. His lips were injured and, upon clinical examination, swelling could be detected. A partial 3 mm intrusion of tooth 21, coupled with a small incisal fracture of teeth 11 and 21, could also be observed (Figs 1 and 2). No alterations could be observed in the radiographic exam. Thus, follow-up with no intervention was chosen. One month later, the patient was cured. Two months later, the patient returned to the clinic presenting gingival changes, with a protuberance in the buccal groove, as well as a negative response to the thermal testing of tooth 21. Considering these factors, the

Fig. 1. Clinical examination showing injured lips, incisal fracture of 11 and 21 and intrusion of 21.

treatment of choice was endodontic therapy by applying a calcium hydroxide [$Ca(OH)_2$] paste, together with palatal gingivectomy to allow for access to the pulp chamber. The patient was scheduled for callback twice but did not attend the appointments. Nine months later, the patient sought out treatment, as he sensed an odd smell after the temporary restoration fell out. This time, root canal cleaning and the placement of a $Ca(OH)_2$ paste were performed. Three months later, the tooth was filled with sealer and gutta-percha. Visits at 5 months (Fig. 3) and 3 years later showed that no clinical or radiographic signs or symptoms could be detected. The patient's clinical dental care was performed in a different location after this period. Nine years after the endodontic treatment, clinical and radiographic follow-up examinations were performed, and the treatment proved to be successful (Figs 4 and 5). A periapical lesion was diagnosed in element 11 on this occasion. It is speculated that this lesion may well be associated with the restoration, which was performed at another dental center.

Fig. 2. Radiographic examination showing incisal fracture of 11 and 21 and intrusion of 21.

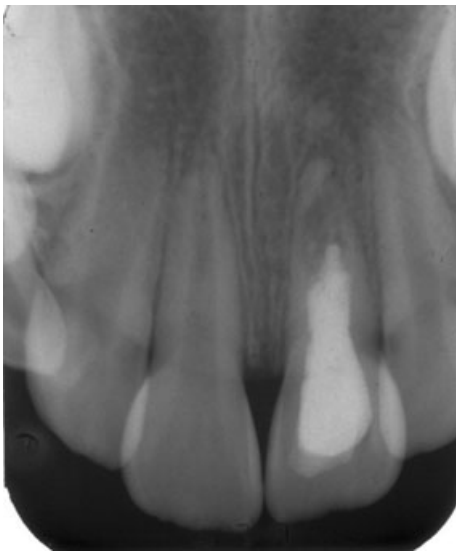

Fig. 3. Radiographic examination showing 5 months of follow-up.

Fig. 4. Clinical examination showing success of tooth treatment 21 after 10 years.

Case report 2

An 8-year-old male patient suffered dental trauma because of a fall and ensuing impact on a wooden playground slide in 1997. The boy arrived at the Pediatric Clinic of the School of Dentistry at the Federal University of Pelotas, Brazil, 3 days after the trauma. Clinical examination revealed a hematoma in the internal portion of the upper lip and a 4–5 mm intrusion of teeth 11 and 21. Upon periapical radiography, the child was diagnosed with stage 7 of the tooth development system, as proposed by Nolla (10) (Fig. 6). The treatment chosen

Fig. 5. Radiographic examination showing success of tooth treatment 21 after 10 years.

Fig. 6. Radiographic examination performed in the first appointment.

was to watch and wait for spontaneous reeruption. In the clinical examination performed 7 months after the trauma, spontaneous eruption of both teeth could be identified. In radiographic examinations, disturbance of root canal development and partial pulp calcification could be observed (Fig. 7). Eight years later, clinical and radiographic examinations of teeth 11 and 21 revealed that the canals had become almost completely calcified. The patient underwent a 10-year follow-up and showed no clinical or radiographic signs or symptoms other than a nearly complete pulp canal obliteration after 8 years and a complete pulp canal obliteration after 10 years (Figs 8, 9, and, 10).

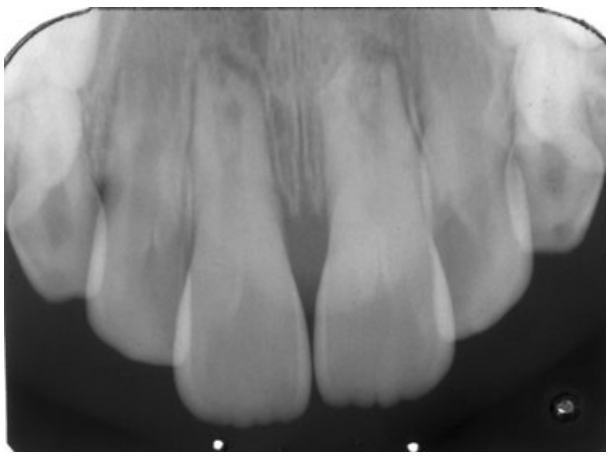

Fig. 7. Radiographic examinations 7 months later showing atypical root formation, pulp calcification for both teeth.

Fig. 8. Clinical examination after 8 year of follow-up

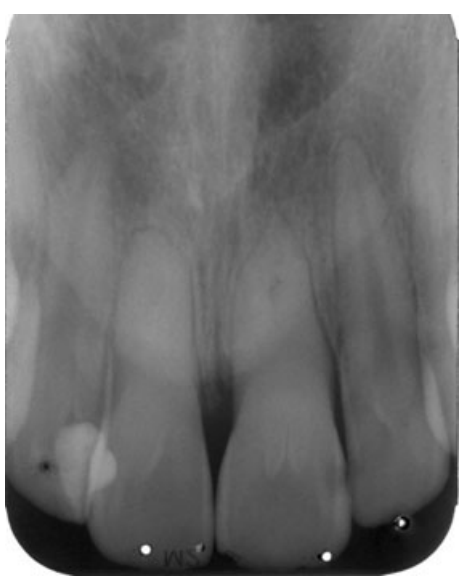

Fig. 9. Radiographic examination showing the almost total pulp calcification after 8 year of follow-up

Fig. 10. Radiographic examination showing the pulp calcification after 10 year of follow-up

Discussion

Clinical studies in the literature on intrusive luxation are scarce, possibly due to the fact that this is a type of trauma tends to be rare in permanent dentitions. Such an injury is a challenge for dentists, as it causes psychological damage to both patients and their relatives.

Diagnosis can be determined by means of clinical and radiographic signs and symptoms, such as occlusal misalignment, bleeding, and the presence of a dull, dry sound – without sensitivity – upon percussion. Upon radiographic examination, the disappearance of the periodontal ligament space and the difference in height between the traumatized tooth apices and their homology could be verified. Moreover, the degree of root formation and eventual bone fracture could also be determined. These determinations are necessary when determining the treatment of choice (11).

According to IADT (12), determining factors to choose the most appropriate treatment include stages in root development, age, and intrusion level. For teeth with either open or closed apices in 12- to 17-year-old patients with an intrusion up to 7 mm, the recommended treatment is to allow spontaneous repositioning to take place. For teeth with closed apices, with an intrusion of >7 mm in 12- to 17-year-old patients, as well as for patients older than 17, the recommended treatment is either orthodontic or surgical repositioning (12).

A clinical study by Andreasen et al. (13) concluded that spontaneous eruption should be expected in patients with intruded permanent teeth with incomplete root formation, which would be the treatment of choice for this type of injury. Nelson-Filho et al. (14) have recommended surgical repositioning as an alternative treatment for intrusive luxation in mature permanent teeth.

The major complications of intrusive luxation include pulp necrosis, root resorption, and marginal periodontal defect (bone insertion loss), where teeth with incomplete root formation present a better prognosis than do those with incomplete root formation in patients of <12 years of age (15). There is a great risk of root resorption and pulp vitality loss in the cases of the intrusive luxation of permanent teeth with complete apexes (16). A study performed in 1989 observed 100% of pulp necrosis in intruded teeth with open apices and 62.5% in teeth with incomplete root formation (17). However, it has been demonstrated that intrusions of up to 3.0 mm present excellent prognoses, whereas incisors with severe intrusion >6.0 mm present unfavorable prognoses, mainly due to the occurrence of inflammatory root resorption and pulp necrosis (18).

The consequences of intrusive luxations in the two aforementioned cases included pulp necrosis (8), as well as pulp chamber and root canal obliteration (5, 6). Factors, such as elasticity, velocities, and varying amounts of mass that the impact of objects poses, serve to determine the extent and types of injuries that can be sustained in real-life traumas (19). One of the determining factors of the different consequences is most likely due to the impacting objects themselves: stone and wood.

One case reported in 2011 (20) refers to the consequences of a stone impact on the face of a 15-year-old male patient, which caused a multiple-tooth trauma in which three teeth were avulsed and others were fractured. The impact resulted in an intrusive luxation leading to pulp necrosis. Wood seems to be a more resilient material, offering less resistance to tooth impact. In this study, a facial strike against wood did not cause pulp necrosis, but rather an anomalous formation of the central incisors, as well as the calcification of the tooth crown and root canals. Pulp canal obliteration appears to be a phenomenon that is closely related to the loss and reestablishment of the pulp nerve supply (21).

In case report 1, because of pulp necrosis, endodontic intervention with gingivectomy was deemed necessary (22), thus allowing for the pulp chamber approach to be applied, which is in accordance with that mentioned by Wigen et al. and Faria et al. (23, 24) Calcium hydroxide paste was placed to obtain an optimal filling condition for the root canal.

Endodontic therapy with calcium hydroxide paste, as employed in the present study, was a commonly used therapy in the academic community until de 1990s (25, 26) and is still used (7, 27) in immature necrotic permanent tooth treatment.

Alternatives to calcium hydroxide paste have been reported in the literature, such as MTA (28) and stem cells, and additional clinical protocols have been established for this kind of lesion (29).

Another relevant factor worth mentioning is the regular dental appointment. Following an intrusive luxation incident, consultations must be more frequent so as to enable the evaluation of clinical conditions and lesion prognosis. Ideally, patients should be present at all consultations to reevaluate the case, with the first recall occurring 15 days after the first dental appointment. This recommendation applies to intrusion cases, so that endodontic treatment, if needed, can be started (30).

Patients should then be called in on a regular basis for injury follow-up. However, in the two cases reported by this study, the patients did not fully comply with the scheduled recall and control appointments. Fortunately, more serious sequels did not appear. In case 1, the patient had already been submitted to an initial pulp necrosis treatment, while in case 2, no intervention was needed.

The cases described in this study confirm that the wait and watch treatment can be applied to traumatically intruded permanent incisors of patients who present an incomplete root formation. Regular tooth monitoring should be followed so as to detect and treat possible complications stemming from such traumas, in turn allowing for these teeth to continue to perform their functions. It was concluded that PI intrusion treatments are good intervention alternatives, as they proved to be successful after a 10-year follow-up period.

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