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Frequency of intrusive luxation in deciduous teeth and its effects

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Abstract – The aims of this study were three-fold: First, to determine the prevalence of partial and total intrusion of the primary anterior teeth. Second, to investigate the sequelae of total and partial intrusive luxation in the primary anterior teeth and in their successors and finally, to establish whether the sequelae on both deciduous and permanent teeth were related to the child's age at the time of the intrusion. Data collected from records of 169 boys and 138 girls, all between the ages of zero and 10 years, who were undergoing treatment during the period of March 1996 to December 2004. The sample was composed of 753 traumatized deciduous teeth, of which 221 presented intrusive luxation injury. Children with ages ranging from one to 4 years were the most affected with falls being the main cause of intrusion. Of all intruded teeth 128 (57.9%) were totally intruded and 93 (42.1%) partially. Pulp necrosis/premature loss and color change were the most frequent sequelae in both total and partial intrusions. Concerning permanent dentition, the most common disturbances were color change and/or enamel hypoplasia. Both types of intrusion caused eruption disturbance. Total intrusion was the most frequent type of intrusive luxation. There was no significant correlation between the child's age at the time of intrusion and the frequency of subsequent sequela on primary injured teeth ($P = 0.035$), between the age at the time of injury and the developmental disturbances on permanent teeth ($P = 0.140$).

Dental traumas are common during childhood, with a frequency that varies from 4% to 30% (1–3). Falls at home are the main cause (1, 2, 4, 5). On deciduous dentition, luxation or avulsion occurs more often than fractures (3, 5–7). This is because the alveolar bone in young children presents wide medullar spaces as well as some flexibility. Therefore, blunt force trauma against these teeth often causes them to move instead of break, as they are not firmly supported (6).

Children between one and 4 years of age are the most affected by dental trauma (2, 4, 7–12), with no gender-related differences (1, 5, 13). The upper front teeth are the most commonly involved (1, 3–5, 7, 11, 14–18), and in case of protrusion, they might contribute to dental injuries in both dentitions (3, 7, 9, 19). Trauma injuries are twice as common in children with forwardly projected incisors: an overjet of three to six millimeters doubles the chance of dental trauma and one of over six millimeters triples this chance (20). Intrusive luxations, total or partial, were the main cause of sequelae in the successor teeth. These types of luxations occur with great frequency in deciduous teeth, and their prevalence varies from 1.5% to 43% (1–3, 5, 8–11, 18).

Deciduous teeth may present several types of sequelae from dental trauma: enamel discoloration, pulp obliteration, pulp necrosis, root resorption, inflammatory resorption, ankylosis, gingival recession, permanent displacement of the deciduous tooth, and pulp necrosis/premature loss (6, 10, 12, 18, 21, 22).

Traumatic injuries in deciduous must be treated not only for esthetical and functional reasons, but also because they might affect the successors' developing germs. Late treatment usually requires several complex pediatric, dentistry, surgical, and orthodontic interventions. Regular follow-up tests and radiographs, as well as appropriate clinical interventions, may minimize or even prevent damage to the successor tooth. Patients need to be made aware of how important the treatment and periodical follow-ups are for their oral health.

The developmental disturbances of permanent teeth caused by trauma in their predecessors have a prevalence that ranges from 12% to 74% (4, 18, 23). The close anatomical relationship between the apices of primary teeth and their developing permanent successor's is a relevant factor as it promotes easy transmission of any impact from the deciduous tooth to the germ of its successor (4, 18, 23, 24). Sequelae on permanent teeth caused by trauma in their predecessors are: discolorations of the enamel white, yellow or brown, enamel hyperplasia, crown dilaceration, root dilaceration, odontoma-like malformation, root duplication, partial or complete arrest of root formation, sequestration of the permanent tooth germ and eruption disturbances (5, 19).

The aims of this study were three-fold: First, to determine the prevalence of partial and total intrusion of the primary anterior teeth. Second, to investigate the sequelae of total and partial intrusive luxation in the primary anterior teeth and in their successors and finally,

to establish whether the sequelae on both deciduous and permanent teeth were related to the child's age at the time of the intrusion.

Material and methods

This is a retrospective study undertaken with the approval of the Ethics Committee of the Pedro Ernesto University Hospital (HUPE), Rio de Janeiro State University (UERJ), and with the consent of the parents or caretakers, who signed documented authorizations.

Data from dental records of 307 children (169 boys and 138 girls), with ages varying from zero to 10 years were analyzed. All patients presented signs of trauma on anterior primary teeth and came to the Dental Trauma Center of the Pediatric Dentistry Clinic of Rio de Janeiro State University (UERJ) during the period of March 1996 to December 2004. Records provided personal data regarding the children, such as name, address, date of birth and gender. The trauma form also contained information on their trauma history, cause and type of injury, place, date and circumstances under which the trauma occurred (according to the WHO classification of types of injuries modified by ANDREASEN and ANDREASEN) (1–25).

Patients were examined and cared for by Pediatric Dentistry graduate students who are trained and constantly supervised by a professor of the Pediatric Clinic. Clinical and radiographic follow up of the patients (including intra and extra-oral techniques) were conducted periodically (weekly, monthly, etc.), according to severity and type of injury. In cases in which the same tooth presented more than one sequela, only the most serious type is considered. The consequences of trauma on deciduous teeth were (in decreasing order of frequency): pulp necrosis/premature loss, inflammatory resorption, ankylosis, pulp obliteration, external root resorption, and enamel discoloration. Gingival recession and permanent displacement of the deciduous tooth are secondary sequelae (18). The disturbances caused on permanent teeth were registered according to the following classification (in decreasing order of frequency): sequestration of the permanent tooth germ, odontoma-like malformation, partial or complete arrest of root formation, crown dilaceration, root dilaceration, root duplication, white or yellow/brown discoloration of enamel and/or enamel dysplasia, and eruption disturbances.

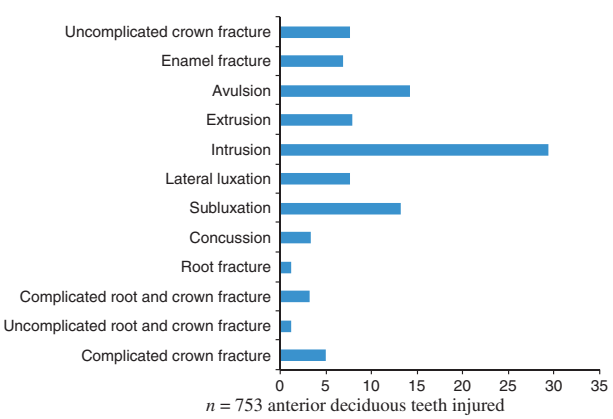

Fig. 1. Frequency of injury types on anterior deciduous teeth during the period of March 1996 to December 2004.

Intrusion was classified as total or partial, according to the depth of injury. It was considered total when the tooth was completely inside gingival tissue (and it was not possible to see any part of the crown) and partial when part of the tooth was inside gingival tissues (and it was possible to see the crown in part or in its entirety).

The results were statistically analyzed using the SPSS (São Paulo, SP, Brazil) 8.0 software. Chi-squared tests were used to determine significant differences in data ($P < 0.05$).

Results

From the total sample of 753 traumatized anterior teeth, the most frequent type of injury was intrusion (29.3%; $n = 221$) (Fig. 1).

Of all intruded teeth, the most affected one was the right central primary incisor with 35.2% total intrusion and 47.3% with partial intrusion. Next came the left central primary incisor, with intrusions of 39.8% and 31.2%, respectively. Children from one to 4 years old were the most often injured. Of all injured children, 169 were boys and 138 were girls. There was no difference in frequency of intrusion between boys and girls ($P > 0.05$).

Of the 221 intruded teeth, 128 (57.9%) were partially and 93 (42.1%) totally intruded. Falls (76.6%), stroller accidents (5.5%) and bicycle accidents (4.7%) were the most frequent causes of total intrusive luxation. The main cause for partial intrusions was found to have been the same: falls (86.1%), followed by bumping against other children (4.3%), and bicycle accidents (3.2%). Most of the accidents took place inside the child's home with 62.5% of the total intrusive luxations, and 67.7% of the partial ones. They were also found to have happened outdoors (18.8% and 14.0%, respectively), and at school (8.6% and 4.3%, respectively).

The initial sample of 187 intruded teeth (120 total and 67 partial) was part of an 8-year clinical and radiographic study. Because of patients' absence, the follow up of 34 teeth could not be conducted. Among the totally intruded teeth, 109 (91.4%) presented some sort of sequelae. Pulp necrosis/premature loss was the most frequent (78.9%; $n = 101$), followed by enamel discoloration (3.1%; $n = 4$) and external/internal root resorption (2.3%; $n = 3$). Concerning partial intrusion, 44 teeth (47.8%) showed sequelae. The most frequent were pulp necrosis/premature loss (23.6%; $n = 24$), enamel discoloration (17.2%; $n = 16$) and root resorption (4.3%; $n = 4$) (Table 1).

Of all successor teeth, 122 were followed until complete eruption Sixty-six of those were successors of totally intruded teeth, and 56 of partially intruded teeth. Seventy-five permanent successors (29.4%) had no follow up as they had not yet erupted, and the 34 (15.4%), because of patients' absence.

Among the 66 successors of totally intruded deciduous teeth, 39 (35.2%) presented sequelae. The most

Table 1. Frequency of sequelae on anterior deciduous teeth caused by trauma

Sequelae on deciduous teeth	Number of teeth		%	
	Total intrusion	Partial intrusion	Total intrusion	Partial intrusion
None	11	23	8.6	24.7
Enamel discoloration	4	16	3.1	17.4
Pulp obliteration	1	0	0.8	0
Inflammatory root resorption	3	4	2.3	4.3
Alveolitis	0	2	0	2.2
Pulp necrosis/premature loss	101	24	78.9	23.6
Missing data	8	26	6.3	28

Table 2. Frequency of sequelae on permanent teeth caused by trauma in their predecessors

Sequelae on permanent teeth	Number of teeth		%	
	Total intrusion	Partial intrusion	Total intrusion	Partial intrusion
None	27	11	21.1	11.8
White or brown enamel discoloration	15	12	11.7	12.9
Enamel hypoplasia	10	14	7.8	15.1
Crown dilaceration	3	3	2.3	3.2
Root dilaceration	2	3	1.6	3.2
Sequestration of the permanent tooth germ	1	0	0.8	0
Eruption disturbances	8	12	6.3	12.9
Non-erupted teeth	54	11	39.6	11.8
Missing data	8	27	8.8	29.1

frequent were: discoloration of enamel/enamel dysplasia (19.5%; $n = 25$), eruption disturbances (6.3%; $n = 8$) and crown dilacerations (2.3%; $n = 3$).

The 56 partially intruded deciduous teeth caused sequelae on the 45 successors (53.0%). Discoloration of enamel, enamel dysplasia (28.0%; $n = 11$) followed by eruption disturbances (12.9%; $n = 12$) and crown and root dilaceration (both with 3.2% and $n = 3$) were the most frequent sequelae (Table 2).

There was no significant correlation between the age of intrusion and the frequency of subsequent sequelae on primary injured teeth ($P = 0.035$) and between the age at the time of injury and the developmental disturbances on permanent teeth ($P = 0.140$).

Discussion

The literature reports luxations and avulsions as the most frequent types of trauma on the deciduous dentition (3, 6, 8, 9, 11, 13, 14). In this study, luxation and avulsion were also found to be the most frequent types of trauma.

Children who presented intruded deciduous teeth were between the ages of one and four at the time of injury (2, 8, 12, 14, 17). There was no correlation between the patient's age at the time of intrusion and sequelae on primary teeth, and developmental disturbances on permanent teeth. These findings are in accordance with the study of Altun et al. (5), who found no significant correlation between age of intrusion and frequency of subsequent developmental disturbances ($P > 0.05$). The teeth that were the most affected by intrusive luxation were the upper central incisives. The results agree with data reported in the literature (1, 3, 4, 7, 11, 13, 15–17, 19, 20).

As far as etiology is concerned, a review of the literature showed that 'falls at home' were the most frequent cause of intrusions, ranging from 17.1% to 82.7% (2, 3, 6, 8, 11, 17, 24). In this study, intrusions were caused mainly by falls, and those accidents happened mostly at home. That can be explained by the fact that children around that age of one to four spend most of their time at home. They are also learning how to walk and trying to explore their environment. Their developing motor skills frequently lead to accidents (9, 10).

In the present study, intrusion was classified as either total or partial in order to allow for separate analyses of their respective frequency and sequelae. It was observed that total intrusion was more frequent than the partial kind.

Pulp necrosis/premature loss of the deciduous teeth was the most frequent sequela in both partial and total intrusions, and it might happen either at the time of injury or during the subsequent period because of complications common to trauma (5, 6, 10, 12, 18, 21, 22, 24).

According to Holan (12), 97 of the traumatized primary incisors that initially presented a dark color may: remain dark, fade into a yellowish hue or disappear completely. Among the teeth that retained their dark shades, 43% presented signs of a necrotic and infected pulp. Of the remaining teeth, only 8% had developed swelling or a sinus tract that would indicate necrotic and infected teeth. His findings justify the follow up with the risk of development of infection and root resorption that may require extraction instead of early endodontic treatment.

Treatment of intrusions on deciduous teeth is usually limited to extraction, because of either the danger presented to the permanent bud or to young age. Around 25% of injured teeth are extracted on the follow up (6, 10–12). The patient's failure to be in follow-up appointments and the consequent interruption of treatment usually leads to a bad prognosis whenever the patient does return.

Deciduous and developing permanent dentition are in very close proximity, which represents great danger in case of an injury, as the impact strength can easily be transmitted to the developing tooth bud (22, 23). Intrusive luxation, total or partial, is the kind of trauma that causes the most sequelae on the permanent dentition (7, 26). Pulp necrosis and premature loss was the most frequent sequelae on primary dentition in both kinds of intrusion, and enamel discoloration/enamel hypoplasia were the most frequent sequelae on permanent dentition and in both types of intrusion. This is in line with Altun et al. (5). They performed a study with 138 intruded primary incisors and found pulp necrosis (78%) as the most frequent post-traumatic consequence on deciduous

teeth and enamel hypoplasia (28.3%) as the most frequent one amongst permanent teeth.

The follow-up appointments with clinical and radiographic exams are extremely important to allow an early diagnosis of the disturbances because of trauma on deciduous and permanent teeth. The early treatment of traumatic injuries endeavors, primarily, to avoid major consequences to the involved tooth and its successor. It also aims to minimize treatment costs.

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