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Developmental dental alterations in permanent teeth after intrusion of the predecessors: clinical and microscopic evaluation

CASE REPORT

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Abstract – This case report describes the management of developmental dental alterations in permanent dentition as a consequence of severe intrusive luxation in its predecessors in a child of 2 years. At 10 years of age, this patient was referred for consultation due to lack of permanent maxillary right central and lateral incisors. Radiographic examination revealed impaction of hypoplasic permanent maxillary central incisor, absence of the lateral incisor and compound odontoma in region of the permanent maxillary lateral incisor. The odontoma was surgically removed and unerupted central incisor was placed in orthodontic traction over a period of 8 months. The central incisor presented with abnormal shape and was restored with composite resin. Odontoma histologic analysis was carried out through Hematoxylin and Eosin coloration and Scanning Electron Microscopy. Cement and osteocement formations were found in soft tissue, as well as some irregularly distributed dentine islands of tooth-like structures, indicative of compound odontoma. We followed up this patient for 5 years and orthodontic management was successfully performed for correct alignment of the maxillary right central incisor impacted by compound odontoma.

Traumatic injuries in the primary incisor during the early developmental stages of permanent dentition could result in alterations in the permanent tooth (1). Avulsion and intrusive luxation are the most frequent types of trauma that affect the development of permanent successors (2, 3). Alterations such as growth, shape, calcification or maturation are sequelae of the close relationship of the apices of primary teeth and their developing permanent successor buds. The extent of the disturbances increases when the corresponding permanent tooth bud is affected in its early developmental stages (4, 5). The prevalence of these alterations varies from 12 to 69% (5).

The most common sequela of developmental alteration is enamel hypoplasia, in which disturbances in the secretory phase of ameloblasts result in a defect in enamel (6). The most severe disturbance is destruction of ameloblasts in the active enamel epithelium. Clinically, hypoplasias with present enamel discoloration and/or enamel defects (3).

Another important developmental disturbance is the odontoma that consists of amorphous masses of calcified tissues (7, 8). According to Pindborg et al. (9), the term odontoma is employed to odontogenic malformations containing epithelial and mesenchymal components with complete differentiation. Factors such as interference with genetic control of tooth development, infection, and growth pressure, in addition to traumatic injuries, may also disturb the biologic mechanism controlling tooth development (10).

Treatment modalities for developmental dental alteration as a consequence of trauma range from surgery to use of orthodontia for esthetic restoration. This article describes the management of hypoplasia in a central incisor and a compound odontoma in a permanent maxillary lateral incisor as a sequela to traumatic intrusion of the primary incisor predecessor that was evaluated clinically and microscopically.

Case report

A 10-year-old boy was referred to the Pediatric Dentistry Clinic of the Federal University of Rio de Janeiro, Brazil with a chief complaint of lack of permanent maxillary right central and lateral incisors. His mother related that at 2 years of age, the patient suffered complete intrusion of his primary maxillary right central and lateral incisors. As the tooth re-erupted after 3 weeks, treatment was not sought. Her general medical history was non-contributory.

Intraoral examination revealed a mixed dentition period, some routine restorative treatment, and absence of permanent maxillary right central and lateral incisors (Fig. 1). Panoramic (Fig. 2a) and periapical (Fig. 2b,c) radiographs revealed absence of permanent maxillary right lateral incisor and a small single radio-opaque mass was present in this region, as well as severe hypoplasia in the central incisor. Therefore, on the basis of the radiographic evaluations, odontoma was diagnosed in the region of the lateral incisor and absence of the lateral incisor.

After 7 days, the odontoma was removed and sent for histologic analysis. In the same surgery session, ulotomy was performed on the maxillary right central incisor region. After 1 month, permanent maxillary right incisor did not erupt, and was therefore exposed surgically and bonded with orthodontic brackets with light-cure orthodontic composite (Transbond^{TM} XT; 3M Unitek/ESPE, Monrovia, CA, USA) for traction. Modified Hawley orthodontic removal appliance was used for anchorage (Fig 3a). Orthodontic traction was performed over a period of 8 months until correct alignment was achieved (Fig 3b). Permanent maxillary right central incisor was restored, due to severe hypoplasia, with composite resin under local anesthesia and rubber-dam isolation, recovering esthetics and functionality (Fig 4).

The child returned for follow-up visits every 3 months, in which cold thermal pulp viability tests were carried out (Endo-Ice; Hygenic Corp., Akron, OH, USA). Four years after restorative treatment, permanent maxillary right central incisor presented signals of pulp vitality. The patient's mother decided to wait until the child turned 18 years old to consider dental implant surgery in region of permanent maxillary right lateral incisor.

Fig 1. Clinical image of absence of permanent maxillary right central and lateral incisors.

Histologic analysis

A small tooth-like structure (sizes: 0.8 mm and 1.5 mm) was revealed to be a compound odontoma when it was surgically removed (Fig 5a).

One part of the odontoma was examined under a scanning electron microscope (SEM) (Original magnification ×100). The remaining part was decalcified in 10% formic acid, sectioned labiolingually, and examined in hematoxylin and eosin (H&E) staining sections (Fig. 5).

Histologically, the H&E staining (Original magnification ×100) revealed well-defined structure, exhibiting an irregular arrangement of enamel matrix, dentin, cementum, and pulp tissue. Peripheral view of disturbed tooth: Presence of cement formation in soft tissue (Fig 5b,c). The histologic diagnosis was a compound odontoma.

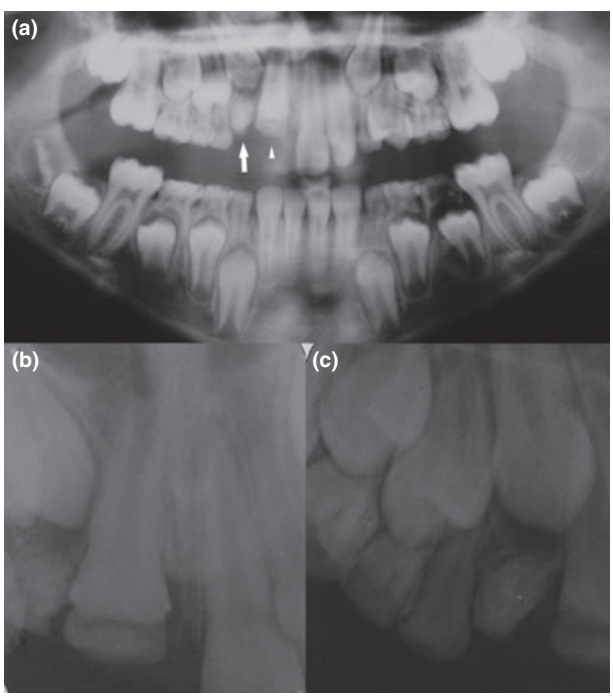

Fig 3. (a) Beginning of orthodontic traction of permanent maxillary central incisor with removal appliance; (b) After 8 months, the end of traction and teeth alignment.

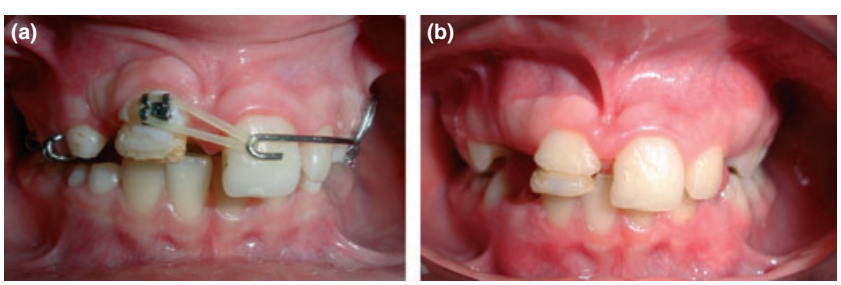

Fig 2. (a) Panoramic radiograph of the odontoma in region of lateral incisor (arrow) and crown dilacerations of impacted central incisor (head of arrow); (b) Crown dilacerations of lateral incisor.

Fig 4. Clinical image after restorative treatment of permanent maxillary central incisor.

In addition, SEM analysis was performed to complement our histologic analysis. This method allows for the assessment of the mineral matrix in enamel and dentin, complementing the H&E staining analysis of the organic matrix. The external surfaces of the coronal tooth-like structures were composed of an atubular hard tissue of regular morphology, showing some irregularly distributed osteoid masses (Fig. 5d,e).

Discussion

Intrusion is a traumatic injury frequently associated with alterations in development of permanent successors (7, 11). According to a clinical observational study (4) that analyzed intrusive injuries of primary incisors in children under 4 years of age, 78% fully re-erupted. However, over half of the permanent successors were found to have one or more developmental disturbances, and 28.3% presented enamel hypoplasia, 16.7% presented ectopic eruption, and 16.7% presented dilacerations.

Here, we reported an uncommon case of two different, concomitant malformations as a consequence of severe dental trauma in primary predecessors. This difference in sequelae could reflect the possibility that the permanent maxillary lateral incisor bud presented with more severe consequences due to the earlier development stage in comparison with the permanent maxillary central incisor. For this reason, it may be hypothesized that the lateral incisor developed as an odontoma and the central incisor presented with only the crown affected.

The majority of traumatic injuries occur at age 2 years, during the developmental stage of the permanent crown (12, 13). Depending on the severity of the trauma and on the stage of tooth morphogenesis, the alteration could result in specific malformations, such as enamel hypoplasia, root and crown dilacerations, and less frequently, odontoma (1, 14). Odontogenic tumors, as odontoma, are rare with an absolute incidence from 0.002% to 0.1% (15, 16).

Odontomas are considered developmental anomalies resulting from the growth of differentiated epithelial and mesenchymal cells (8). Histologically, they are formed of enamel and dentin, and can also have variable amounts of cement and infrequently, pulp tissue (17). In this case, histologic analysis showed pulp tissue areas within hard tissue, presenting a complex structure of tissue formation, hereby confirming the previous radiographic diagnostic of compound odontoma. Usually, in histologic analysis, only H&E staining is performed. This staining test is able to identify organic matrix and the irregular distribution of pulp tissue, whereas SEM-scanning is able to identify mineral matrix (18). For this reason, in this study, calcified mineral matrix was analyzed through SEM-scanning. Thus, it was possible to see the presence of dentine areas in enamel.

As intrusive luxation represents an injury that results in a large proportion of sequelae, it is important to

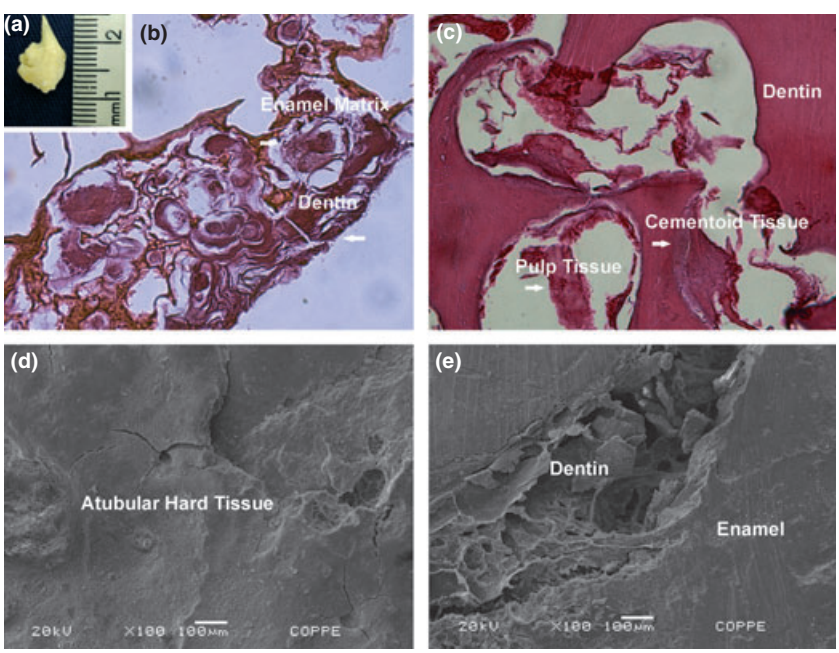

Fig 5. (a) Clinical image of compound odontoma with sizes of 0.8 mm and 1.5 mm. (b,c) Histologic evaluation with H&E (Original magnification ×100) coration revealed irregular arrangement of enamel matrix, dentin cementum, and pulp tissue; (d) Scanning electron micrograph (Original magnification ×100) of the external surface of a tooth-like structure presenting atubular hard tissue; (e) Internal surface presenting dentine areas in enamel.

establish early follow up and, if necessary, choose the appropriate treatment for each specific case. In this case, dental alterations did not allow spontaneous eruption of the incisor. Thus, the odontoma was removed and orthodontic traction was performed on the central incisor, followed by dental restoration.

Conclusion

This article describes unusual concomitant sequelae in permanent dentition as a consequence of severe intrusion in primary dentition. The treatment performed consisted of removal of compound odontoma and conservative management of hypoplasia, reestablishing the esthetics and functionality of the retained tooth.

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