CASE REPORT

Using Cone-beam CT in Diagnosis and Management of Severe Dilaceration Following Trauma in Primary Teeth: A Case Report

Athanasia Bletsa[1], Maria V Bessonova[2], Ole Iden[3]

Abstract

Aim: This case report illustrates the multidisciplinary treatment of a 12-year-old boy with esthetic challenges and endodontic problems in his maxillary incisors after severe dental injury at the age of 2½ years.

Background: The close anatomic relationship of the primary tooth to the permanent tooth germ explains why traumatic dental injuries in primary dentition may affect the development of permanent teeth especially in the maxillary anterior region. Developmental defects of enamel (DDE) as well as crown/root dilacerations are often seen after displacement injuries such as intrusion or avulsion occurring at lower age.

Case description: A 12-year-old boy with severe discoloration and enamel hypoplasia of his maxillary incisors was treated with composite restorations. History of avulsion injury of teeth 51 and 61 at the age of 2½ years explained the DDE, the severe dilaceration, and delayed tooth eruption of tooth 21. Use of cone-beam computed tomography (CBCT) was decisive in diagnosis and treatment planning of esthetic concerns and endodontic complications.

Conclusion: Trauma to primary teeth taking place at early childhood may have severe consequences on permanent successors.

Clinical significance: Severe morphological variations in permanent incisors caused by dental injuries in the predecessor teeth require monitoring and multidisciplinary approach. Advanced three-dimensional radiographic imaging is useful in identification and treatment planning of such cases.

Keywords: CT scan, Radiographic, Trauma dilaceration.

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Background

Traumatic dental injuries to primary maxillary incisors are common and there is a well-documented risk of complications in the permanent dentition.[1–4] This is due to the close anatomical relationship between the apex of primary teeth and the germ of the permanent successors. The frequency and severity of developmental disturbances are related to the stage of development of the permanent tooth when trauma occurs and the severity of the injury. Enamel discoloration, enamel hypoplasia, crown and root dilacerations are common sequelae observed in the successor teeth. In general, more severe defects are seen after displacement injuries such as intrusive luxation or avulsion at a lower age.[5–7]

Dilaceration is an abrupt deviation of the long axis of the crown or the root of the tooth. The mechanism behind is nonaxial displacement of the already calcified portion of the permanent germ while the rest noncalcified part of the permanent tooth germ continues its formation with an abnormal angle. The most common etiological factor is acute mechanical injury to the primary teeth such as intrusion and avulsion. However, ectopic development of permanent tooth germ as well as syndromes have been related to this developmental anomaly.[8] Maxillary and mandibular incisors are the most affected teeth.[5,8] At the age of 2–3 years, the tooth germ of the permanent maxillary incisor lies in a palatal position, above the apex of the primary incisor. If injury occurs up to this age, the potential consequence on the successor tooth would affect the buccal surface of its crown and crown dilaceration is more likely to occur.[8,9] If the trauma occurs at the age of 4–5, when the crown of the permanent tooth is in direct relationship with the resorbed root of the primary predecessor, the impact force will be transferred to the cells of Hertwig's epithelial root sheath on the labial aspect of the newly formed root. This part of the root will rotate along with the crown while further root development usually continues in the same direction it was following before the injury resulting in root dilaceration.[8,10]

Complications in eruption and esthetic problems are often related to dilacerated teeth. Early and appropriate diagnosis of dilacerations together with follow-up visits are essential for offering the best treatment option for each case. Treatment depends on the position and direction of dilaceration. Therefore, it is essential with detailed radiographic information on the dilacerated teeth. It is apparent that those cases need a multidisciplinary approach.

[1,3]Oral Health Centre of Expertise in Western Norway, Vestland, Bergen, Norway

[2]Department of Clinical Dentistry, Faculty of Medicine, University of Bergen, Bergen, Norway

Corresponding Author: Athanasia Bletsa, Oral Health Centre of Expertise in Western Norway, Vestland, Bergen, Norway, Phone: +47 98907231, e-mail: Bletsa@vlfk.no

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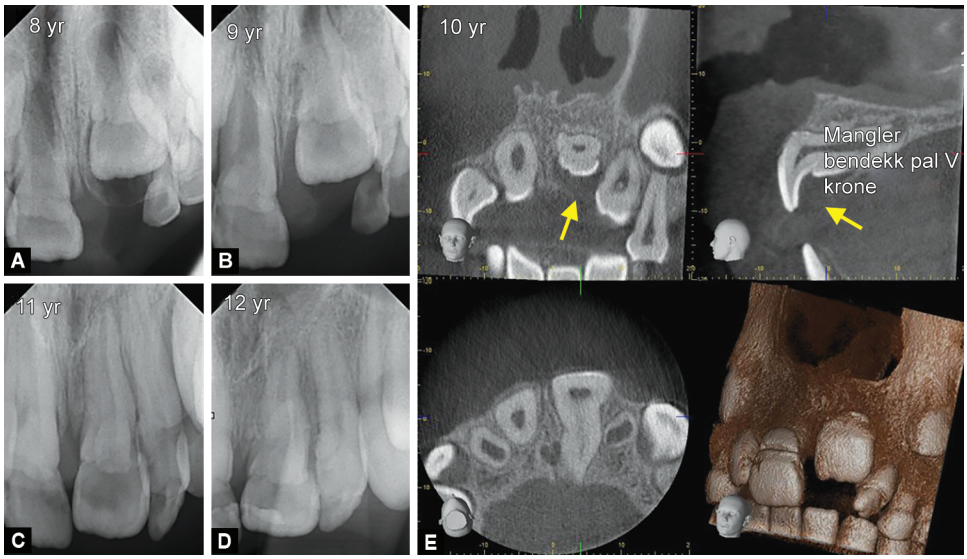
Case Description

A 12-year-old healthy boy was referred from the Public Dental Health Services (PDHS) to a prosthodontist at the Oral Health Centre of Expertise (specialist dental care) for treatment of the maxillary incisors. The boy's chief complain was the appearance of his upper front teeth. A history of multiple traumas at the primary teeth was revealed. The first at the age of 1½ years was perceived by the parents as not significant, whereas the second at the age of 2½ years was severe. The boy had fallen off his bicycle against a fence outside the family's house. Trauma was recorded in PDHS with the diagnoses of avulsed teeth #51 and 61 and uncomplicated crown fracture tooth #52. Three weeks after trauma, delayed intraoral wound healing was recorded with gingival retraction buccal for tooth #62 and alveolar fracture at the area was suspected. At the age of 7, teeth #11 and 21 had not erupted. One year later, it was noted that the erupted tooth #11 had atypical crown shape and enamel hypoplasia whereas tooth #21 had not erupted yet. Periapical radiograph showed that tooth #21 had aberrant crown anatomy similar to the erupted tooth #11 (Fig. 1). At the age of 9, the boy was referred to a private orthodontist due to delayed eruption of tooth #21 (Fig. 1). The orthodontist perceived the delayed eruption as a result of a supernumerary tooth and referred the patient to an oral surgeon at the university dental clinic for examination and surgical removal of the supernumerary tooth. Small-volume cone-beam computed tomography (CBCT) revealed atypical morphology of tooth #21 with the root forming a 90° angle to the longitudinal axis of the crown. The root was located parallel to the nasal floor in anterior dorsal direction. It was further described that the crown had an irregular and atypical shape. In addition, CBCT showed that teeth #12, 11, and 22 had varying degrees of enamel hypoplasia, with teeth #11 and 22 being described with significant enamel defects but normal root anatomy (Fig. 1). Tooth #21 was surgically exposed by removal of the soft tissue and erupted shortly after. The developmental defects followed by sensitivity to cold made oral hygiene challenging. There were several attempts with composite fillings on teeth #11 and 21 to improve the appearance, facilitate cleaning, and reduce sensitivity problems before the boy was referred to specialist care (Fig. 1).

Upon examination, all the maxillary incisors had atypical crown morphology, yellow-brown enamel discoloration and enamel hypoplasia, and plaque and gingivitis were evident. Tooth #21 was most affected, and the cervical filling edge had surplus with a rough and jagged surface toward the gingiva (Fig. 2). All incisors responded normally to Endolce and there were no signs of apical pathology at the periapical radiographs. The teeth were restored with composite resin with a step-by-step technique (Fig. 2). Both patient and father were informed of the importance of good dental hygiene with emphasis on the proper brushing technique. The patient was satisfied with the esthetic result and seemed motivated to maintain good oral hygiene. He was further referred to a pedodontist for follow-up. The pedodontist instructed and motivated the boy on the proper tooth brushing technique and suggested use of an interdental toothbrush for accessing the palatinal surfaces.

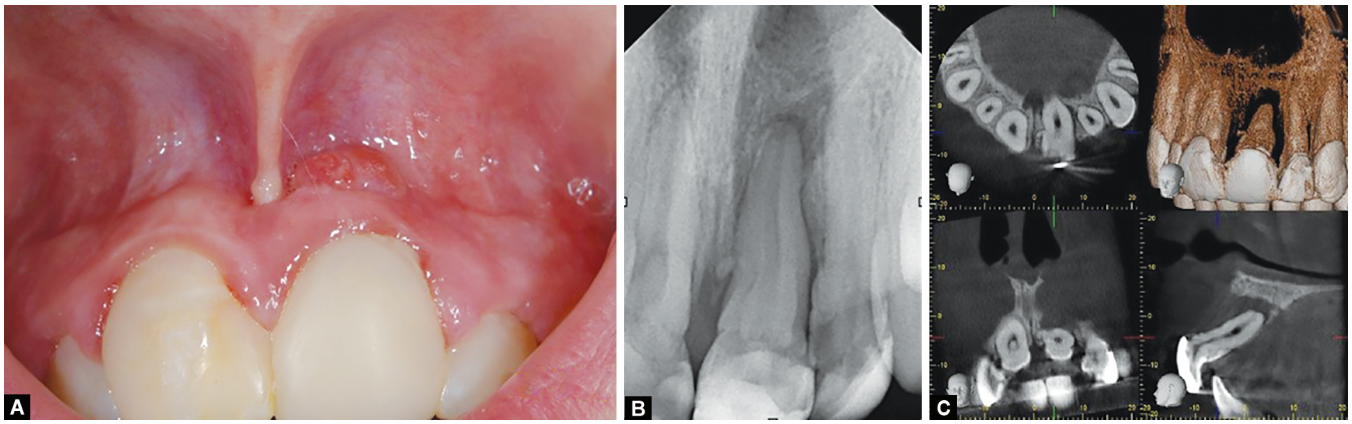
Eight months later, the patient was diagnosed with pulp necrosis and periapical abscess tooth #21 and referred to the endodontist for root canal treatment (Fig. 3). Plaque, bleeding on probing, and swollen palatal gingiva at the central maxillary incisors were seen. A new CBCT was requested prior to treatment. A large bone defect along the buccal root surface as well as apical to tooth #21 was seen (Fig. 3). Due to the concave palatinal surface of tooth #21 and the severe dilaceration, access to the root canal was achieved by buccal preparation (Fig. 4). Endodontic treatment was performed in two appointments with calcium hydroxide intracanal medication and composite filling in the access cavity between the sessions (Fig. 4). At the second appointment, the patient was asymptomatic, and the canal was filled with gutta-percha and TotalFill sealer using the lateral condensation technique. The patient returned to the prosthodontist for adjusting the composite restorations in all four maxillary incisors. Palatinal gingivectomy by electrosurgery on teeth #11 and #21 was done prior to composite resin buildups using an incremental restorative technique with nanohybrid composite resin. The patient and the parents were encouraged to maintain adequate oral hygiene and attend follow-up visits.

One and 2 years after endodontic treatment, the patient was asymptomatic. Healing of apical periodontitis at tooth #21 was evident in the periapical radiographs. The adjacent incisors



Figs 1A to E: Intraoral periapical radiographs and CBCT of the maxillary anterior region taken at different ages. Aberrant crown anatomy in both central incisors was evident in the periapical radiographs. However, severe dilaceration was revealed with CBCT

Figs 2A to E: Clinical appearance of maxillary incisors before (A to D) and after (D and E) composite restorations



Figs 3A to C: Clinical and radiographic images of tooth 21 8 months after initial treatment. Intraoral swelling (A) and apical radiolucency (B) were observed. CBCT revealed extensive bone destruction related to tooth 21 (C)

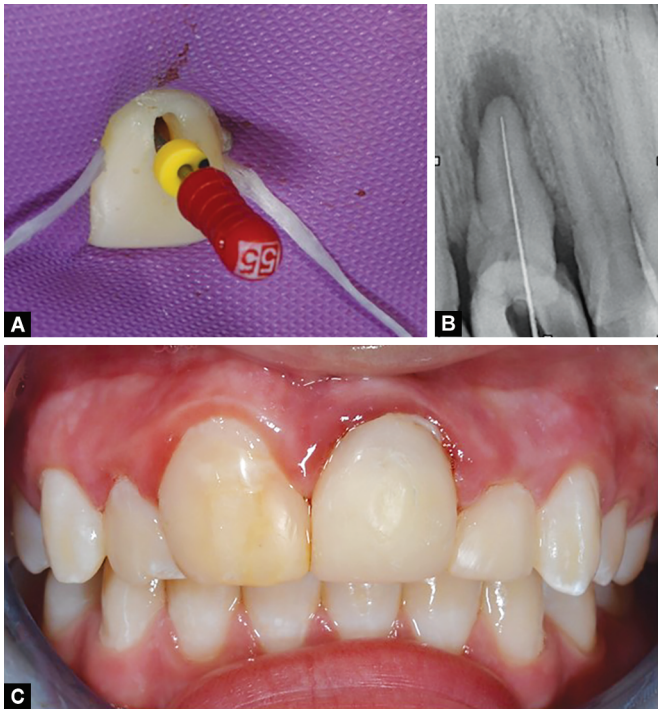
were vital. However, the patient expressed difficulties with dental hygiene. The restorations were polished, and the patient was advised to use interdental brushes more often (Fig. 5).

Discussion

This case report illustrates the consequences that severe trauma in primary teeth may have in the permanent successors. It is important that trauma in primary teeth is well-documented in the patient's journal as the consequences may be severe and cause substantial need of dental treatment many years later. However, documentation of dental trauma in primary teeth depends on parent's/caregiver's compliance and seek of dental personnel. History of trauma is not always reported because dental injuries of early childhood may go undetected or merely forgotten by parents. In Norway, the first visit in dental clinic is offered by the PDHS the year the child turns 3 years old. Nevertheless, in case of severe injuries it is likely that the child is seen and followed up by the dental personnel.

Intrusion and avulsion of primary teeth are considered severe dental injuries connected to most of the developmental defects seen in permanent teeth as a trauma sequela.[3,4] The boy in this case had sustained serious trauma in early age that had caused enamel hypoplasia and severe dilaceration followed by delayed tooth eruption. It is known that dentoalveolar trauma may cause tooth eruption disturbances and clinicians should always consider a thorough examination when there are significant differences in eruption of contralateral teeth. In this case, the boy was referred to an orthodontist. The delayed eruption of tooth #21 was initially thought to be caused by the supernumerary tooth. However, the radiographic appearance of tooth #21 together with the clinical signs as well as the dental history could have led to the diagnosis of dilaceration. Among the developmental disturbances, alteration in tooth morphology and impaction represent a clinical challenge with regards to diagnosis, treatment plan, and prognosis. These situations imply the need for advanced imaging techniques rather than the conventional radiographs, and CBCT can be useful. It depicts sections at various depths of the region of interest and allows clinicians to assess accurately the exact position of the crown, apex, and the degree of dilaceration.[11] The CBCT had provided important information affecting the treatment plan. The severe dilaceration in this case was not only a challenge regarding the esthetic restoration of tooth #21 but also opposed difficulty in accessing the canal for endodontic treatment. A second CBCT 3 years later was undertaken. Use of CBCT-ionizing radiation should be limited and the ALARA (As Low As Reasonable Achievable) principle should be followed as the radiographic examination must be justified and the benefits should be greater than the risks

especially in growing individuals.[12] The International Commission on Radiological Protection (ICRP) states that the use of dental CBCT for pediatric patients is a concern due to the patients' higher radiosensitivity and smaller body size.[13] However, CBCT can play an important role in optimizing pediatric patient outcomes.[14] The endodontist required the CBCT as it was important for the diagnosis and treatment planning. The axis of the root in relation to the crown was decisive for the endodontic access from the buccal aspect of the tooth. In endodontics, the main objective of access cavity preparation is to identify the root canal entrances and provide unimpeded (straight line) access to the apical one-third of the canal for both preparation and subsequent obturation.[15] The access cavity is usually created through the occlusal or lingual surface of the teeth. In this particular case, accessing the canal through the buccal surface of the crown was the only option as traditional approach would have caused significant bending of the endodontic instruments and thus cleaning and shaping of the canal would have been challenging and probably inadequate.

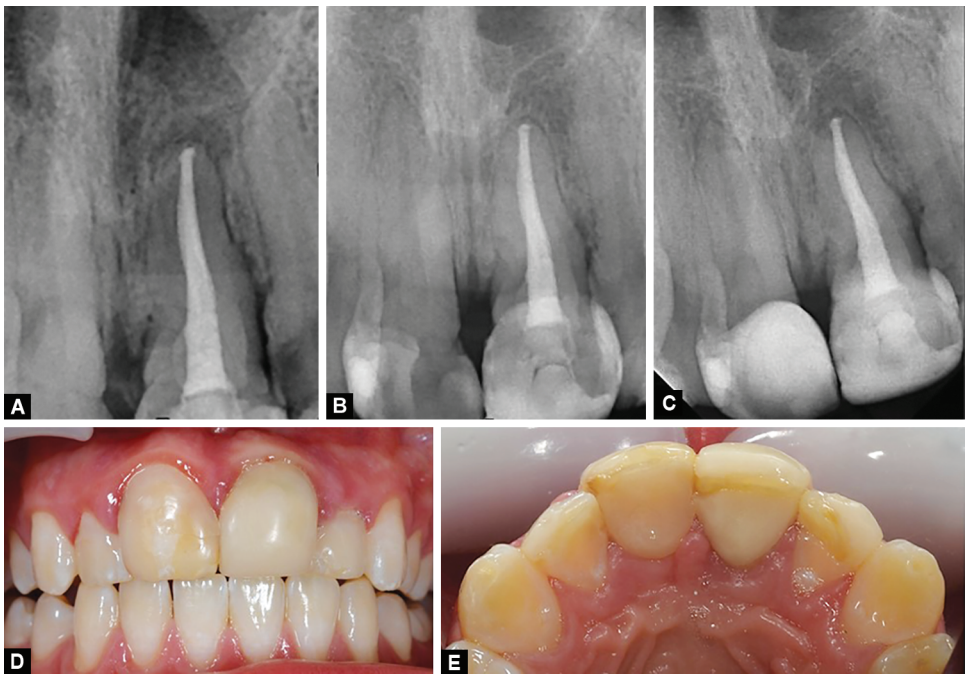


Figs 4A to C: Endodontic treatment of tooth 21 (A to C). Rubber dam was secured in place with dental floss and endodontic cavity preparation was done on the buccal aspect of the tooth allowing straight line access to the root canal (A and B). The access cavity was sealed with Cavit followed by composite resin between endodontic appointments (C)

Extensive bone destruction related to tooth 21 was also revealed upon endodontic treatment planning. One could question the need of a second CBCT. Argumentation in favor of the second CBCT was to clarify the apical status of the adjacent teeth as the large composite restorations made it difficult to rely on the vitality tests. Most important, representative images of the first CBCT were not available in the patient's public dental health radiographic journal and therefore not seen by the endodontist as it was taken at a university clinic. This illustrates the importance of good communication between primary dental caregivers and specialists as well as public and private dental services.

Nevertheless, alternative isolation of the tooth (rubber dam secured with dental floss instead of clamps) and buccal access made endodontic treatment uneventful. The procedure was well accepted by the patient and the parents as it was explained in advance. In addition, a buccal composite filling was used between appointments for esthetic reasons.

Enamel hypoplasia caused not only functional (hypersensitivity) but also esthetic problems affecting the patient's self-esteem. This was a serious problem for the boy and became even more important



Figs 5A to E: Follow-ups after endodontic treatment. Periapical radiographs of tooth 21 right after endodontic treatment (A), 1 (B) and 2 years (C) after treatment showing healing of apical periodontitis. The patient was happy with the esthetic result of the composite buildups but complained of gingivitis at the maxillary anterior region (D and E)

as he was becoming teenager. Children react in different ways. A study on the impact of developmental defects of enamel (DDE) showed that esthetic problems affected the children in varying degrees depending on the defining sense of self and not according to the severity of DDE.[16] The boy in this case was bothered by the look of his front teeth. This problem was taken seriously by the dentist in PDHS and attempts were made to restore the front teeth. In young patients, a conservative approach is often preferred as it saves the tooth substance. Nowadays, composite restorations offer a good esthetic and functional result. However, this depends on the presence of sound enamel and it may be challenging when enamel quantity and quality is disturbed as it is often the case in DDE. The patient was satisfied with the esthetic result and his quality of life had improved. However, the crown shapes and the extensive defects, especially at the central incisors, required extensive buildups. The varying degree of enamel hypoplasia resulting in discoloration was demanding to cover up evenly and keep a degree of normal translucency with a composite restoration. As seen at the follow-up visits, dental hygiene was challenging by regular means and required further effort from the patient. A full-coverage crown restoration could have helped in maintenance of adequate oral hygiene and further improved esthetics. However, this option was not considered as the severe dilaceration and the position of the long axis of the root could result in tooth fracture at the crown/root junction and potentially tooth loss. Avoiding tooth loss and preserving the alveolar process is important in growing individuals until other relevant treatment options are present.

Conclusion

Dentists must be aware of the consequences that dentoalveolar trauma in primary dentition may have on permanent teeth. Developmental defects of the enamel and dilacerations are often seen after avulsion of primary teeth and the dentists need to know how to correlate the child's age at the time of trauma with the possible type of dilaceration. Often these cases require multidisciplinary treatment.

Clinical Significance

Severe morphological variations in permanent incisors caused by dental injuries in the predecessor teeth require monitoring and multidisciplinary approach. Advanced three-dimensional radiographic imaging is useful in identification and treatment planning of such cases.

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