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### **CASE REPORT**

## Duplication of a permanent maxillary incisor root caused by trauma to the predecessor primary tooth: clinical case report

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#### Abstract

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**Aim** This report describes a permanent maxillary incisor tooth with two roots possibly caused by trauma to the predecessor primary tooth.

**Summary** Diagnosis, aetiology, clinical implications and endodontic and aesthetic treatment of an incisor tooth with two roots are presented. Diagnosis, early intervention by a multidisciplinary team and clinical and radiographic examination of patients who suffer trauma to primary teeth are of importance to minimize or avoid damage to successor teeth.

#### **Key learning points**

• A possible sequelae of trauma to a primary tooth is root duplication in the permanent tooth.

• Root duplication is a rare anomaly that has its diagnosis based on the radiographic examination.

• Careful diagnosis and follow-up are necessary to prevent future complications related to the successor tooth.

Keywords: dentition, endodontic, odontogenesis, primary, tooth injury.

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#### Introduction

Trauma to primary teeth is frequent varying from 4% to 30% of the population (Andreasen & Andreasen 1994). Careful diagnosis and follow-up are necessary to prevent future complications related to the successor tooth (Fried & Erickson 1995, Campos et al. 2004).

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The most common factors resulting in dental trauma in children are iatrogenesis in the newborn baby, learning to walk and run, falls, child abuse, accidents in sports and in automobiles, mental retardation, convulsive diseases and physical aggression (Andreasen & Andreasen 1994, Jacomo & Campos 2009).

The frequency of dental trauma varies according to the child's age, gender, environment, as well as the nature of the trauma and predispositional factors, such as protrusion of the maxillary incisors in both maxilla and mandible (Andreasen & Ravn 1971, Andreasen et al. 1971, Von Arx 1993, Andreasen & Andreasen 1994, Borum & Andreasen 1998). The most commonly involved teeth are the maxillary central incisors, both primary and permanent (Andreasen & Ravn 1971, Andreasen et al. 1971, Ravn 1975, Von Arx 1993, Fried & Erickson 1995). The most commonly affected age group is that between 1 and 4 years old, the age when psychomotor development enables children to learn how to walk and run, which makes them more independent and therefore more prone to falling (Von Arx 1993, Fried & Erickson 1995, Borum & Andreasen 1998, Jacomo & Campos 2009). After dental trauma, the signs and symptoms of the patient are important to determine whether there are sequelae and to estimate the ability of the pulp and affected support tissues to react to the effects of the trauma (McDonald & Avery 2001).

Alterations in the development of permanent teeth caused by trauma to the predecessors vary from 12 to 69% (Andreasen & Ravn 1971, Ben-Bassat et al. 1989, Andreasen & Andreasen 1994). A relevant factor is the anatomical proximity of the apices of primary teeth to the germs of their successors (Andreasen & Ravn 1971, Andreasen et al. 1971, Von Arx 1993, Andreasen & Andreasen 1994, Diab & Elbadrawy 2000). The distance from the root apex of the maxillary central primary incisor to the incisal edge of the crown of its successor varies from 2.97 mm in 3-year-olds to 1.97 mm in 6-year-olds (Smith & Rapp 1980).

The seriousness of sequelae depends on the age of the child at the time of the trauma, the degree of resorption of the root of the traumatized primary tooth, the nature and extension of the trauma and the stage of development of the successor at the time of the trauma (Andreasen & Andreasen 1994, Borum & Andreasen 1998, McDonald & Avery 2001). Trauma that can cause the most damage to permanent teeth is intrusive luxation and avulsion (Andreasen & Ravn 1971, Andreasen et al. 1971, Ben-Bassat et al. 1985, 1989, Kaufman et al. 1990, Von Arx 1993, Andreasen & Andreasen 1994).

Colour alteration and hypoplasia of the enamel are the most frequent sequelae in successors after trauma to the primary tooth. Other sequelae that may occur less often are dilaceration of the crown and root, sequestering of the germ of the permanent tooth and even root duplication (Andreasen & Ravn 1971, 1973, Ben-Bassat et al. 1985, 1989, Von Arx 1993, Andreasen & Andreasen 1994, Chagas et al. 2006).

Root duplication of a permanent tooth is a rare anomaly that may result from severe intrusive luxation of its predecessor, when the child is approximately 2 years old at the time of the trauma. At that point, less than half of the crown of the successor tooth has been formed. The duplication is seen radiographically as a division of the root into one mesial and one distal portion (Al-Nazhan 1991, Andreasen & Andreasen 1994, Diab & Elbadrawy 2000).

Histological findings reveal a calcium-traumatic line separating the hard tissue formed before from that which is formed after the injury (Andreasen & Andreasen 1994, Diab & Elbadrawy 2000). The pathogenesis of this type of development indicates that there is a traumatic division of the cervical loop at the moment of the trauma, resulting in the formation of two separate roots (Andreasen & Andreasen 1994).

The clinical approach may be either conservative or surgical, depending on the extension of the lesion. The diagnosis of teeth with root duplication is extremely important in the cases that require endodontic therapy or exodontia (Neville et al. 1998, Bnenati 2006, Sponchiado et al. 2006).

This report describes a patient with a permanent maxillary incisor with two roots, which was possibly caused by dental trauma to the predecessor. The means of diagnosis, the aetiology, clinical implications and the endodontic and aesthetic treatments are highlighted.

#### **Case report**

A female patient aged 11 years attended the dental trauma clinic. Her main complaint was malformation of tooth 11. During the course of the history, the mother reported that the patient had fallen off her tricycle when 2 years old, resulting in intrusion of teeth 51, 52 and 61.

The clinical examination revealed dark-brown circular enamel hypoplasia on the buccal surface of tooth 11 with an enamel tubercle in the cervical third with the appearance of a cingulum. Tooth 21 was altered in colour (Fig. 1).

The occlusal radiographic revealed tooth 11 had two roots and a radiolucent area around the apices (Fig. 2). The patient was referred for root canal treatment of tooth 11.

The periapical radiographic examination also confirmed the existence of two roots, one buccal and one palatal. An apical lesion, probably endodontic in origin, was found on the



Figure 1 Patient on presentation.



Figure 2 Intra-oral occlusal radiograph.

palatal root. On the buccal root, the image revealed no pathosis but the presence of the cervical tubercle on the buccal aspect.

The area selected for access cavity preparation was the buccal surface, as its aesthetics was already compromised and also because the presence of the tubercle could be connected to the entry of the buccal canal. At first, the palatal canal was located at the centre of the buccal face. Access through the tubercle revealed the buccal canal (Fig. 3). The palatal canal drained purulent exudate, which confirmed the initial diagnosis of the apical lesion being of endodontic origin; tissue in the buccal canal was bleeding (Fig. 4).

Root canal treatment was carried out using standard techniques, and the patient then referred to the trauma clinic for restoration of tooth 11 (Figs 5 and 6). Clinical and radiographic recall examinations were carried out every 3 months. Twenty-four months after the treatment, the patient returned to the endodontic clinic with no clinical symptoms and with radiographic sign of a healed periapical region (Fig. 7).



Figure 3 Access through the buccal surface of tooth 11.



Figure 4 Gutta-percha points on tooth 11.



Figure 5 Periapical view of root filling during lateral compaction of gutta-percha.



Figure 6 Patient following restoration of tooth 11.

#### Discussion

Dental trauma to primary teeth accounts for approximately 10% of all hypoplasia in successor teeth, which almost always take place on the buccal side of maxillary incisors. The aesthetic consequences are unfortunate (Andreasen & Ravn 1971, 1973, Andreasen et al. 1971, Ben-Bassat et al. 1989, Von Arx 1993, Chagas et al. 2006, Jacomo & Campos 2009).

According to Andreasen & Andreasen (1994) and Diab & Elbadrawy (2000), root duplication may result from severe intrusive luxation of a primary tooth in a child who suffered at the age of 2 years when half of the crown of the successor has formed. The



Figure 7 Two-year follow-up radiograph of tooth 11.

intensity of the trauma may cause a division of the cervical loop at the moment of the trauma, resulting in the formation of two separated roots (Andreasen & Andreasen 1994).

The principal means of diagnosis of root duplication is through radiographic examination. The history and the crown appearance play a supporting role. In these cases, the crown is almost always aesthetically compromised but not always is the pulp diseased (Bnenati 2006, Sponchiado et al. 2006).

In the reported case, the patient suffered an intrusion of the primary incisors when 2 years old, which probably caused circular hypoplasia in the enamel of tooth 11. However, by-products of blood degradation in the trauma area might have infiltrated the mineralization sites during the formation of the enamel, resulting in brownish-yellow areas (Andreasen & Ravn 1971, 1973, Ben-Bassat et al. 1985, Diab & Elbadrawy 2000). Ameloblastic activity interrupted by the trauma contributed to the forming of areas of irregular and imperfect enamel on the buccal side of tooth 11, which probably caused the formation of a tubercle after the injury (McDonald & Avery 2001). The severity of the trauma and the formation stage of the successor germ facilitated a division of the cervical loop, which caused the root to duplicate.

Pulp disease in tooth 11 occurred because of bacterial penetration through the permeable malformed enamel on the buccal surface. This accounts for the lesion in the palatal canal. The cervical tubercle on the buccal side indicated a connection to the buccal canal.

The suspicion that the buccal cervical tubercle was connected to the buccal canal indicated that access from the buccal approach was necessary, for it would have been impossible to reach the buccal canal from the palatal surface.

#### Conclusion

Root duplication is a rare anomaly whose diagnosis is based on radiographic examination. Despite the complexity of the case, both the root canal treatment and tooth restoration were completed successfully.

#### Disclaimer

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