



Arrest of Root Formation in Relation to Permanent Mandibular Incisors: A Rare Case Report

Priya Subramaniam, Megha Gupta, Harsha Gona

ABSTRACT

Aim: To report a rare case of arrested root formation of permanent incisors in a young boy with mixed dentition and its management.

Background: Traumatic injury to a primary tooth may damage the underlying permanent tooth germ and affect its development. The extent of the malformation depends upon the developmental stage of the permanent tooth and the intensity of trauma. Discoloration and hypoplasia of the crown, dilaceration, root angulation and disturbances in eruption are commonly seen developmental disturbances following trauma. However, partial or complete arrest of root formation is a rare developmental sequela of trauma to primary teeth. Attempt should be made to retain these natural teeth during the mixed dentition period.

Case description: A case is presented of a young boy with rare occurrence of arrested root formation of permanent mandibular incisors, following trauma to the primary predecessors. Clinically these teeth exhibited mobility and radiographic examination showed absence of root formation in relation to the incisors. The treatment plan was to retain the natural permanent teeth for a maximum period and to stabilize them until a more permanent replacement could be carried out. As the patient had mixed dentition, immediate stabilization was done using fiber reinforced splint until further definitive treatment is carried out.

Early diagnosis of developmental disturbances in permanent teeth resulting from trauma at a young age is necessary. Regular follow-up appointments, through clinical and radiographic examination and timely intervention may minimize or even avoid harm to the developing tooth.

Keywords: Dental anomalies, Dysplasia, Arrested root formation, Trauma, Developmental disturbance, Hertwig's epithelial root sheath, Permanent tooth bud.

How to cite this article: Subramaniam P, Gupta M, Gona H. Arrest of Root Formation in Relation to Permanent Mandibular Incisors: A Rare Case Report. *J Contemp Dent Pract* 2013; 14(3):552-555.

Source of support: Nil

Conflict of interest: None declared

BACKGROUND

Traumatic injuries to developing teeth can influence their further growth and maturation, usually leaving a child with

a permanent and often readily visible deformity, especially when the injury occurs during initial stages of development. The accidents that occur with children at home, such as falling from strollers and falling against hard surfaces are the causes most related in the dental trauma clinics.¹⁻³ The severity of trauma depends on the age of the child at the time of injury, the grade of root resorption of the traumatized primary tooth, the type and extension of the injury and the development stage of the successor at the time of injury.^{4,5}

As a result of trauma to the primary incisors, both developmental and/or formative disturbances can occur in the underlying permanent successors. The prevalence of disturbances, secondary to dental injuries in the primary dentition, ranges from 12 to 69%.^{1,4,5}

An intrusion of a primary incisor can cause injury to the bony crypt surrounding the tooth follicle, dilacerations of crown/root, odontoma-like malformation or rarely even sequestration of tooth germ. Any ensuing infection caused by invasion of bacteria into the injury site can result in enamel hypoplasia of the succedaneous tooth. The most commonly seen developmental disturbance due to injuries to the developing teeth are enamel hypoplasia, followed by crown and root dilacerations and disturbances in eruption.^{1,4} The lesser frequently seen are odontoma-like malformation, root duplication, partial or complete arrest of root formation and sequestration of the permanent tooth germ.^{1,6}

This is an unusual case of a young healthy child with normal dentition and periodontium, but presented with mobility of all four mandibular permanent incisors. These teeth exhibited normal crown morphology and appeared to be 'without roots'.

CASE DESCRIPTION

A 9-year-old normal and healthy boy reported to Department of Pedodontics and Preventive Dentistry, with a chief complaint of loose lower front teeth since 1 month. It was

the child's first dental visit. There was no associated pain and/or swelling. His medical history was uneventful. Family history was noncontributory. On repeated questioning, the parents could briefly recall the occurrence of an accidental fall, when the child was around 3.5 to 4 years old. The boy had fallen with his face hitting the hard surface of the floor, and the impact of the injury was transmitted to his chin. The vector of force was perpendicular to the chin and was transmitted along a plane that was parallel to floor of the mouth. He had complained of pain that lasted for about 15 to 20 minutes and there was an abrasion on the chin which healed uneventfully. Thereafter, the child was symptom-free and was hence not taken to a dentist. The exfoliation of primary teeth and eruption of the permanent teeth was age appropriate and uneventful.

Extraoral examination revealed a convex profile and facial symmetry. Intraoral examination showed permanent mandibular incisors exhibiting normal morphology, with well defined mamelons. Bluish discoloration of the permanent left mandibular central incisor was seen (Fig. 1). On palpation, grade II mobility was elicited in relation to all the four permanent mandibular incisors. The patient had a class 1 molar relation with normal overjet and overbite. Intraoral periapical radiograph of the mandibular anterior region showed minimal root formation in relation to the permanent incisors (Fig. 2). The pulp space of the left central incisor appeared to be very narrow or even obliterated. No periapical radiolucencies were observed in relation to these teeth. An orthopantomograph was also taken to identify any other associated condition. It revealed the presence of all permanent teeth without any associated pathology. There was near absence of roots in relation to only the permanent mandibular incisors (Fig. 3). These teeth appeared to be placed directly over the alveolar ridge. The enamel and dentin of the other teeth showed normal density and root development.



Fig. 1: Intraoral view of permanent mandibular incisors

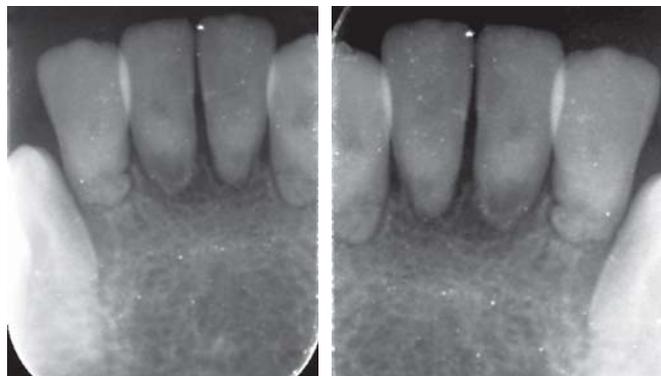


Fig. 2: Intraoral periapical radiographs showing permanent mandibular incisors

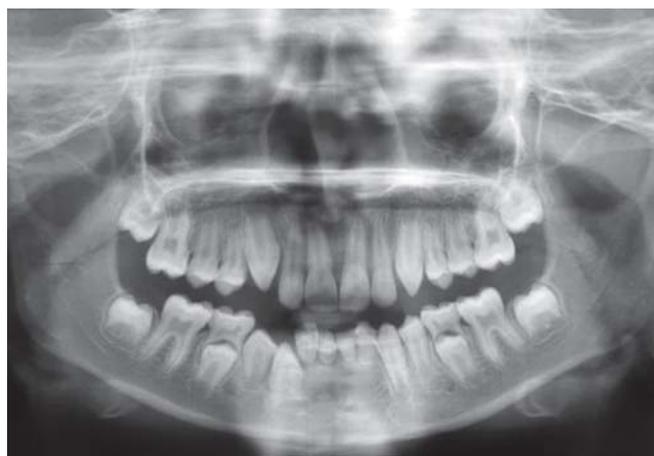


Fig. 3: Panoramic view showing arrested root formation in relation to teeth nos. 31, 32, 41, 42



Fig. 4: Interim stabilization of incisors with resin-reinforced fiber splint

Referral to a pediatrician did not report of any abnormality. As an interim measure, immediate stabilization of the mandibular anterior teeth was done using resin fiber reinforced splint (Ribbond®) (Fig. 4).

DISCUSSION

Trauma during the stage of odontogenesis can seriously affect the morphogenetic stages of dental development and

give rise to developmental alterations in permanent teeth. Partial or complete arrest of root formation are rare sequelae to injuries in the primary dentition, affecting 2% of involved permanent teeth.^{1,7} The extent of these malformations depends on the developmental stage of the permanent tooth and the severity of trauma.

During odontogenesis, crown formation is usually followed by initiation of root development.⁸ Therefore, malformations such as partial or complete arrest of root formation occur when the crown formation is complete and the root formation begins. The onset of root development occurs after enamel and dentine formation has reached the presumptive cemento-enamel junction. This development is guided by the enamel organ which forms Hertwig's epithelial root sheath (HERS), a developmental structure which molds the shape of the roots. An insult to HERS during development will cause disruption or cessation in its future morphology. Root formation is determined by the activity of HERS and root growth is dependent upon a continuous proliferation of the epithelium.⁸

The younger the child is at the age of trauma, the more severe is the developmental disturbance, and it involves the crown of the permanent successor. Disturbances in root formation occurs more commonly when trauma affects children more than 4 years old, at a time when the crown of the successor is in its final stage of formation and the root is in its initial development, i.e. corresponding to stage VI of Nolla's classification of tooth development.⁹⁻¹¹ Root formation of the mandibular incisors generally begins at age of 4 to 5 years (when enamel formation is complete).¹² In the present case, trauma occurred at age of 3.5 to 4 years, when the crown formation was complete and root formation would have just begun, leading to complete cessation of root formation.

An important factor to be considered is the close anatomical relationship between the apices of the primary teeth and their developing permanent successors.^{1,3,4} The distance between the apex of the primary central incisor and the incisal edge of the permanent central incisor ranges from 2.97 mm at the age of 3 years to 1.97 mm at the age of 6 years.¹¹

The other causes of rootless teeth or teeth with arrested root formation include dentin dysplasia type 1,¹³ irradiation after chemotherapy in the head and neck region,¹⁴ trauma sustained during pediatric fracture management (for example: during miniplate fixation),¹⁵ and during surgical procedures involving the maxillary sinus or nasal antrum.^{16,17} In the present case, both history and clinical-radiographic examination did not indicate these possible factors. There are very few reports on complete/partial root

agenesis following trauma sustained in early childhood.^{18,19} To the best of our knowledge, none of these reports pertain to root agenesis of the mandibular incisors as a consequence of trauma in the early years.

The jaws grow considerably in size from birth to around 6 months of age.²⁰ After this time, very little increase in the dimensions of the tooth-bearing regions takes place in the deciduous dentition.²¹ During eruption of the permanent dentition, some transverse changes do occur in intercanine width, but the dimensions are small. A maximum increase of no more than 2 mm can be expected in the mandible and 4 mm in the maxilla, occurring up to the age of 12 years, with some of this increase being lost by the end of the second decade. This increase in the intercanine width is achieved largely through alveolar rather than skeletal change, during eruption of the permanent incisors and canines. In contrast to maxilla, very little change occurs in the mandibular intercanine width once the incisor teeth have erupted, which is one of the reasons why mandibular incisor irregularity is so common. It should be remembered that wide individual variation is associated with all these dimensional changes, but generally there is more growth in boys than girls and the intermolar width will increase more than the intercanine width and over a longer period of time.²²

Treatment plan had to take into consideration the mixed dentition status of the patient, with lack of adequate abutment support from adjacent teeth. Therefore immediate stabilization of all four permanent incisors was carried out using a fiber-reinforced resin splint which is esthetic and biocompatible. The splint was placed passively along middle thirds of lingual and labial surfaces of only the teeth; without extending onto the dentoalveolar segment. This was more suitable than a removable partial denture because the retentive elements of the appliance could restrict transverse growth. Also, such appliances depend on patient compliance and need to be replaced more often. On complete eruption of permanent dentition, an anterior fixed prosthesis will be given for restoration of function, periodontal health and esthetics.

CONCLUSION

Permanent mandibular incisors exhibiting mobility due to arrested root development were successfully managed with immediate stabilization using resin-reinforced fiber splint. The natural teeth were retained in position until a permanent replacement could be done.

CLINICAL SIGNIFICANCE

Injuries affecting the primary dentition are often overlooked and at times neglected by parents and/or caregivers.

Traumatized teeth should be periodically monitored through clinical and radiographic examination in order to detect probable alterations in the dentition and supporting structures. There is a need for awareness among parents and for education of primary health givers with regard to trauma during childhood. Early diagnosis of developmental disturbances in permanent teeth resulting from trauma at a young age is necessary. Regular follow-up appointments, through clinical and radiographic examination and timely intervention may minimize or even avoid harm to the developing tooth.

REFERENCES

1. Andreasen JO, Ravn JJ. The effect of traumatic injuries to primary teeth on their permanent successors. Part II. A clinical and radiographic follow-up study of 213 teeth. *Scand J Dent Res* 1971; 79(4):284-294.
2. Diab M, elBadrawy HE. Intrusion injuries of primary incisors. Part III: Effects on the permanent successors. *Quintessence Int* 2000 Jun;31(6):377-384.
3. Smith RJ, Rapp R. A cephalometric study of the developmental relationship between primary and permanent maxillary central incisor teeth. *ASDC J Dent Child* 1980 Jan-Feb;47:36-41.
4. Andreasen, Jens O. Injuries to developing teeth. In: Andreasen, Jens O.; Andreasen, Frances M. editors. *Textbook and color atlas of traumatic injuries to the teeth*. 3rd ed. Copenhagen: Munksgaard; 1994. p. 457-494.
5. Ben-Bassat Y, Brin I, Zilberman Y. Effects of trauma to the primary incisors on their permanent successors: multidisciplinary treatment. *ASDC J Dent Child* 1989 Mar-Apr;56(2):112-116.
6. Shaked I, Peretz B, Ashkenazi M. Development of odontoma-like malformation in the permanent dentition caused by intrusion of primary incisor – a case report. *Dent Traumatol* 2008 Jun;24(3):395-397.
7. Zilberman Y, Ben Bassat Y, Brin I, Lustmann J, Fuks A. Effect of trauma to primary incisors on root development of their permanent successors. *Pediatr Dent* 1986 Dec;8(4):289-293.
8. Sicher, H; Bhasker, SN. *Orban's oral histology and embryology*. 7th ed. St Louis: CV Mosby Co; 1972. 17-37 p.
9. do Espirito Santo Jacomo DR, Campos V. Prevalence of sequelae in the permanent anterior teeth after trauma in their predecessors: a longitudinal study of 8 years. *Dent Traumatol* 2009 Jun;25(3):300-304.
10. Nelson-Filho P, Silva RAB, Faria G, Freitas AC. Odontoma-like malformation in a permanent maxillary central incisor subsequent to trauma to the incisor predecessor. *Dent Traumatol* 2005 Oct;21(5):309-312.
11. Nolla CM. The developmental of the permanent teeth. *J Dent Child* 1960;27:254-266.
12. Logan WHG, Kronfeld R. Development of the human jaws and the surrounding structures from birth to the age of 15 years. *J Am Dent Assoc* 1933;20(3):379-427.
13. Mc Donald, Ralph E.; Avery, David R.; Hartsfield, James K., Jr. Acquired and developmental disturbances of the teeth and associated oral structures. In: Mc Donald, Ralph E.; Avery, David R, et al., editors. *Dentistry for the child and adolescent*. 8th ed. Mosby: St. Louis; 2004. p. 103-147.
14. Dury DC, Roberts MW, Miser JS, Folio J. Dental root agenesis secondary to irradiation therapy in a case of rhabdomyosarcoma of the middle ear. *Oral Surg Oral Med Oral Pathol* 1984 Jun;57(6):595-599.
15. Güngörmüş M, Yolcu U, Aras MH, Halicioğlu K. Simultaneous occurrence of compound odontoma and arrested root formation as developmental disturbances after maxillofacial trauma: a case report. *Med Oral Pathol Oral Cir Bucal* 2010 Mar;15(2):e 398-400.
16. Seow WK. Root agenesis associated with chronic infection and traumatic curettage of the maxillary sinus. *Pediatr Dent* 1994 May-Jun;16(3):227-230.
17. Ball IA, Manton SL. Root agenesis in the developing canines as a complication of intranasal antrotomy. *Oral Surg Oral Med Oral Pathol* 1991 Nov;72(5):509-513.
18. Nelson-Filho P, Silva RA, Leonardo MR, de Freitas AC, Assed S. Arrest of root formation in a permanent maxillary central incisor subsequent to trauma and pulp necrosis to the primary predecessor. *Dent Traumatol* 2008 Oct;24(5):e53-e55.
19. Nagatani S, Mathieu GP. Partially arrested root formation in a permanent maxillary central incisor subsequent to trauma to the primary dentition. *Endod Dent Traumatol* 1994 Feb;10(1): 23-26.
20. Clinch LM. Variations in the mutual relationship of the maxillary and mandibular gum pads in the new born child. *Int J Orthod* 1934 Apr;20(4):359-372.
21. Foster TD, Grund MC, Lavelle CL. Changes in occlusion in the primary dentition between 2-and- one-half- and 5-and- one-half-years of age. *Trans Eur Orthod Soc* 1972:75-84.
22. Lee RT. Arch width and form: a review. *Am J Orthod Dentofacial Orthop* 1999 Mar;115(3):305-313.

ABOUT THE AUTHORS

Priya Subramaniam (Corresponding Author)

Professor and Head, Department of Pedodontics and Preventive Dentistry, The Oxford Dental College and Hospital, Bengaluru Karnataka, India, e-mail: drpriyapedo@yahoo.com

Megha Gupta

Senior Lecturer, Department of Pedodontics and Preventive Dentistry Rajasthan Dental College and Hospital, Jaipur, Rajasthan, India

Harsha Gona

Resident, Department of Pedodontics and Preventive Dentistry, The Oxford Dental College and Hospital, Bengaluru, Karnataka, India