Dental Traumatology

Dental Traumatology 2011; **27**: 408–412; doi: 10.1111/j.1600-9657.2011.00991.x

Management of a permanent tooth after trauma to deciduous predecessor: an evaluation by cone-beam computed tomography

CASE REPORT

Carla Vecchione Gurgel[1], Natalino Lourenço Neto[1], Tatiana Yuriko Kobayashi[1], Daniela Gamba Garib[2], Salete Moura Bonifácio da Silva[2], Maria Aparecida de Andrade Moreira Machado[2], Thais Marchini Oliveira[2]

[1]Department of Pediatric Dentistry, Orthodontics and Public Health, Bauru School of Dentistry, University of São Paulo, São Paulo; [2]Department of Pediatric Dentistry, Orthodontics and Public Health, Bauru School of Dentistry, University of São Paulo, São Paulo, Brazil

Correspondence to: Thais Marchini Oliveira, Department of Pediatric Dentistry, Orthodontics and Public Health, Bauru School of Dentistry, University of São Paulo, Al. Octávio Pinheiro Brisolla, 9-75 Bauru, 17012-901 São Paulo, Brazil
Tel.: +55 1432358224
Fax: +55 1432234679
e-mail: marchini@usp.br.

Accepted 29 January, 2011

Abstract – Impaction of permanent teeth represents a clinical challenge with regard to diagnosis, treatment plan, and prognosis. There is a close relationship between deciduous teeth and permanent teeth germ, and any injury in the deciduous dentition may influence the permanent teeth eruption. The extent of the damage caused to the permanent teeth germ depends on the patient age at the time of injury, type of trauma, severity, and direction of the impact. Conventional radiographic images are frequently used for diagnosis; however, recent developments in three-dimensional (3D) imaging systems have enabled dentistry to visualize structural changes effectively, with better contrast and more details, close to the reality. The cone-beam computed tomography (CBCT) has been used in the diagnosis and treatment plan of these impacted teeth. The purpose of the present case report is to describe a successful conservative management of a retained permanent maxillary lateral incisor with delayed root development after a trauma through the deciduous predecessor in a 9 year-old patient. After clinical and radiographic examination, a CBCT examination of the maxilla was requested to complement the diagnosis, providing an accurate 3D position of the retained tooth and its relationship to adjacent structures. The proposed treatment plan was the surgical exposure and orthodontic traction of the retained tooth. The lateral incisor spontaneously erupted after 6 months. Therefore, this case report suggests that permanent teeth with incomplete root formation have a great potential for spontaneous eruption because no tooth malposition or mechanical obstacles are observed.

Impacted incisor is usually diagnosed accurately when there is delay in the eruption of tooth during the mixed dentition. The problem of an impacted maxillary incisor resulting in space concerns in the dental arch during the early mixed dentition is usually a clinical challenge for clinicians (1, 2).

As there is a close relationship between deciduous teeth and permanent teeth germ, any injury during deciduous dentition can influence the eruption of permanent teeth (2, 3). Trauma may cause deflection or displacement of the permanent tooth bud; alter the eruption pathway, leading to ectopic, premature, delayed eruption, or impaction of the permanent tooth; cause root duplication or dilaceration; and/or hinder normal root development (4). The prevalence of developmental disturbances of permanent dentition following trauma to deciduous predecessor was reported to be 41% (5). The extent of the disturbance of the developing tooth germ is related to the stage of germ development (patient's age at the time of injury), the type of trauma, the severity, and the direction of impact (6).

High-resolution three-dimensional (3D) images have improved the diagnosis and treatment plan of patients with impacted teeth (7). Several studies have investigated the ability of cone-beam computed tomography (CBCT) to accurately diagnose traumatic injuries with the potential to overcome most of the technical limitations of the plain film projection and the capability of providing a 3D representation of the maxillofacial tissues in a cost- and dose-efficient manner (8).

The purpose of the present case report is to describe a successful conservative management of a permanent maxillary right lateral incisor traumatized through the deciduous predecessor, emphasizing the need for treatment planning based on a comprehensive evaluation using 3D digital imaging techniques.

Case report

A 9-year-old male patient was brought by his parents to the Pediatric Dentistry Clinic of our institution with the chief complaint of non-eruption of permanent maxillary

right incisors. The past medical history was reviewed, and the child was physically healthy with no remarkable medical and family histories.

During the clinical interview, the mother reported a history of trauma at approximately 6 years of age, when the child had sustained a severe traumatic injury at the region of the deciduous maxillary anterior teeth. The injury was caused by a collision with another boy while playing football.

The clinical examination revealed the absence of the permanent maxillary right central and lateral incisors and no apparent length discrepancy in both maxillary and mandibular arches (Fig. 1). Additionally, the patient showed normal soft tissues, good oral hygiene, without caries, lesions, and class I occlusal relationship.

Panoramic and periapical radiographs were performed (Figs 2 and 3). The radiographs revealed two non-erupted permanent maxillary right incisors without any supernumerary teeth or odontoma that could explain tooth retentions. The permanent maxillary right central incisor was near the gingival margin, and the root was still immature. The permanent maxillary right lateral incisor was in the initial stage of root formation. Further information was not obtained regarding morphology and position of the impacted permanent maxillary central and lateral incisors.

Then, the patient was submitted to CBCT examination of the maxilla. CBCT images were requested for diagnosing accurately the location of the retained teeth (Figs 4 and 5). The images were created and viewed interactively using a dental computed tomography software program. Axial section images showed horizontal impaction of the permanent maxillary right incisors (Fig. 4) and cross-section oblique images showed impacted permanent maxillary right lateral and central incisors, as well as the relationship with the adjacent teeth and structures (Fig. 5).

The aim of the treatment was to allow the root formation because the apex was still opened. After explaining the advantages and disadvantages of the therapeutic options for the patient and his family, the treatment choice was a surgical exposure and orthodontic traction of the retained tooth.

The surgical technique was performed under local anesthesia. An incision was performed along the gingival margin, from the deciduous maxillary canine to the permanent left central incisor. Releasing incisions were made in both the right canine and left incisor regions, and a mucoperiosteal flap was elevated to the minimum necessary extent. The mucoperiosteal soft tissue underlying the right central incisor was removed and the crown was exposed. The bone that covered the dental crown of the right lateral incisor was removed with surgical round burs to expose the labial surface (Fig. 6). After cleaning the area and getting hemostasis, an orthodontic bracket with ligature wire was directly bound onto the labial surface of the lateral incisor (Fig. 7). Then, the flap was repositioned and sutured (Fig. 8).

At the next appointment, the incisal of the right central incisor emerged in the oral cavity. The orthodontic appliance was fitted and extrusive orthodontic movement on the right lateral incisor was initiated (Fig. 9). Elastics were used for orthodontic traction initially. Five days later, the patient returned to our clinic without the orthodontic appliance. However, in only 5 days, the incisal edge of the right lateral incisor

Fig. 1. Initial intraoral view showing the absence of the permanent maxillary right central and lateral incisors.

Fig. 2. Periapical radiograph showing impacted permanent maxillary right lateral and central incisors.

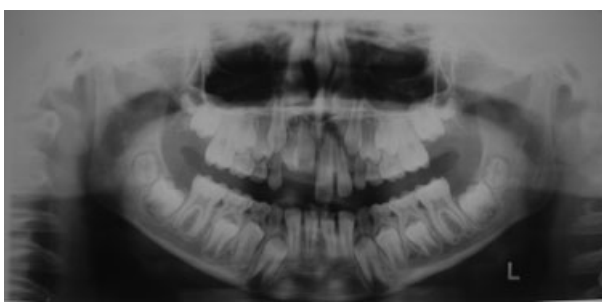

Fig. 3. Panoramic radiograph showing impacted permanent maxillary right lateral and central incisors.

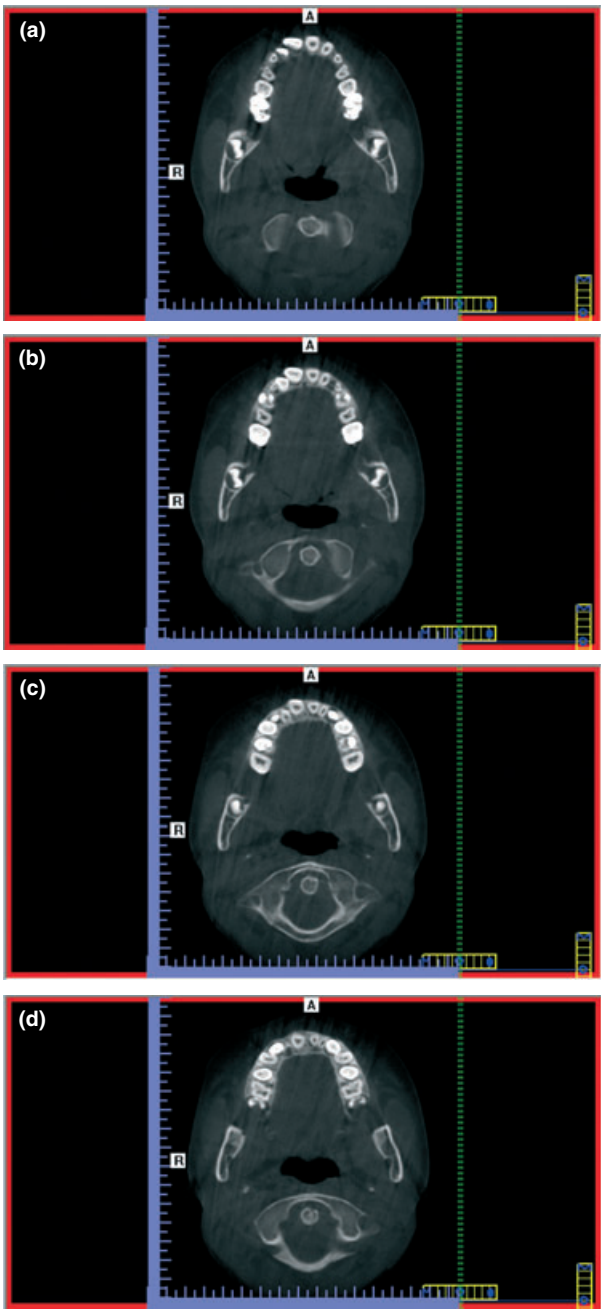

Fig. 4. (a–d) Axial section images showing horizontal impaction of the permanent maxillary right incisors.

emerged in the oral cavity. In the next appointment, the deciduous right canine was extracted to gain space for the permanent maxillary right lateral incisor eruption.

The permanent maxillary lateral incisor spontaneously erupted after 6 months of follow up post-traction. After eruption, the lateral incisor remained vital and responded normally to percussion, mobility, and sensitivity testing. The soft tissue, periodontal attachment, gingival contour, and probing depth were normal (Fig. 10). The periapical radiograph showed an advanced stage of root formation (Fig. 11). The patient has been followed for 12 months in our institution.

Discussion

Traumatic injuries to deciduous dentition are the most relevant physical factors that can disturb permanent tooth formation. The germs of the permanent incisors are positioned palatally and in close proximity to the roots of their predecessors, predisposing them to secondary injuries when the deciduous teeth are traumatized (9, 10). The central incisors are the most affected teeth, as the lateral incisors are located behind them and are protected against labial traumatisms (10). In the present case, the injury to the deciduous incisor was the possible etiological factor that caused the retention of the permanent maxillary right incisors.

Traumatic injury to the deciduous teeth may lead to developmental disturbances in permanent dentition, which severity depends on the interaction between the stage of odontogenesis of the permanent tooth and the intensity and direction of the impact (10, 11). Impaction of permanent incisors is a possible outcome following traumatic injuries to their predecessors. In our case, the trauma on the permanent successor tooth may also have caused changes in the stage of root formation.

Determining prognosis and treatment planning for a retained tooth are often difficult tasks (12). Treatment alternatives for an impacted incisor include the following: orthodontic space regaining, surgical exposure, and traction of the impacted incisor into the proper position; extraction of the impacted incisor and orthodontic closure of the space with subsequent prosthetic restoration; and extraction of the impacted incisor and restoration with a bridge or an implant later when growth had ceased (13). Therefore, our option was the surgical exposure followed by orthodontic traction of the retained tooth. Enough space for maxillary lateral incisor eruption was obtained with deciduous canine extraction. Furthermore, a confidential relationship among the patient, parents and treating professional team was mandatory. Periodic visits were advised to monitor the oral hygiene.

Several reports have successfully treated impacted maxillary anterior teeth by proper crown exposure surgery and direct orthodontic traction instead of tooth extraction (1, 13, 14). A light extrusive force applied to the exposed tooth markedly accelerates its eruption, although statistics are not available to define the time difference between forced and spontaneous eruption (15). Spontaneous eruption is more likely to occur after presurgical orthodontic space opening, exposure of the impacted tooth, and maintenance of the open area (15). In the present case, orthodontic traction was performed only for 5 days, and this procedure was followed just by tooth development observation. The retained lateral incisor erupted spontaneously in 6 months.

The choice of the best treatment planning depends on the correct diagnosis. Oral surgeons require information on both the location and the shape of an impacted tooth before performing an operation for extraction or surgical exposure. Intraoral and/or panoramic radiography has conventionally been used for preoperative examination of an impacted tooth. However, panoramic radiography alone is not sufficient for determining the exact location

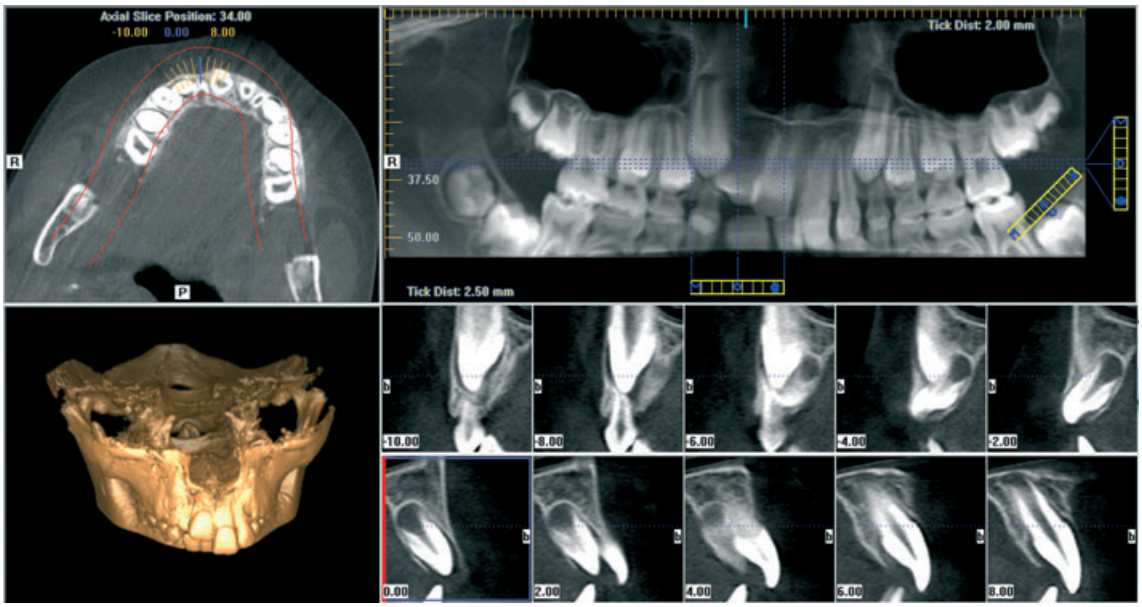

Fig. 5. The cross-section oblique images showing impacted permanent maxillary right lateral and central incisors.

Fig. 6. Crown exposure after flap reflection of the permanent maxillary right lateral incisor.

Fig. 7. Orthodontic bracket with ligature wire onto the labial surface of the permanent maxillary right lateral incisor.

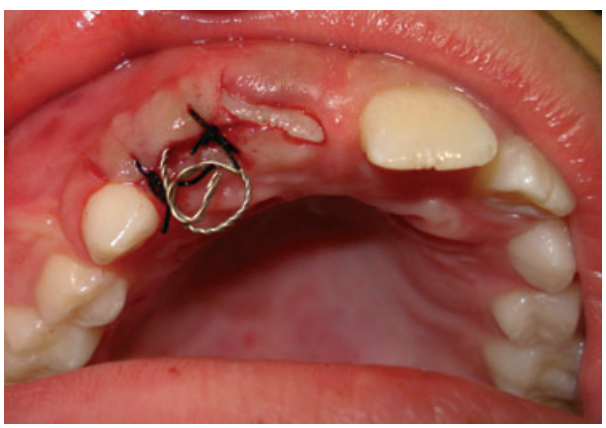

Fig. 8. Flap repositioned and sutured.

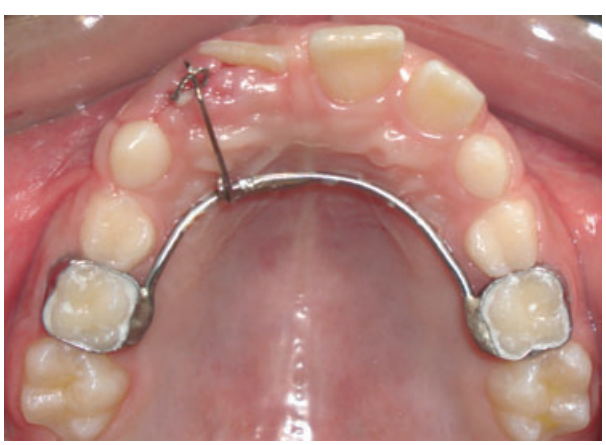

Fig. 9. Palatal view of the orthodontic appliance fixed.

Fig. 10. Intraoral view showing the permanent maxillary right lateral and central incisors erupted.

Fig. 11. Periapical radiograph showing an advanced stage of root formation.

of an impacted tooth, because of image superimposition. CBCT seems to be a good tool for the evaluation, accurate diagnosis, and determination of the location of an impacted tooth. Determination of the precise location is important for deciding the best approach for tooth impaction (7, 8, 16, 17).

In the present case, CBCT provided valuable information that helped us to determine the morphology of the root and exact tridimensional positioning of the retained teeth. Subsequently, we were able to confidentially establish an appropriate treatment plan. This case report highlights the need for treatment planning based on a comprehensive evaluation by all diagnostic modalities available including CBCT digital imaging techniques. Only one CBCT exam was performed for the diagnosis during the 12 month period.

Therefore, it may be concluded that deciduous tooth injuries have the potential to create disturbances of the developing permanent tooth. Permanent teeth with incomplete root formation have a great potential for spontaneous eruption because no tooth malposition or mechanical obstacles are observed. The appropriate diagnosis is essential for the choice of the best treatment plan and successful treatment.

References

1. Lin YT. Treatment of an impacted dilacerated maxillary central incisor. Am J Orthod Dentofacial Orthop 1999;115:406–9.
2. Andreasen JO, Andreasen FM. Textbook and color atlas of traumatic injuries to the teeth, 4th edn. Copenhagen: Munksgaard; 2001.
3. Sakai VT, Moretti AB, Oliveira TM, Silva TC, Abdo RC, Santos CF et al. Replantation of an avulsed maxillary primary central incisor and management of dilaceration as a sequel on the permanent successor. Dent Traumatol 2008;24:569–73.
4. Kamat SS, Kumar GS, Raghunath V, Rekha KP. Permanent maxillary central incisor impaction: report of two cases. Quintessence Int 2003;34:50–2.
5. Bassiouny MA, Giannini P, Deem L. Permanent incisors traumatized through predecessors: sequelae and possible management. J Clin Pediatr Dent 2003;27:223–8.
6. Montalvo-Polk A, Kittle PE. Impaction and malformation of a central incisor: sequelae of trauma. J Dent Child 1993;60:29–32.
7. Haney E, Gansky SA, Lee JS, Johnson E, Maki K, Miller AJ et al. Comparative analysis of traditional radiographs and cone-beam computed tomography volumetric images in the diagnosis and treatment planning of maxillary impacted canines. Am J Orthod Dentofacial Orthop 2010;137:590–7.
8. Cohenca N, Simon JH, Roges R, Morag Y, Malfaz JM. Clinical indications for digital imaging in dento-alveolar trauma. Part 1: traumatic injuries. Dent Traumatol 2007;23:95–104.
9. Diab M, ElBadrawy HE. Intrusion injuries of primary incisors. Part III: effects on the permanent successors. Quintessence Int 2000;31:377–84.
10. Andrade MGS, Weissman R, Oliveira MG, Heitz C. Tooth displacement and root dilaceration after trauma to primary predecessor: an evaluation by computed tomography. Dent Traumatol 2007;23:364–7.
11. Turgut MD, Tekçiçek M, Canoglu H. An unusual developmental disturbance of an unerupted permanent incisor due to trauma to its predecessor: a case report. Dent Traumatol 2006;22:283–6.
12. Farronato G, Maspero C, Farronato D. Orthodontic movement of a dilacerated maxillary incisor in mixed dentition treatment. Dent Traumatol 2009;25:451–6.
13. Thosar NR, Vibhute P. Surgical and orthodontic treatment of an impacted permanent central incisor: a case report. J Indian Soc Pedod Prev Dent 2006;24:100–3.
14. Kocadereli I, Turgut MD. Surgical and orthodontic treatment of an impacted permanent incisor: case report. Dent Traumatol 2005;21:234–9.
15. Becker A. Early treatment for impacted maxillary incisors. Am J Orthod Dentofacial Orthop 2002;121:586–7.
16. Sawamura T, Minowa K, Nakamura M. Impacted teeth in the maxilla: usefulness of 3D Dental-CT for preoperative evaluation. Eur J Radiol 2003;47:221–6.
17. Kim KD, Ruprecht A, Jeon KJ, Park CS. Personal computer-based three-dimensional computed tomographic images of the teeth for evaluating supernumerary or ectopically impacted teeth. Angle Orthod 2003;73:614–21.