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Dilacerations Of Maxillary Central Incisor

A Project Submitted to
The College of Dentistry, University of Baghdad, Department of oral diagnosis in Partial Fulfillment for the Bachelor of Dental Surgery

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بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

اقْرَأْ بِاسْمِ رَبِّكَ الَّذِي خَلَقَ ﴿1﴾ خَلَقَ الْإِنْسَانَ مِنْ عَلَقٍ ﴿2﴾ اقْرَأْ وَرَبُّكَ الْأَكْرَمُ ﴿3﴾ الَّذِي عَلَّمَ بِالْقَلَمِ ﴿4﴾ عَلَّمَ الْإِنْسَانَ مَا لَمْ يَعْلَمْ ﴿5﴾

صدَق الله العَظِيم

Certification of the Supervisor

I certify that this project entitled " **Dilacerations of maxillary central incisor** " was prepared by the fifth-year student **Teba Ghassan Mohammed** under my supervision at the College of Dentistry/University of Baghdad in partial fulfilment of the graduation requirements for the Bachelor Degree in Dentistry.

Supervisor’s name

Date

Dedication

To my family, I could never do this without your faith, support, and constant encouragement. thank you for teaching me to believe in myself, In God, and in my dreams.

to my respectful brother Mustafa who supported me and made me feel special.

To my supervisor Dr. Maryam who believed in my abilities and was always there for me whenever I needed

To all people who supported and encouraged me

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Many thanks to all of you.

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Primarily I would like to thank the supreme power the **Almighty God** for being able to complete this project with success.

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Grateful thanks are express to **……** , head of department of oral diagnosis who gave me opportunity to do this project.

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I cannot express enough thanks to my caring, loving and supporting family, with special thanks to my sweetheart, my brother **……....**

Last but not least I would like to thank all my classmates who helped me directly or indirectly, also special thank from the heart to my friends **……**

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Introduction:

Dilaceration is an abnormal angulation or bend in the root or, less frequently, the crown of a tooth

Although most examples are idiopathic, a number of teeth with dilaceration appear to arise after an injury that displaces the calcified portion of the tooth germ, and the remainder of the tooth is formed at an abnormal angle. The damage frequently follows avulsion or intrusion of the overlying primary predecessor, an event that usually occurs before 4 years of age.

Injury-related dilaceration more frequently affects the anterior dentition and often creates both a functional and a cosmetic dental problem.

Less frequently the bend develops secondary to the presence of an adjacent anatomic structure, cyst, tumor, or odontogenic hamartoma (e.g., odontoma, supernumerary tooth)

CHAPTER ONE
REVIEW OF LITERATURE

1.1 Dilacerations of maxillary central incisor:

Maxillary central incisors have a significant impact on the esthetics of an individual. **(Shi *et al.*, 2015)** Although its impaction is infrequent, yet whenever it is impacted, it is a cause of concern toward the external appearance. **(Chaushu, Zilberman and Becker, 2003)** Multiple factors affect eruption of central incisors of which dilaceration is the usual etiology.

The term dilaceration was first coined in 1848 by Tomes, **(Tomes, 1848)** who defined the phenomenon as the forcible separation of the cap of the developed dentin from the pulp in which the development of the dentin is still progressing. Later, it was defined as an angulation or a sharp bend/ curve in the root or the crown portion of a formed tooth (Figs. 1-1) **(Wankhade *et al.*, 2013)**

According to the glossary of dental terms,**(Institution, 1983)** dilaceration is defined as the deformity of a tooth due to a disturbance between the unmineralized and mineralized portions of the developing tooth germ.

(Andreasen et al., 1971) defined dilaceration as the abrupt deviation of the long axis of the crown or root portion of the tooth, which is due to a traumatic non axial displacement of already formed hard tissue in relation to the developing soft tissue.

The same and other authors **(Andreasen, Andreasen and Andersson, 2018)** distinguish dilaceration from angulation, which is described as a bend of the root due to the gradual change in the direction of development, when no abrupt shift of the tooth germ has taken place during odontogenesis.

Fig. (1-1) Dilaceration. Sharp curvature of the root of a maxillary central incisor **(Chi *et al.*, 2017)**

Stewart **(Walia *et al.*, 2016)** has likened tooth dilaceration to the hand of a traffic policeman, whereas Moreau **(Moreau, 1985)** used the term scorpion tooth for this condition. The criteria for recognizing root dilaceration vary in the literature. According to some authors, a tooth is considered to have a dilaceration toward mesial or distal direction if there is a 90° angle or greater along the axis of the tooth or root, **(Hamasha, Al-Khateeb and Darwazeh, 2002))** whereas others defined dilaceration as a deviation from the normal axis of the tooth of 20° or more in the apical part of the root.**(Topouzelis *et al.*, 2010)**

The incidence of dilaceration involving the permanent anterior dentition following trauma to the primary dentition is about 4.7% (Fig. 1-2) **(Soxman, Wunsch and Haberland, 2019)**

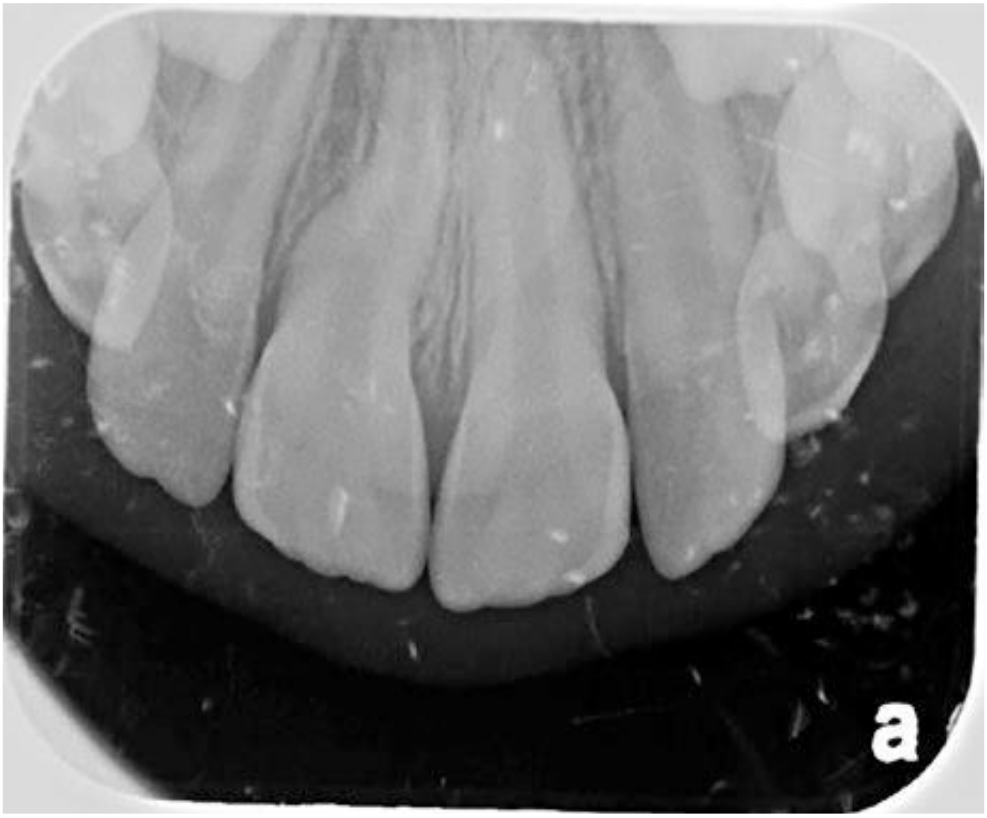


Fig. (1-2) Periapical radiograph revealing dilaceration of the right maxillary permanent central incisor secondary to trauma to primary incisor **(Soxman, Wunsch and Haberland, 2019)**

1.2 Etiology

The aetiology of the dilaceration is not fully understood, although there are two main explanations: the most widely accepted cause is the mechanical lesion of the temporary tooth, which results in the dilaceration of the replacement tooth. **(Salek *et al.*, 2019)**

The calcified portion of the permanent tooth germ is displaced in such a way that the remainder of the permanent tooth germ forms at an angle to it **(Jafarzadeh and Abbott, 2007)**

Although the prevalence of traumatic injuries to the primary dentition ranges from 11%–30%, the incidence of dilacerated permanent teeth is very low and disproportionate to the high prevalence of trauma. Hence, traumatic injuries to the primary dentition are unlikely to account for all cases of dilaceration and especially those of primary teeth themselves. **(Jafarzadeh and Abbott, 2007)**

In 1978, Stewart8 studied the phenomenon in 41 cases of dilacerated incisors and found that only in 22% (nine patients) of the cases, this was due to injury. Therefore, he concluded that the cause lay in the ectopic development of the tooth germ. **(Walia *et al.*, 2016)**

This view was supported by Howe who claims that an injury transmitted to the crown of the non-erupted tooth cannot lead to usual curvature orientation of maxillary central incisors, with the crown facing upwards and labially, unless the tooth germ of the permanent successor had already been displaced before the traumatic injury**. (Topouzelis *et al.*, 2010)**

McNamara et al have reported that there are many studies which have found no history of trauma in cases of dilaceration. Also, only a single maxillary central incisor presents dilaceration, whereas if injury was the only etiological factor, then adjacent teeth should be involved in the dilaceration more often. Therefore, it has been suggested that injury of a primary predecessor tooth is not the exclusive etiological factor of dilaceration. **(Walia *et al.*, 2016)**

Others suggest that the injury of a primary predecessor tooth is not the exclusive aetiological factor of dilacerations as it is usually only one tooth that presents dilaceration, whereas, if injury was the only etiological factor, then adjacent teeth should be involved in the dilaceration more often **(Singh and Sharma, 2006)**

The second explanation proposes an idiopathic developmental disturbance as the cause of dilacerations especially in cases that have no clear evidence of traumatic injury. Supporters of this theory maintain that an injury to a primary tooth sometimes leads to intrusion or avulsion, an event that normally occurs before the age of 4. At this age, the formation of the root of the succedaneous permanent tooth does not start. Therefore, injury is not the main etiological factor of dilacerations and this disorder is caused by ectopic tooth germ development. This theory is more acceptable because dilaceration is observed more frequently in posterior teeth, which are less susceptible to traumatic injury. **(Walia et al., 2016)**

Other causes involved in the development of a dilaceration are local factors such as the formation of scar tissue, odontogenic infections and the effect of anatomical structures, such as the cortical bone of the sinus, the mandibular canal, and the nasal fossa, which may shift the epithelial diaphragm. Mechanical trauma from orotracheal intubation and laryngoscopy have also been blamed causes for the dilaceration of primary maxillary central incisors as well as the presence of cysts, tumors, odontogenic hamartoma/ odontoma, and mechanical interference during the eruption, such as an ankylotic primary tooth the roots of which are non-resorbed **(Topouzelis *et al.*, 2010)**

1.3 Mechanism Causing Dilaceration

In early developmental stages, the permanent tooth germ of the maxillary incisor is situated palatally and superiorly to the apex of the primary incisor and gradually changes its path in a labial direction with its crown coming closer to the resorbing primary root. **(Walia *et al.*, 2016)**

The tissue between a temporary upper central incisor and its permanent replacement tooth is 3 mm thick and consists mainly of fibrous connective tissue. The narrow anatomical relationship explains the severe disorders of the development of this tooth. During an axial impact on the temporary incisor, the apex comes into contact with the incisal edge of the permanent tooth (1), which is in a very slightly anterior position. This displacement causes the seed of the germ upwards and forwards and the already formed root portion follows the movement of the crown (2) while the unedited part (hertwig sheath) will continue its edification in an orientation initially programmed before the displacement of the germ (3). (Fig. 1-3) **(Salek *et al.*, 2019)**

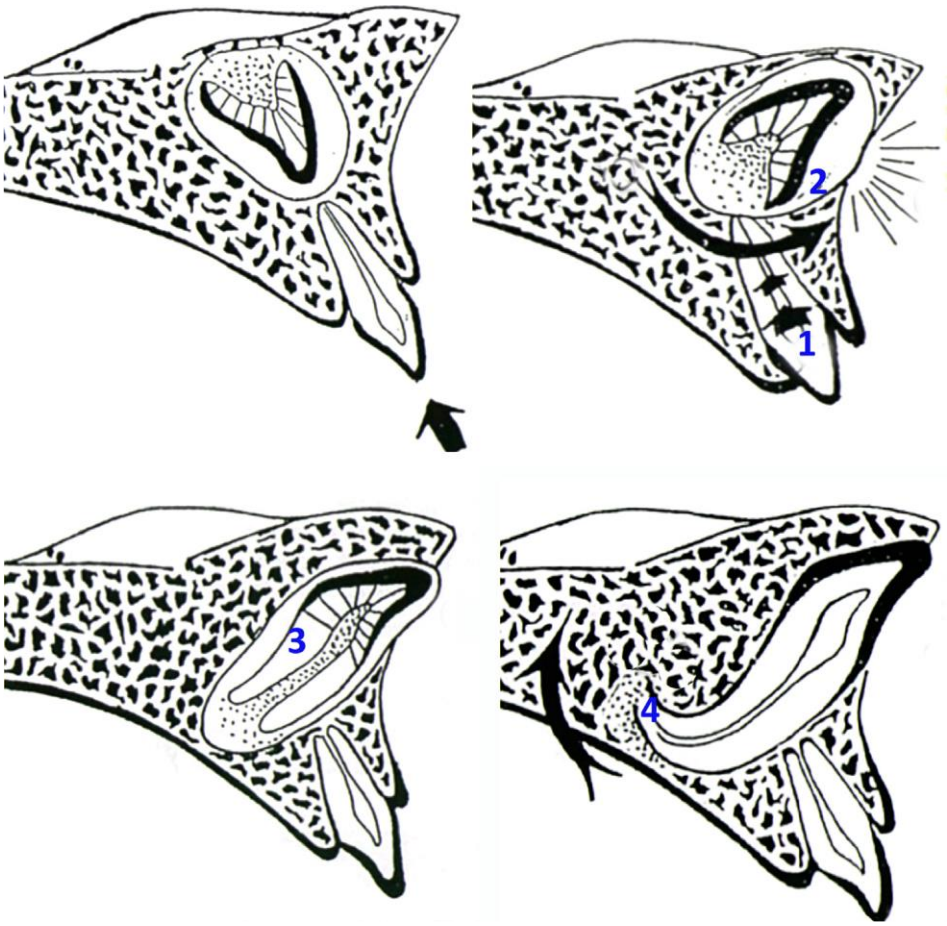


Fig. (1-3) Chronology and etiopathogeny of the dilaceration according to Bourdillat **(Salek *et al.*, 2019)**

Dilaceration is one such disorder, the position of which will depend on the developmental stage of the tooth at the time of the injury. The impact force on primary incisor which is vertically directed is transferred in the direction of the longitudinal axis and it may be carried along the apex to the noncalcified or partially calcified tooth germ of the permanent successor. **(Walia *et al.*, 2016)**

If injury to the primary tooth occurs at the age of 2–3 years, buccal surface of the permanent maxillary incisor tooth would be affected as the tooth germ of the permanent maxillary incisor lies in a palatal position, above the apex of the primary incisor (Fig. 1-4) **(Walia *et al.*, 2016) .**

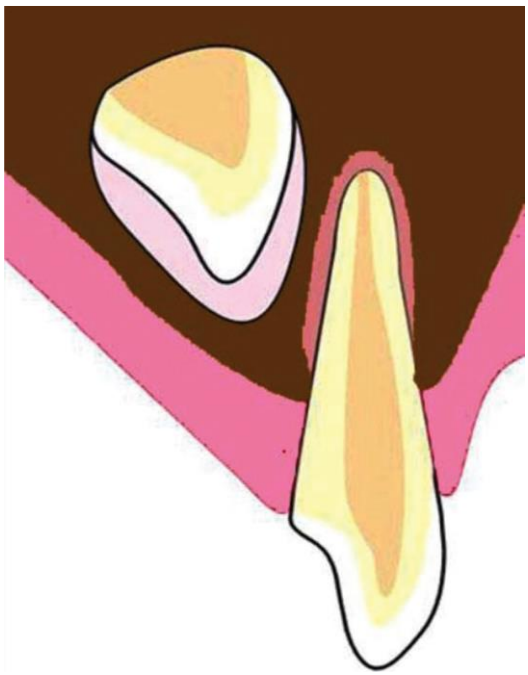


Fig. (1-4): Close proximity of maxillary deciduous and permanent successor tooth germ at 2–3 years of age **(Walia *et al.*, 2016)**

At the age of 4–5 years, the tooth germ of the permanent incisor shifts toward the labial direction, thus coming closer to the resorbing root of the primary tooth (Fig. 1-5) **(Walia *et al.*, 2016)**.

Fig. (1-5): Close proximity of maxillary deciduous and permanent successor tooth germ at 4–5 years of age **(Walia *et al.*, 2016)**

At this critical age, when the crown of the permanent tooth is in direct relationship with the resorbed root of the primary predecessor, if the child is injured, the impact force will be transferred along an imaginary oblique line that goes through the incisal edge of the permanent incisor and a point on the labial aspect of its newly formed root (Fig.1- 6). **(Walia *et al.*, 2016)**

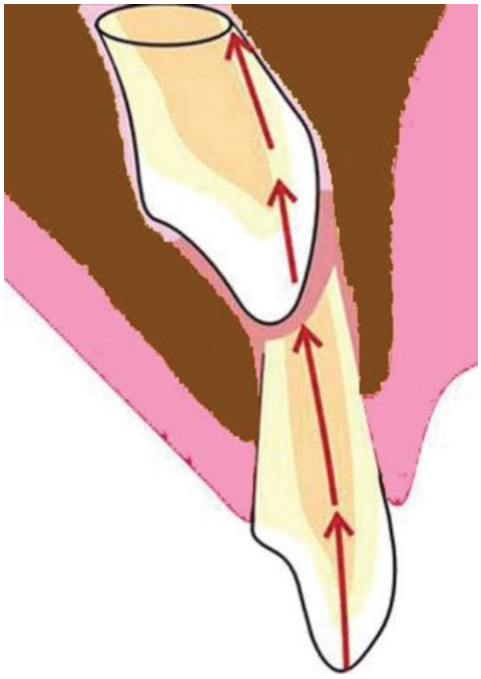


Fig. 1-6: Vertically directed force through the deciduous incisor transmitted to the labial aspect of the mineralizing root of unerupted permanent incisor **(Walia *et al.*, 2016)**

It is appraised that the direction of this force may be more significant than its magnitude. As the impact force is directly transferred to the cells of Hertwig's epithelial root sheath, through the sharp end of the nonformed root of the permanent tooth, it is possible for serious damage to be caused despite the relatively mild forces involved. The resorbing apex of the primary incisor creates an impact point with the incisal edge of the crown of the permanent incisor and causes this crown to turn upward into its tooth follicle. **(Walia *et al.*, 2016)**

As the permanent incisor root has not been fully developed at the moment of injury, the part of the root already formed will rotate along with the crown. However, further root development, following the injury, usually continues in the same direction it was following before the injury. This creates an unusual angle between the pre- and the posttraumatic parts of the tooth, which results in local curvature of the longitudinal axis of the permanent central incisor and causes dilaceration. **(Walia *et al.*, 2016)**

As the injured Hertwig's epithelial root sheath continues to produce dentin at the same rate as before the injury, the final root shape of the permanent maxillary central incisor will be formed in a continuous labial curve, until apex formation has been completed. Furthermore, as the Hertwig's epithelial root sheath remains in its place within the alveolar process against the eruptive forces of the developing tooth and guides the orientation of root development, the crown of the permanent central incisor appears to be moving labially and upward for as long as this asymmetric calcification of the root continues (Fig. 1-7)**(Walia *et al.*, 2016)**. Therefore, dilaceration of this classical type is an anomaly which is traumatic in origin and developmental in its final expression. This mechanism explains the typical appearance of dilacerated tooth with a relatively minor degree of trauma and high proportion of cases with no apparent history of trauma and no damage to the adjacent teeth. It also provides explanation for bilaterally affected cases, nonoccurrence among lateral incisor and absence of any association with supernumerary teeth, cyst and odontoma. **(Walia *et al.*, 2016)**

Fig. (1-7): Progressive alteration in the direction of a dilacerated incisor during unequal root formation following traumatic injury. The position of Hertwig's epithelial root sheath remains unaltered **(Walia *et al.*, 2016)**

1.4 Prevalence

In one review of 1166 randomly selected patients, 176 dilacerated teeth were identified. Of these teeth, the most commonly affected were the mandibular third molars, followed by the maxillary second premolars and mandibular second molars. The maxillary and mandibular incisors were the least frequently affected, representing approximately 1% of the series. This contrasts with other authors who have reported a high frequency of dilaceration involving anterior teeth. **(Chi *et al.*, 2017)**

In reality, the molars most likely demonstrate the highest prevalence of dilaceration but are not highlighted because of a lack of associated clinical problems in most instances. Occasionally, involvement of the deciduous teeth is reported, and some have been associated with prior trauma secondary to neonatal laryngoscopy and endotracheal intubation. **(Chi *et al.*, 2017)**

Previous research has shown that dilaceration is more common in the late dental age group than the early age group and that dilaceration of the cervical third of the root is more common than dilaceration at any other root portion. **(Hui *et al.*, 2021)**

1.5 Clinical features of dilacerations

Clinical features of dilaceration usually include the noneruption of the responsible tooth, (Fig. 1-8) the longer retention of the primary predecessor tooth, possible apical fenestration of the buccal or labial cortical plate, or it may be asymptomatic**. (Walia *et al.*, 2016)**

Fig. (1-8): Missing permanent maxillary left central incisor
(Mannathoko-Molefhe and Hu, 2015)

The presence of dilacerations in an impacted maxillary central incisor may be diagnosed clinically through palpation at two locations. The first lies high on the labial side of the alveolar ridge in the vestibular sulcus. The upper middle line is normally on the same line as the projection of the anterior nasal spine with a shallow depression on either side.**(Walia *et al.*, 2016)**

In cases of dilaceration of the permanent central incisor when the palatal surface of the crown has rotated anteriorly, there is pronounced swelling in the region in place of the shallow depression. When the upper lip is pulled upwards, the oral mucosa moves freely above the protruding region which indicates the outline of the crown of the impacted dilacerated central incisor. The importance of such a palpation should not be underestimated, because if it is not thorough, the opportunity for an important diagnosis might be missed . **(Walia *et al.*, 2016)**

The second palpation area lies in the palate. If there is an abnormal position, such as when the crown has rotated upwards and labially, the root continues to develop along a more palatally tilted axis. Therefore, at the final stages of incisor root formation when the apex is closed, the apex may be palpated in the palate as a small hard nodule. **(Walia *et al.*, 2016)**

1.6 Radiographic features of dilacerations

The direction of root dilaceration should be considered in two planes and they can be categorized as mesial, distal, labial/buccal or palatal/lingual.**(Walia *et al.*, 2016)** if the bend occurs in a mesial or distal direction. Roots that bend facially or lingually may be more difficult to detect. **(Chi *et al.*, 2017)**

However, when the dilacerations is toward the labial/buccal or palatal/lingual, the central X-ray beam passes almost parallel to the deviating part of the root. The deviating root portion appears at the end of the non-deviating portion as a circular radiopaque region with a dark central radiolucent spot, which represents the apical foramen and is a part of the root canal as well. This radiographic image is known as a Bull's Eye or a target (Fig. 1-9).

The periodontal ligament around the deviating part of the root appears as a black region (radiolucent halo). The deviating portion of the root appears more radiopaque as compared with the rest of the root because the X-ray beam passes through a higher osseous density portion of the root. **(Walia et al., 2016)**

Fig. (1-9): Periapical radiograph showing "Bulls Eye" phenomenon in a central incisor with dilacerated root **(Walia *et al.*, 2016)**

In the cases of labial-buccal and lingual-palatal root dilaceration, the use of a panoramic radiograph as the only means of detection is insufficient and it is necessary to exposure further radiographic images at a different angulations.**(Topouzelis *et al.*, 2010)**

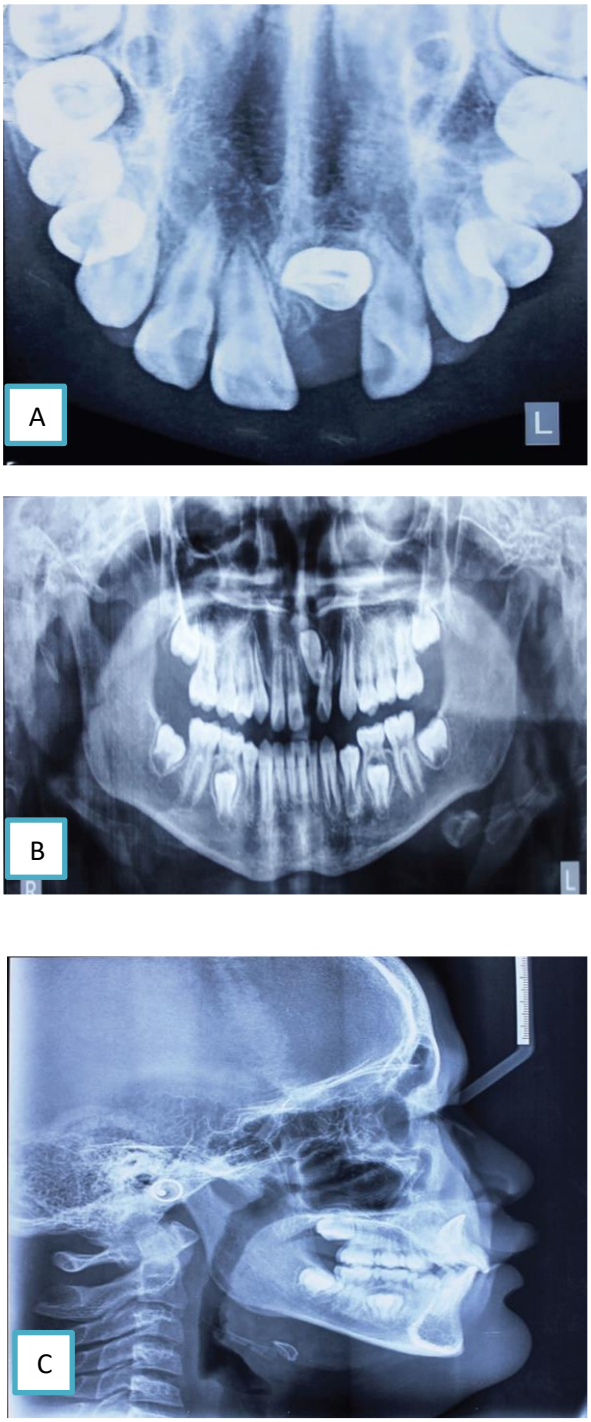
Besides periapical radiographs, occlusal (Fig. 1-10), lateral cephalo-metric and panoramic radiographs may more clearly identify the position and extent of central incisor root dilaceration. **(Topouzelis *et al.*, 2010)**

Fig. (1-10). Occlusal radiographic image of a child with maxillary left permanent central incisor dilaceration.**(Topouzelis *et al.*, 2010)**

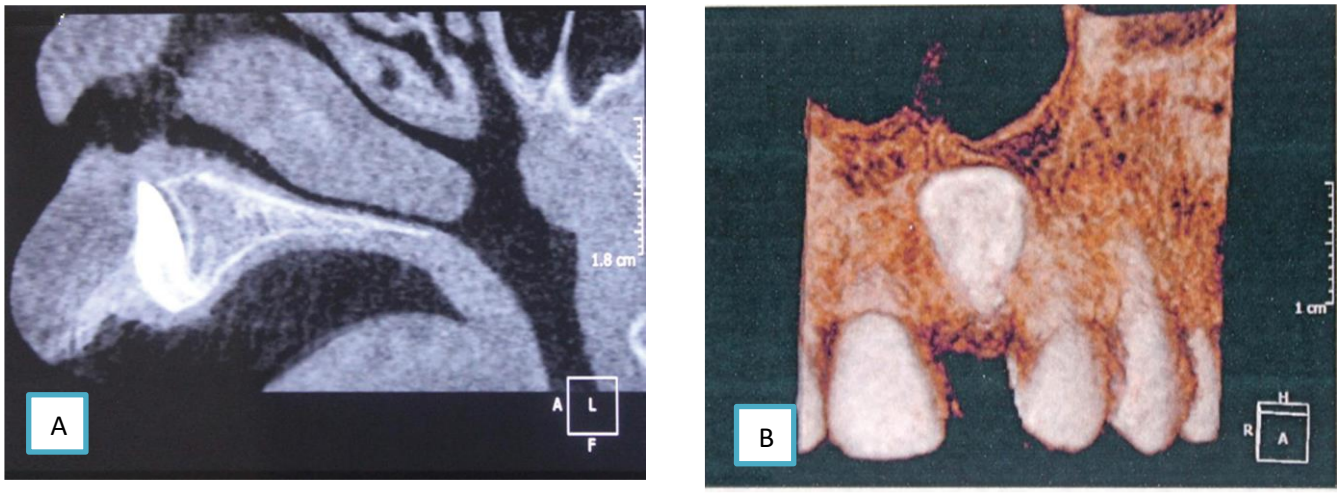
Conventionally, radiographic diagnosis was based on two-dimensional (2D) radiographic images **(Halazonetis, 2005)** (Figs 1-11A to C). However, 2D radiographic images can be hindered by rotation, distortion and errors in head positioning, which cause inaccurate representations of anatomic landmarks and poor visualization of some anatomic structures. **(Park *et al.*, 2006)**

Cone beam computed tomography (CBCT) has been recently introduced in radiographic diagnosis of impacted teeth, since it provides multiple planes for accurately identifying three-dimensional (3D) landmarks of dental structures with submillimeter resolution. **(Alqerban *et al.*, 2011)**

Cone beam computed tomography also provides various sections of the structure of interest, allowing clinicians to assess the exact positions of the apex and the crown, and the degrees of root formation and dilacerations **(Crescini and Doldo, 2002)** (Figs 1-12A and B). The advantages of CBCT over conventional computed tomography or dental images include low radiation dose, low cost, excellent tissue contrast, elimination of blurring and overlapping of adjacent teeth and high spatial resolution. **(Cevidanes *et al.*, 2007)** Therefore, the application of CBCT in the diagnosis and treatment of impacted dilacerated teeth has become increasingly indispensable.



Figs (1-11): A to C: (A) Occlusal view of a patient with maxillary left permanent central incisor dilaceration, (B) panoramic radiographic view of a patient with maxillary left permanent central incisor dilaceration, and (C) lateral cephalogram of a patient with maxillary left permanent central incisor dilacerations **(Walia *et al.*, 2016)**



Figs 1-12A and B: (A) Sagittal section of cone beam computed tomography image showing an impacted tooth root located palatally with a large part close to palatal cortical bone, and (B) three dimensional frontal photographic reconstruction from CBCT image of a patient with maxillary left permanent central incisor dilacerations **(Walia et al., 2016)**

1.7 Prognosis

The prognosis of aligning an impacted dilacerated tooth mainly depends on the following factors: (1) the position and direction of the impacted tooth, (2) the degree of root formation, (3) the degree of dilaceration, and(4) the availability of space for the impacted tooth. **(Walia *et al.*, 2016)**

Machtei et al also include the condition of the periodontium. McNamara et al underline the decisive significance of the posttraumatic condition of the Hertwig's epithelial root sheath for a successful therapeutic outcome, as the odontogenic epithelium plays a truly important role inroot formation through the effect of its Hertwig's epithelial root sheath. **(Topouzelis *et al.*, 2010)**

Continuing normal root development depends on the integrity of the Hertwig's epithelial root sheath. A dilacerated tooth with an obtuse inclination angle, a lower position in relation to the alveolar crest combined with an in-complete root formation has a better prognosis for orthodontic traction.**(Walia *et al.*, 2016)**

Chaushu et al reported that orthodontic surgical treatment of impacted central incisor is generally successful but relatively long and is significantly affected by the initial height of the impacted tooth. **(Walia *et al.*, 2016)**

1.8 Treatment considerations

To provide an opportunity for the noncalcified root to change direction and develop a proper spatial relationship with the already calcified formed crown, the treatment of dilacerated teeth should start early **(Walia *et al.*, 2016)**

Due to position of impacted dilacerated maxillary central incisor, the problem is usually recognized by the parents during the child's mixed dentition period. Failure to treat in a timely manner may lead to delayed tooth eruption, midline shift, space occupation by adjacent teeth and alveolar crest height differences **(Walia *et al.*, 2016)**

Treatment should take place following careful planning and requires cooperation of various experts **(Pomarico, de Souza and Primo, 2005)**.

Management of an impacted dilacerated permanent teeth includes two different treatment approaches:(1) surgical exposure with orthodontic traction or (2) extraction which may be followed by (a) space closure by mesializing the lateral incisor in place of the central incisor with subsequent prosthetic restoration,**(Rizzatto *et al.*, 2012)** (b) surgical repositioning of the impacted central incisor, (c) autotransplantation of a premolar to the region and (d) restoration with an implant or a bridge after cessation of growth. **(Walia *et al.*, 2016)**

Among these, orthodontically induced tooth eruption would be the first choice based on sound evidence of its benefits.**(Pinho, Neves and Alves, 2011)**

It helps in maintaining tooth structure, provides bone stimulation and maintenance of alveolar bone width besides providing periodontal and esthetic benefits.**(Rizzatto and Freitas, 2009)**

This treatment although complex can be successfully managed by careful planning and by a multidisciplinary team including the pedodontist, orthodontist, maxillofacial surgeon, endodontist, and periodontist.**(Pomarico, de Souza and Primo, 2005)**

Even after successful orthodontic treatment, esthetic periodontal surgery might be necessary if the final position of the gingival margin is not acceptable due to gingival recession and/or clinical crown lengthening. **(Walia *et al.*, 2016)**

Orthodontists are often reluctant to proceed with aligning severely dilacerated teeth as treatment might fail due to complications such as ankylosis, loss of attachment, external root resorption and/or root exposure following orthodontic traction. In cases of root exposure, endodontic treatment and/or apicoectomy would be necessary. **(Walia *et al.*, 2016)**

However, in some cases, dental extraction might be the only option due to pronounced tooth inversion. also, exposure and orthodontic traction either fail or not be initially considered, the treatment must consist of surgical tooth extraction. This would be followed by an implant or space closure with orthodontic traction or fixed bridge or partial denture placement **(Topouzelis *et al.*, 2010)**

Chapter Two
Conclusion

Conclusion

Dilacerated teeth are not common, but they do pose a number of diagnostic, management, and prognostic challenges to dental practitioners.

Knowledge of dilaceration prevalence and early diagnosis can help dentists to prevent procedural errors and improve the success rate by referring these cases to the specialists.

Dilacerated teeth are diagnosed clinically, but radiographic imaging plays a decisive role. Treatment should start as early as possible and aim at tooth alignment in the dental arch following surgical exposure and orthodontic traction. the identification of a dilaceration is equally important to ensure appropriate management.

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