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Dilacerated Teeth and there Implication in Orthodontic

A Project Submitted to
The College of Dentistry, University of Baghdad,
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the Bachelor of Dental Surgery

By:

Zaid Ismail Abdalhussien

Supervised by

Assistant Professor

Dr. Noor Muhammed Hasan Garma

BDS, MSc, PhD (Orthodontic)

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Certification of Supervisor

I certify this project entitled "Dilacerated Teeth and there Implication in Orthodontic " was prepared by Zaid Ismail Abdalhussien under my supervision at the College of Dentistry / University of Baghdad in partial fulfillment of the graduation requirements for B.D.S degree.

Supervisor's Name: Assist. Prof. Dr. Noor Muhammed Hasan Garma

Date:

Dedication

I dedicate this work to my mother the woman that was and is the best teacher I have ever have . To my father the man that supported me to be here today , to my family that loved my and supported me so much, to my second family my friends and my special someone that helped me to overcome my life difficulties, I hope you will always be with me.

Acknowledgement

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Introduction

The term dilaceration was first coined in 1848 by tomes 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 deviation or sharp bend or curve in the linear relationship of the crown of a tooth to its root (Latin: dilacero=tear up) **(Shafer et al, 1983; Tiecke et al, 1983).**

Dilaceration is one of the causes of permanent central incisor eruption failure The treatment of dilacerated anterior teeth usually involves surgical excision with subsequent orthodontic methods to either close the space or keep it open until the patient reaches an age when definitive implants or prosthodontic treatments may be used. Both methods have associated problems: orthodontic space closure is seldom indicated nor aesthetically satisfactory, while removable prosthetic replacement during childhood and adolescence may be unsatisfactory for psychological reasons. Orthodontic traction of impacted dilacerated teeth into the arch has been reported in the literature **(Odegard, 1997).** Therefore, the importance of dilacerated tooth and it's implication in orthodontic is worth being discussed.

Aim of the review

This review was set out to study the dilacerated teeth regarding their:

Origin, Etiology, Mechanism and Management.

Chapter one: Review of Literature

1.1 Definition

According to the glossary of dental terms dilaceration is defined as the deformity of tooth due to 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 term vestibular root angulation ("sickle" incisor) is distinguished from dilaceration, as it denotes a curvature of the root resulting from a gradual change in the direction of root development without any evidence of abrupt displacement of the tooth germ during odontogenesis. **(Andreasen jo et al., 2007).** Becker (2012) has described this condition as "classic" dilaceration (Fig. 1).

Whereas 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 90º angle or greater along the axis of the tooth or root **(Hamasha et al., 2002; Mlcic et al., 2006)**, Whereas others defined dilaceration as a deviation from the normal axis of the tooth of 20º or more in the apical part of the root.

Figure 1: An extracted dilacerated maxillary central incisor tooth showing "classic" dilaceration **(Pwanjit et al., 2016)**

1.2 Etiology

The etiology of dilaceration is not fully understood and there is no consensus among researchers, although there are two prevailing explanations: the most widely accepted cause of dilaceration is acute mechanical injury to the primary predecessor tooth that leads to the dilaceration of the underlying developing succedaneous permanent tooth. The calcified portion of the permanent tooth germ is displaced in such a way that the remainder of the noncalcified part of the permanent tooth germ forms an angle to it **(Kilpatrick et al., 1991).**

In 1978, Stewart 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. McNamara (1998) has 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. The second explanation proposes an idiopathic developmental disturbance as the cause of dilacerations especially in cases that have no clear evidence of traumatic injury. Mhadwick and Millet (1995), White and Pharoh (2009) 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 dilaceration and this disorder is caused by ectopic tooth germ development **(1995; Prabhaker et al., 1998 White and Pharoh, 2009)**. This theory is more acceptable because dilaceration is observed more frequently in posterior teeth, which are less susceptible to traumatic injury **(Hamashaet al., 2002).**

Other possible contributing factors mentioned in the literature include the formation of scar tissue, developmental disorder in the primary tooth germ, facial clefting, advanced infection of root canals **(Kalraet al., 2000),** tooth germ development and lack of space, **(Malcic et al., 2006)** the effect of ectopic anatomical structures, e.g., the cortical bone of the maxillary sinus, the mandibular canal and the nasal fossa, which may shift the epithelial diaphragm **(Walton and torabinejad, 2002).** Orotracheal intubation and laryngoscopy **(Neville et al.2002)** as well as the presence of cysts, tumors, odontogenic hamartoma, **(Atwan et al., 2000; Yeung et al., 2003)** mechanical interference during eruption, such as an ankylotic primary tooth, the roots of which are nonresorbed **(Profit et al.,2000),** tooth transplantation **(Monsourand Adkins KF., 1984).** extraction of a primary tooth **(Matsuoka et al., 2000)** and hereditary factors **(Regezi et al., 2003).** Certain syndromes and developmental disorders have also been associated with root dilaceration, such as, Smith-Magenis syndrome **(Tomona et al., 2006).** the hyper mobility type of Ehlers-Danlos syndrome **(Yassin and Rihani, 2006)** congenital ichthyosis.

In addition , results from animal studies reported in the literature communicated that root alterations were related to defective genes as Nfic (Nuclear Factor I C), Ptc (patched), DKK1 (Dikkopf-related protein 1), Osx (osterix), Smad 4 (mothers against decapentaplegic homolog 4) and Wls (wntless) genes **(Han et al.,2011; Huang and Chai, 2012; Kim et al., 2015; Bae et al., 2015).** Nevertheless, only CLNC7 (osteopetrosis, infantile malignant 2) and PLG (Plasminogen) genes have been reported associated to hereditary root malformations in humans **(Xue et al., 2012; Tananuvat et al., 2014).**

1.3 Mechanism Causing Dilceration

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. The fibrous connective tissue present between deciduous maxillary central incisor and succedaneous permanent maxillary incisor is <3 mm in thickness **(Smith and Rapp, 1980).** Injury to the primary central incisor leads to various developmental disorders in the developing permanent tooth bud due to close anatomical relationships between the permanent tooth bud and the root of the primary central incisior **(Diab and Elbadrawy , 2000; Crescini and Doldo, 2002).**

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 **(Diab and Elbadrawy, 2000),**(Figure 2, a). 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 **(Crescini and Doldo, 2002),(**Figure 2, b).

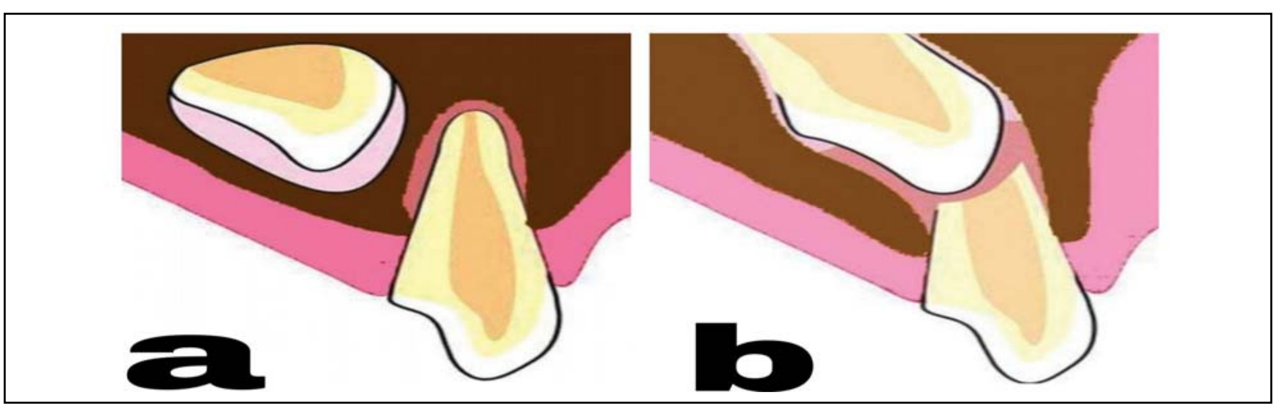

Fig. 2: Close proximity of maxillary deciduous and permanent successor tooth germ at: (a) 2–3 years of age, (b) at 4–5 years of age **(Pwanjit et al., 2016)**

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 **(Becker, 2012)** (Figure 3). 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 non formed 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 **(Crescini and Doldo, 2002).** 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 dilacerations **(Becker, 2012).**

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 **(Becker, 2012).** 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 **(Andreasen and Flires, 2007; Becker, 2012),**(Figure3, (b)).

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 **(Becker, 2012).**

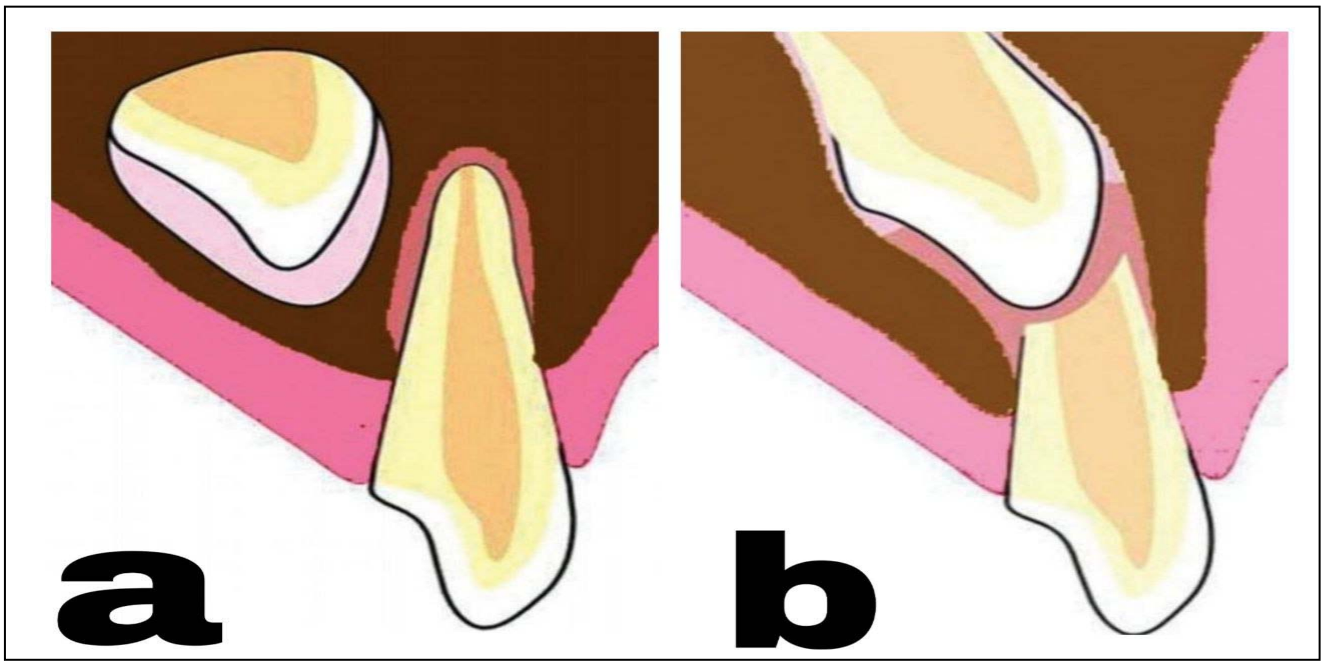

Figure 3; (a) Vertically directed force through the deciduous incisor transmitted to the labial aspect of the mineralizing root of un erupted permanent incisor, (b) Progressive alteration in the direction of the dilacerated incisor during unequal root formation following traumatic injury. The position of Hertwing's epithelial root sheath remains unaltered **(Pwanjit et al., 2016).**

1.4 prevalence and incidence

Although the prevalence of traumatic injuries to the primary dentition ranges from 11 to 30% the incidence of dilacerated permanent teeth is very low and disproportionate to the high prevalence of trauma (Figure.1).Hence, traumatic injuries to the primary dentition are unlikely to account for all cases of dilaceration and especially those of primary teeth themselves**.** Dilaceration may appear in both permanent and primary teeth but incidence in the latter is very low **(Bimstein, 1978).**While some studies report no gender preference for dilacerations **(Eversole, 2002)** others report a male to female ratio of 1:6 **(McNamera etal., 1998).** In 2006, **Malcic** reported a prevalence rate of 1.3 or 0.53% for maxillary central incisors on the basis of periapical and panoramic radiographs respectively. **(Hamasha et al., 2002)** examined 4,655 teeth on periapical radiographs and found that 176 (3.78%) presented dilaceration. Maxillary central and lateral incisors had rates of 0.4 and 1.2% respectively **(Malcic A et al., 2006)** reported that dilaceration is observed in the apical third of the roots of incisor, canines and premolars, while the middle third is more often affected in molars and finally, the cervical third in third molars. These authors also reported that premolars and maxillary anterior teeth present a higher total prevalence (4.6%) as compared with the rate affecting the corresponding region of the mandible (1.3%).

Dilaceration might occur anywhere along the length of the tooth, i.e., the crown, the cement–enamel junction, along the root or the root apex **(Malcic et al., 2006)** Crown dilaceration of a permanent tooth constitutes 3% of all traumatic injuries to developing teeth and is habitually due to intrusion or avulsion of their primary predecessors, and it usually involves maxillary or mandibular central incisors. Maxillary incisors are more often involved than their mandibular counterparts.17 Approximately, 50% of teeth with crown dilaceration become impacted, with the remainder erupting normally or in a labio lingual direction **(Andreasen and flores, 2007).**

Crown dilacerations of permanent maxillary incisors usually presents with palatal angulation, while permanent mandibular incisors usually present crown dilaceration with labial angulation **(Lowe, 1985)**. The clinical appearance of this deformity in succedaneous permanent tooth depends on the developing stage at which the injury occurred **(Light, 1981).**

Bilateral dilacerated teeth have been observed in the same patient **(Rengaswamy, 1979).** While the presence of dilacerated teeth in both the maxillary and mandibular dental arches in the same patient is quite a rare phenomenon **(Lin et al., 1982).** The most common type of dilaceration is that of a tooth root angulation combined with a reversal crown direction. The palatal aspect of the crown faces the labial side and the tooth is usually impacted **(kuvvetli, 2007; Becker, 2012)** has called this condition as classic dilaceration.

1.4 Clinical Features of Dilaceration

The spectrum of clinical presentation for dilacerated tooth may vary from noneruption of the affected tooth, prolonged retention of the primary predecessor, apical fenestration of the buccal or labial cortical plate or it may be asymptomatic **(Seow et al., 1990; Yassin, 1999).** The presence of dilaceration in an impacted maxillary central incisor may be diagnosed clinically through palpation at two sites. The first site lies high on the labial side of the alveolar ridge in the vestibular sulcus. The superior midline area is delineated by the prominence of the anterior nasal spine on either side of which a shallow depression can be felt. In cases of dilaceration of the permanent central incisors, when the palatal surface of the crown faces the labial surface, there is a noticeable bulge in place of the shallow depression.

When the upper lip is pulled upward, the oral mucosa moves freely above the bulge, which indicates the outline of the cingulum area of the crown of the impacted dilacerated central incisor. If the palpation of this area is not performed meticulously, an important diagnosis may be missed **(Becker, 2012).** The second palpation area lies in the palate. With the abnormal position of the coronal portion of the tooth, such as when the crown has rotated upward 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. This feature is overlooked by most clinicians and is a more consistent finding than may be realized **(Seward, 1963).**

1.6 Radiographical Features

The recognition and diagnosis of dilacerations are essential for any tooth that requires orthodontic treatment **(Thongudomporn and Freer, 1998).** Root canal treatment or extraction. Dilaceration of a crown can be visually observed in the mouth (provided the tooth is not impacted); however, radiographic examination is required to diagnose dilaceration in the root **(Hamasha et al., 2002).** The direction of root dilaceration should be considered in two planes and they can be categorized as mesial/distal, labial/buccal or palatal/lingual. If the roots bend mesially or distally, the dilaceration is clearly apparent on a periapical radiograph. However, when the dilaceration 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. 4).

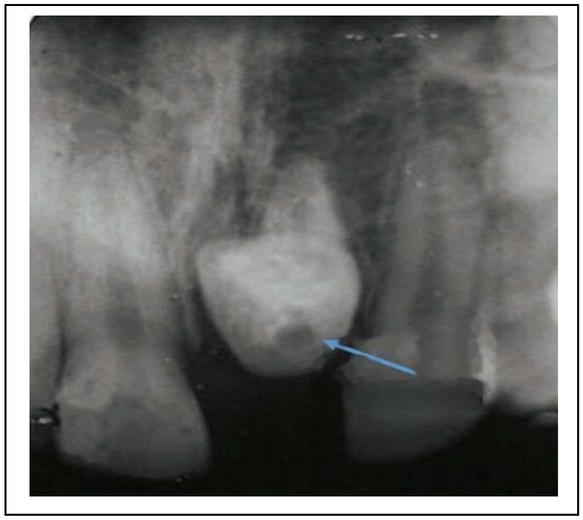

Fig. 4: Periapical radiograph showing "Bulls Eye" phenomenon in a central incisor with dilacerated root **(Pwanjit et al., 2016)**

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 **(Ingle and Bakland, 2002; White and Pharoah, 2009).**

Conventionally, radiographic diagnosis was based on two-dimensional (2D) radiographic images **(Halazonetis, 2005),**(Figures 5,6,8). 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 **(Alqerbanet al., 2001; Cevidanes, 2007).** 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),**(Figures 7,9). 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 **(Cevidanset al., 2007; Mah and Hatcher, 2004).** Therefore, the application of CBCT in the diagnosis and treatment of impacted dilacerated teeth has become increasingly indispensable.

1.7 Prognosis

The prognosis of aligning an impacted dilacerated tooth mainly depends on the following factors **(Tanaka et al., 2006):**

(1) The position and direction of the impacted tooth

(2) The degree of root formation

(3) The degree of dilaceration

(4) The availability of space for the impacted tooth

(5) The condition of the periodontium

McNamara (1998**)** 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 in root formation through the effect of its Hertwig’s epithelial root sheath. Continuing normal root development depends on the integrity of the Hertwig’s epithelial root sheath **(Mcnamara, 1998).** A dilacerated tooth with an obtuse inclination angle, a lower position in relation to the alveolar crest combined with an incomplete root formation has a better prognosis for orthodontic traction **(Chew and Ong, 2004).**

Chaushu et al. (2015) 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.

1.8 Treatment Consideration

To provide an opportunity for the non calcified root to change direction and develop a proper spatial relationship with the already calcified formed crown, the treatment of dilacerated teeth should start early **(Mcnamara et al., 1998).** 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 **(Tsai, 2002).**

Management of impacted dilacerated permanent teeth includes two different treatment approaches:

(1) Surgical exposure with orthodontic traction **(Uematsu et al., 2004; Tanaka et al., 2006)**

(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 **(Kokich and Gandcrabill, 2006; Rizzato, 2012),**(Figures 5,6,7,8,9)

(b) Surgical repositioning of the impacted central incisor, autotransplantation of a premolar to the region **(Czochrowskaet al., 2002; Tsai, 2002)** (c)Autotransplantation of a premolar to the region **(Czochrowskaet al., 2002; Tsai, 2002)**

(d) Restoration with an implant or a bridge after cessation of growth **(Becker et al., 2002).**

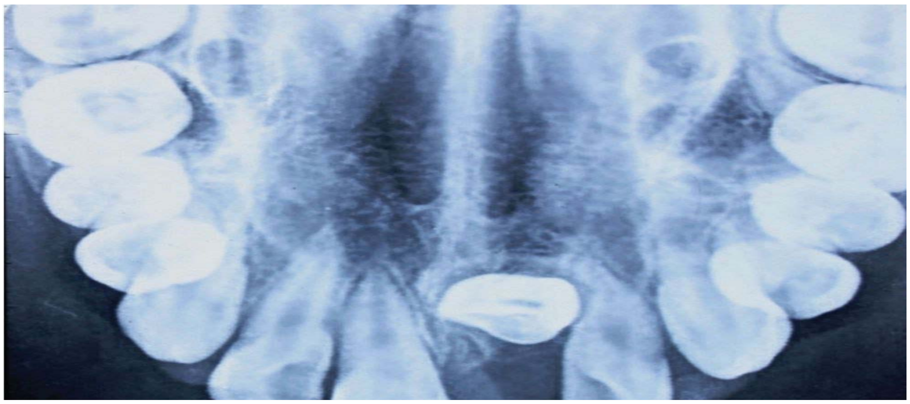

Figure 5: Occlusal view of a patient with dilacerated maxillary left central incisor **(Pwanjit et al., 2016)**

Figure 6: Panoramic view of a patient with a dilacerated maxillary permanent central incisor **(Pwanjit et al., 2016).**

Figure 7: CBCT of dilacerated tooth **(Luis, 2014).**

Figure 8: Lateral cephalogram of a patient with maxillary left permanent central incisor dilaceration **(Pwanjit et al., 2016).**

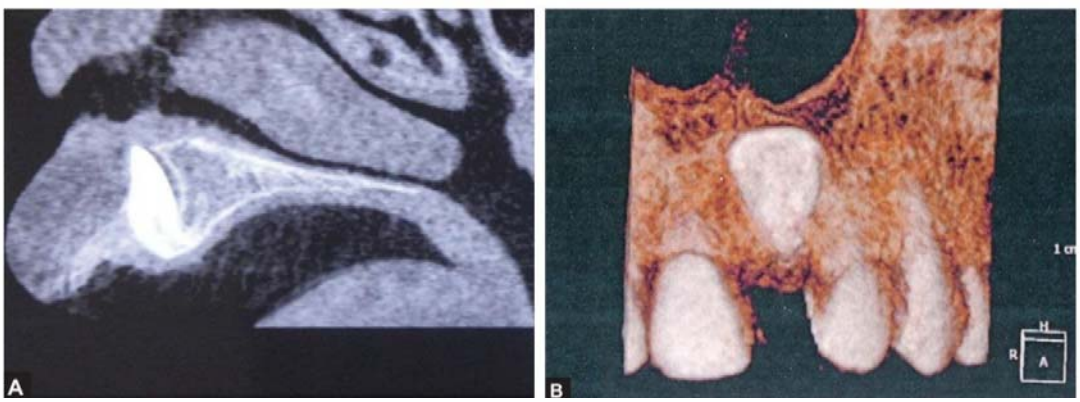

Figure 9; (a) : Sagittal section of cone beam computed tomography image showing an impacted tooth root located palatally with a large part close to palatal cortical bone, (b) three dimensional frontal photographic reconstruction from CBCT image of a patient with maxillary left permanent central incisor dilaceration **(Pwanjit et al., 2016).**

Among these, orthodontically induced tooth eruption would be the first choice based on sound evidence of its benefits **(Rizzato and Freitad, 2009; Rulleasand Mattos, 2012).** And it helps in maintaining tooth structure, provides bone stimulation and maintenance of alveolar bone width besides providing periodontal and esthetic benefits **(Rizzato and Freitad, 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 **(Pomaricoet al., 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 **(Kajiyama and Kai, 2000).**

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 **(Tanaka et al., 2001)**. In cases of root exposure, endodontic treatment and/or apicectomy would be necessary **(Lin, 1999).**

1.9 Clinical cases

1.9.1 Case 1 (A. Sumathi Felicita, 2017)

A male patient aged 14 years, with a chief complaint of irregular arrangement of teeth intra oral examination revealed a class I molar relation bilaterally. canine relation on the right side was class I. The canine relation could not be ascertained on the left side as the maxillary canine was not present in the arch. Only the incisal tip of the left maxillary canine was visible in the lef tupper buccal vestibule.

Treatment plan involved Unilateral extraction of left maxillary first premolar and lingually blocked lower central incisor, Canine retraction spring to bring the partially impacted tooth into alignment. Anterior bite plane to open the bite. Clinical evaluation of pre-treatment (Figure 12a-f) and post-treatment (Figure 13a-f).

Figure 10: Simple canine disimpaction spring placed to bring the partially impacted canine into the arch **(A. Sumathi, 2017).**

Figure 11: Canine retraction in progress. The base arch wire has been stepped up to a stiff 0.01800 round stainless steel wire with anocclusal offset in the left maxillary canine region **(A. Sumathi, 2017).**

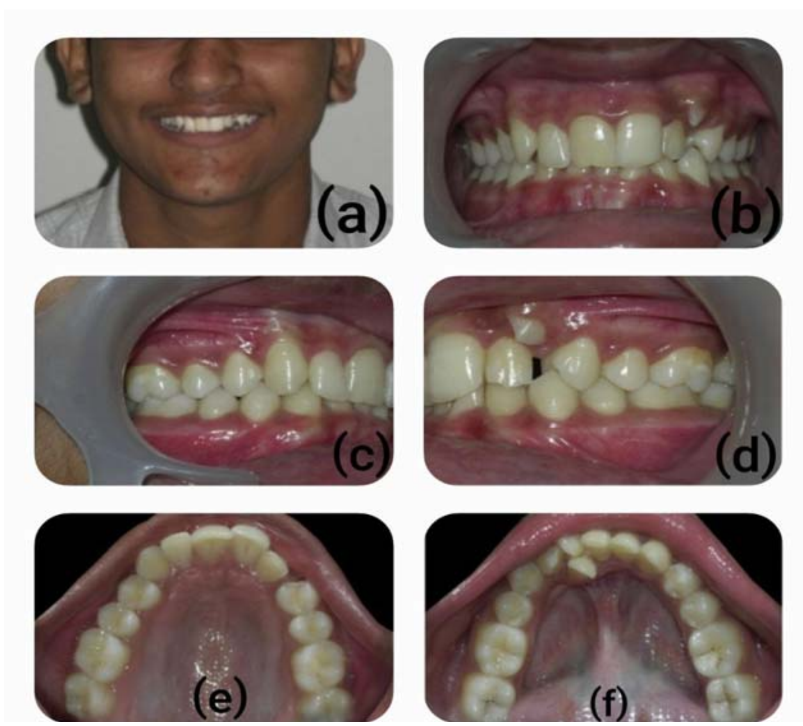

Figure 12: (a) Pre-treatment extra-oral photographs. (b–f) Pre-treatment intraoral photographs showing the partially impacted canine **(A. Sumathi, 2017).**

Photographs revealed an increase in lower anterior facial height and an improvement in the depth of the mento-labial sulcus. The upper midline was coincident with the facial midline. The lower midline did not coincide with the upper midline and the facial midline due to the lower incisor extraction. Lip competency was maintained. Intraoral examination revealed a class I molar relation bilaterally. The patient had a class I canine relation on the right side whereas on the left side the maxillary canine came into occlusion between the mandibular premolars. The mandibular teeth were well aligned. Bite opening was achieved and there was normal overjet and overbite between the maxillary and mandibular anterior teeth. The curve of Spee was flat.

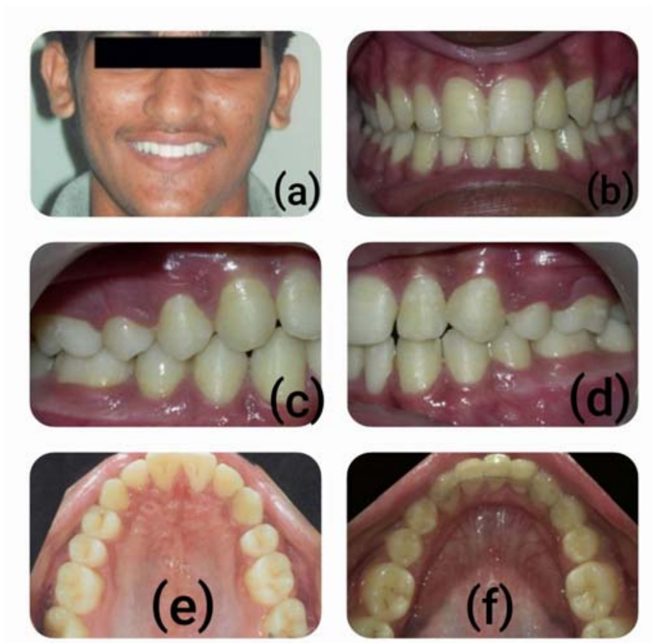

Figure 13: (a) Post-treatment extra-oral photographs. (b-f) Post treatment intraoral photographs **(A. Sumathi, 2017).**

1.8.2 Case 2 (Jose´ Valladares Neto, 2010)

A 7-year-old male patient with balanced facial pattern, and Class I skeletal relationship early mixed dentition with a dental Class II relationship on the left side only. A dilaceration was noted radiographically, and it was noted in the middle third, distally directed at approximately 80 degrees with the long axis of the tooth (Fig. 17A).

Initial treatment used an asymmetrical Klo¨ehn-type headgear to correct the left side Class II and gain some space. Concomitantly, brackets (Edgewise, 0.022 0.025-inch slot; Dental Morelli, Sa˜oPaulo, Brazil) were placed on the 3 maxillary permanent incisors, and a 3*2 segmented alignments with open coil spring was performed to redistribute space in the arch, with special emphasis to the left central incisor region (Fig. 16C). Once adequate space was achieved, a surgical-orthodontic traction was programmed. Surgery was performed to expose the un erupted incisor and attach an accessory (lingual button type) with a 0.010-inch ligature wire on it.

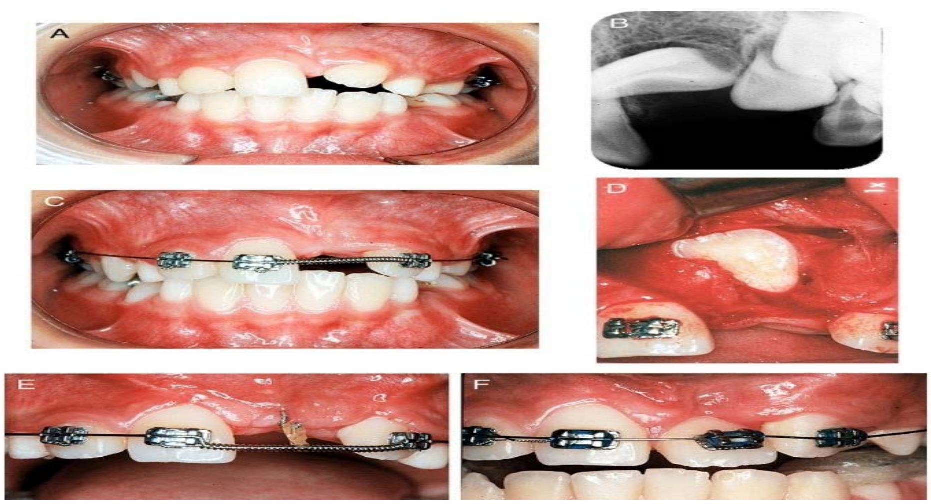

Figure 14: (A) Frontal view showing clinical absence of left maxillary central incisor with space closure and midline deviation; (B) pretreatment periapical radiograph; (C) compressed open-coil spring to open enough space for unerupted tooth; (D) surgical crown exposure showing its palatal surface; (E) elastic attached to alignment wire and hook end for initial movement; (F) left maxillary central incisor engaged in continuous arch wire showing improper tooth alignment due to divergent long axis **(Jose´, 2010)**

Orthodontic traction started 10 days later. The aim was to bring the tooth into proper position by a change in its eruption direction. Biomechanical control was performed with the aid of transpalatal arch. An extrusion force was applied by an elastic band (1/8 inch) attached in the alignment wire (Fig. 16E). As the tooth moved downward, it became obstructed and quit erupting. Mandibular occlusal splint was indicated to minimize occlusal contact. Although the tooth was asymptomatic and vital, the only strategic alternative was to perform endodontic therapy (Fig. 17B) followed by an apicectomy (Fig. 17C). By removing the dilacerated root-end, the obstructive factor allows for the subsequent alignment of the tooth with a full orthodontic appliance. This procedure restored normal appearance to the upper anterior teeth.

At 3 and 8 years after treatment, there were preserved bone, normal probing depth, no apparent root resorption, and an acceptable gingival contour.

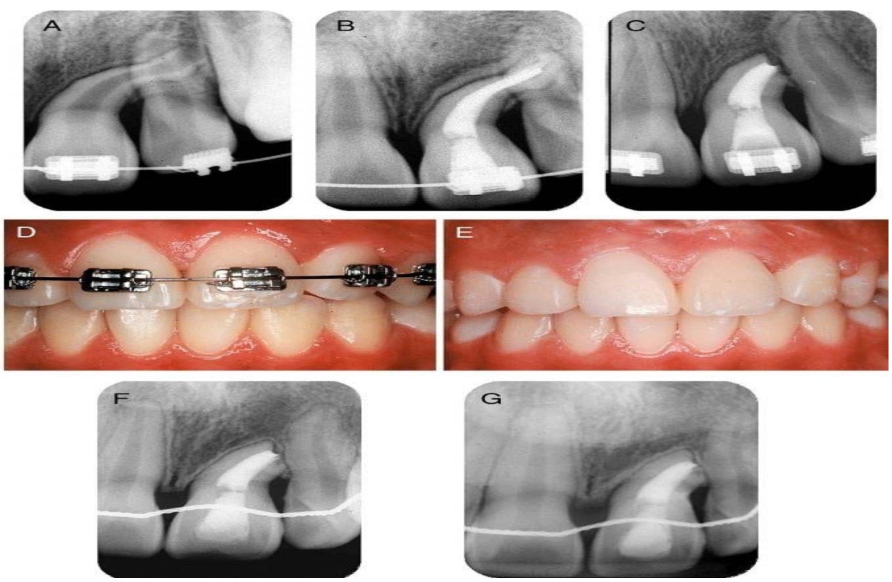

Figure 15: (A) Periapical radiograph of the root dilaceration; (B) after root canal filling; (C) and after apicoectomy. (D) Proper alignment of left maxillary central incisor after removal of interference and completion of torquing; and (E) final clinical aspect. (F) Follow-up after 3 years and (G) 8 years **(Jose´, 2010).**

Chapter two: Discussion

Dilaceration is a well-known dental defect anomaly involving change in the normal alignment of the root and the crown. Features of this entity are not well understood and present data on its origin, frequency, gender preference and most commonly involved teeth is controversial **(Ledesma-Montes et al., 2018)**

Diagnosis of unidentified veiled entities are somewhat problematic, and the panoramic radiograph is a very useful tool to detect clinically hidden lesions, tumors and alterations. Identification of teeth with dilacerated roots is not uncommon during the dental practice, Endodontics and Oral and maxillofacial pathology, but the presence of dental defect anomalies s in patients with dilaceration have not received wide attention in previous literature and its frequency and pathogenic mechanisms are unknown. According to **(Luder, 2015),**

According to the above mentioned, it was considered that root development alterations s are associated to disturbance and/or failure of the epithelial diaphragm during the early root development or to a deficient apical growth in length of the Hertwig's epithelial root sheath **(Xue et al., 2012; Tananuvat et al.,2014).** Previous studies communicated that root dilaceration can be found in patients with some genetic syndromes as Kabuki, Axenfeld-Rieger, Smith–Magenis Ehlers-Danlos and Proteus **(do Prado-Sobral et al., 2012; Berenstein-Aizman et al,. 2011; Yilmaz et al., 2013).** These patients showed dilacerated teeth and other dental anomalies: tooth agenesis, taurodontism, enamel hypomaturation, microdontia, peg-shaped lateral incisors **(Campbell,2014)**. Based on **Ledesma-Montes (2019)** we can suggest that a careful review of the radiographic material will allow the detection of veiled developmental anomalies. Precise diagnosis and timely intervention in patients with dilacerations could reduce, prevent or eliminate serious complications. It is important to point out that occurrence of simultaneous dental development anomalies suggests synchronic developmental defects during dental growth and it is suspicious for the existence of a systemic or genomic abnormality.

Chapter three: Conclusion and Suggestion

conclusion

- Dilaceration of permanent teeth is a relatively rare phenomenon but when present they pose a multitude of diagnostic, prognostic, and management challenges.
- In addition to routine clinical examination, radiographic examination is essential for diagnosing dilacerations. To reach a definitive diagnosis and improve treatment planning, the role of latest imaging tools such as CBCT is indispensable.
- Two possible etiological causes of dilaceration were suggested: (First) trauma to the primary tooth resulting in displacement of the tooth germ. (Second) developmental disturbance of unknown origin when a traumatic factor is not known.
- Treatment of dilacerated maxillary incisor impaction should start as early as possible and comprises surgical exposure followed by orthodontic traction and tooth alignment in the dental arch. For successful management a multidisciplinary approach and a high level of cooperation from the patient is required.

Suggestions

- Conduct a survey study to find out the prevalence of dilacerated teeth in orthodontic patients treated in orthodontic department(college of dentistry University of Baghdad).
- Scrutinize in the etiological factor in a further experimental and clincal studies

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