

Management of trauma to the anterior segment of the maxilla: alveolar fracture and primary incisors crown and root fracture

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ABSTRACT

Background: An injury to both the primary and permanent teeth and the supporting structures is one of the most common dental problems seen in children. Splinting is usually difficult or impossible to perform in the primary dentition (due to diminutive room size and lack of patient cooperation). Healing must, therefore, occur despite mobility at the fracture line, usually resulting in interposition of connective tissue. In some instances, infection will occur in the coronal pulp. The present study reported a case of trauma to the anterior primary teeth and alveolar bone in a four year old child. The trauma has caused fracture to the crowns and roots of the primary anterior teeth. The following case was managed in a procedure that may provide primary teeth subjected to trauma a better chance than extraction with a better prognosis.

Case presentation: a 4 and a half year old child was subjected to trauma in anterior segment of maxilla. Suturing of the torn soft tissue was the first step followed by pulpotomy for the left primary lateral incisor. Fixation of the right primary central and lateral incisors was done by acid etch wire fixation. Both clinical and radiographic follow up was carried out for 6.4 years.

Results: healing of the soft tissue was observed after one week and completed after two months. Fixation of the teeth continued for ten months. The fracture lines in the roots remained in position. Clinically there was no sign of any pulpal inflammation or necrosis. Radiographically, no signs of infection to the surrounding tissues could be seen, no resorption in the alveolar bone, external or internal resorption of the root did not happen also. After ten months fixation ended and the wire was removed. At that time there was normal resorption of the roots of the primary incisors in relation with the normal development of the permanent incisors. After 3 years both permanent central incisors erupted in their normal position. After 6.4 years all four permanent incisors erupted into occlusion in their normal position.

Conclusion: primary teeth with root fractures and severely mobile coronal fragments can be treated by a conservative approach. The severity of the sequels is directly related to the degree of permanent tooth formation (child's age), type of dental trauma and extent of the impact.

Key words: trauma, primary incisors, fractured crown and root. (Received: 18/2/2021, Accepted: 22/3/2021)

INTRODUCTION

Oral and dental trauma is common in infants, preschool and school aged children⁽¹⁾. The prevalence of traumatic injuries to primary incisors and canines was 24.4% in an Iraqi study carried out in 1988 by KH Yagot et al, being at its highest percentage in the 4 year old children⁽²⁾.

Injuries to children's teeth can be very distressing for children as well as their parents. The maxillary central incisors are most commonly involved because of their anterior position and protrusion caused by the eruptive process. The peak period for trauma to the primary teeth is 18 to 40 months of age, because this is a time of increased mobility for the relatively uncoordinated toddler. Injuries to primary teeth usually result from falls and collisions as the child learns to walk and run⁽¹⁾.

Root fractures are uncommon in teeth with incomplete root development and those in various stages of eruption because of resilience of the alveolar bone. A traumatic injury in a

deciduous tooth or in one with an incompletely formed root with less periodontal support will most likely result in a luxation or avulsion injury rather than a root fracture. Etiology of root fractures can be classified into two groups as: Group 1 comprising of fractures occurring in none endodontically treated teeth and Group 2 as fractures occurring in endodontically treated teeth. Group 1 fractures are rare and occur from accidental or occlusal trauma⁽³⁾. Few literature is available about trauma to primary dentition in Iraq. Most studies are on trauma to the permanent dentition

The treatment principles for horizontally fractured teeth mainly involve immobilizing the coronal segment so as to maintain pulp vitality. There are four healing patterns that can affect the prognosis and tissue response to dental trauma. Healing with the formation of calcified tissue, healing with the formation of interproximal connective tissue, healing with the formation of interproximal bone and connective tissue, and interproximal inflammatory tissue without healing⁽⁴⁾.

Treatment alternatives for fractured roots in primary roots depend on the stability of the coronal fragment of the injured tooth. If the coronal part of the tooth is stable and does not

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cause discomfort to the patient the tooth should only be monitored by clinical and radiographic examination post trauma until the permanent tooth erupts. If the tooth is mobile and the patient causes discomfort the coronal fragment should be removed. If the apical fragment should be left to resorb so as not to disturb the developing permanent tooth⁽⁵⁾.

The following case was managed in a procedure that may provide primary teeth subjected to trauma a better chance than extraction with a better prognosis.

Case Presentation

A four and a half year old boy was subjected to trauma in the anterior segment of the maxilla late in the evening. The cause of the trauma was an accidental fall on another child's head in a chasing game. The child was seen by a dentist at home (author) within the first minute. The following was revealed:

- There was fracture of the alveolar socket wall of the maxilla in the labial cortical plate extending from the area of the primary right lateral incisor to that of the primary left central incisor. The gingiva covering this area was torn off and attached only in the flange area.
- The apices of the roots of the maxillary right primary central and lateral incisors were seen orally displaced labially while their crowns were displaced palatally.
- The maxillary left primary central incisor was fractured at the cervical area. The fracture was oblique extending labially in the cervical third to the palatal side subgingivally. The fractured segment was attached palatally by few periodontal ligaments.

The immediate response was wetting sterile square gauze (Shahrazad gauze sponges, China) with normal saline and holding the fractured parts with repositioning them in their position and stabilization by hang grip until a clinic was reached.

After reaching a dental clinic local infiltration anesthesia was administered labially and palatally. The whole treatment was modified according to what was available in the clinic of a non-specialized dentist in a rural region. The first step was suturing the torn gingiva using a transverse cutting suturing needle (made for suturing skin and thick tissues) which was the only available type. Extreme care was taken during suturing since the soft tissue was already torn and approximating the edges was very difficult. After suturing bleeding was controlled. It was decided to maintain the left primary

incisor (the remaining root) although it was not savable but the decision was made to make use of this incisor's root and surrounding bone for stabilizing the fractured parts otherwise its removal will create a hollow space in the alveolar process that will weaken the maxilla anteriorly and cause its collapse in this region. Formocresol pulpotomy was carried out for the left central incisor.

The third step was fixation of the traumatized teeth to the non-traumatized teeth and this procedure was also modified because stainless steel wire of any type or diameter was not available and at that time it was late at night and obtaining a wire was incapable. The dental needle (Septoject XL, Septodont, France) is made of stainless steel with a diameter of 0.4mm (27 G, 0.40 × 35 ") so two needles were extracted from their plastic base and twisted together in order to gain the strength of a 0.8mm stainless steel wire. It was then bended and adapted to the curvature of the dental arch of the maxilla. Light cured composite filling was used to attach the twisted wire to the labial surfaces of the teeth extending from the right primary molar to the left primary canine (figure1).



Figure 1: Suturing of soft tissue and fixation of teeth using two twisted dental needles.

During the next day the oral hygiene was improved by continuous mouth washing and irrigating the traumatized region with normal saline. Antibiotic therapy was started. The child was then taken to a specialized dental clinic and the procedure of fixation was repeated to replace the twisted wires with a braided retainer wire (ORTHO TECHNOLOGY, USA) (figure 2).



Figure 2: Replacement of twisted wire with a braided retainer wire

The child was affected psychologically by the loss of the primary left incisor crown, therefore an impression was done for the fractured segment of this tooth and an identical crown was fabricated using composite (Tetric EvoCeram, Ivoclar Vivadent, Liechtenstein). It was then attached to the wire in the same way of attachment of the wire to the rest of the tooth. In this way the appearance of the anterior teeth was restored (figure 3).



Figure 3: Replacement of the lost left central incisor crown with a fabricated replica.

A periapical radiograph for the central and lateral incisors was taken (figure 4) and it revealed fracture of the roots of the right primary central and lateral incisors. Two lines of fracture were seen in the central incisor (in the middle and apical thirds) and one fracture line in the middle third of the lateral incisor.



Figure 4: Periapical radiograph showing lines of root fracture in the right primary central and lateral incisors.

Follow up clinical and radiographic examination was done. The clinical results (as illustrated in figure 5) were healing of the soft tissue and although there was deficiency in gingival extension and root cementum exposure they reduced with time and with the maintaining of good oral hygiene. The color of the teeth (right central and lateral incisors) remained normal which was a sign that the teeth didn't develop necrosis. The wire was removed 10 months later. The mobility reduced to reach the normal physiological degree (figure 6).

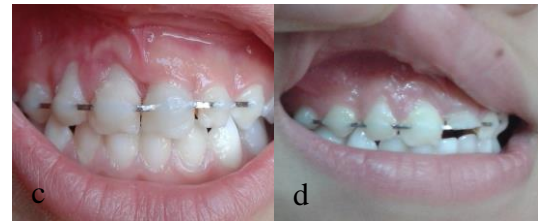
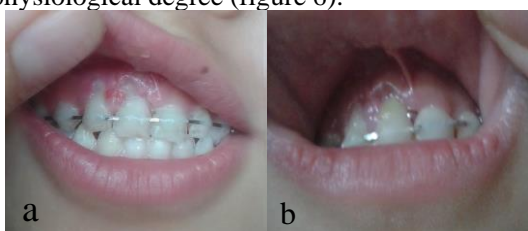


Figure 5: clinical results of follow-up; a-removal of sutures one week after suturing b, c and d show soft tissue healing (b-2 weeks, c-3 weeks and d-3 months). Note the color of the teeth has not changed.

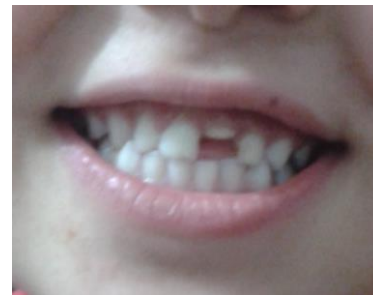


Figure 6: removal of the wire.

After the removal of the wire (10 months later) a final periapical radiograph was taken and it showed normal physiological resorption of the roots of the involved teeth and normal positioning of the developing permanent successors (figure 7).

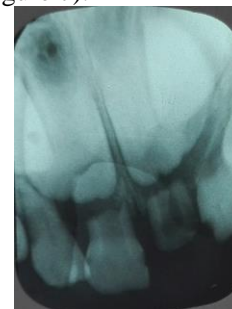


Figure 7: follow up x-ray showing normal resorption of the roots (note; the age of the child at this x-ray was 5 years and 2 months)

Both figures 8 and 9 show the eruption of the permanent central incisors after the exfoliation of the primary incisors. The permanent lateral incisors have not erupted yet. Their eruption occurred later on (as shown in figure 10).



Figure 8: follow up after 2 years clinical view showing eruption of both central incisors (note; the age of the child at this time was 6 years and 10 months)



Figure 9: follow up after 3 years clinical view showing eruption of both central incisors (note; the age of the child at this time was 7 years and 1 month)



Figure 10: follow up after 6.4 years clinical view showing eruption of both central incisors and lateral incisors into occlusion (note; the age of the child at this time was 10 years and 9 months)

DISCUSSION

In general, trauma to primary teeth is a neglected health problem. A meta-analysis on traumatic dental injuries reveals a world prevalence of 22.7% affecting the primary dentition⁽⁶⁾. It should be noted that the emergency treatment of this case was by using materials not suitable to suture or to fix this type of trauma in an oral cavity of a young child. The immediate response to position and stabilize the fractured parts within a minute and the use of normal saline during this procedure may have been the reason for minimizing wound infection and intraosseous infection (in addition to the improvement of the oral hygiene). This may have played a role in maintaining the fracture line of the roots of the right central and lateral incisors intact. It may have also minimized the chance of root canal infection which was obvious by the normal color of those teeth that persisted throughout two years. Radiographically, absence of internal, external and periapical radiolucency also confirmed the absence of infection in the roots and alveolar bone⁽⁵⁾.

The decision to not extract the primary teeth was made for many reasons. One of the reasons was to make use of these incisors roots and surrounding bone for stabilizing the fractured parts as described previously in the method. Another reason is that premature loss of a primary tooth can lead to eruption problems in the permanent successor tooth, even if treatments are done to recover and maintain space, because there is no way to accelerate the formation of root or stop the eruption of a permanent tooth (having an immature root)⁽⁷⁾. The degree of permanent

tooth development (in general) does not differ after the extraction of its primary predecessor. An eruption impulse occurs after the extraction of the primary element, regardless of the development stage of the permanent germ or the age of the child. This has been observed when a primary molar is extracted due to infection that has spread to the periapical area followed by the eruption of an under developed premolar in the oral cavity with mobility that may cause the tooth to fall off during mastication⁽⁸⁾. Malmgren et al stated the importance of treating the traumatized primary dentition in a more conservative approach rather than to advocate routine tooth extraction⁽⁵⁾. Following a conservative approach may help to reduce the additional suffering for the child and reduce the risk of further damage to the permanent teeth⁽⁹⁾.

Treatment of alveolar process fractures requires manually repositioning the segment of displaced teeth back into proper arch alignment. A very rigid splint would be required for two months.⁽¹⁾

A horizontal root fracture is classified based on the location of the fracture in relation to the root tip (apex)⁽¹⁾. Horizontal root fractures may occur in the apical third, middle third, or cervical third of the root. The prognosis worsens the further cervically (towards the crown) the fracture has occurred. Tooth fractures are often not apparent during a clinical examination, and can usually only be diagnosed using appropriate radiographs. Sometimes radiographs with at least two views are required for making this diagnosis⁽¹⁾.

The wire was removed 10 months later. This decision was made not depending on a previous reference. The mobility of the affected teeth reduced to reach the normal physiological degree and after about one year and eight months, two thirds of the roots showed resorption (noted on radiograph). This result was also seen in another study that treated mid-root and apical third horizontal root fracture in both primary central incisors by splinting using orthodontic brackets and stainless steel wire for three months. Physiological mobility was obtained and normal root resorption occurred with the eruption of the permanent incisors⁽¹⁰⁾.

What appeared to occur due the force of trauma to the primary teeth was seen after the eruption of the permanent left central incisor in the form of Turner's hypoplasia. Turner's hypoplasia is found in the anterior area of the mouth, the most likely cause is a traumatic injury to a primary tooth. The traumatized tooth, which is usually a maxillary central incisor, is pushed into the developing tooth underneath it and consequently

affects the formation of enamel. Because of the location of the permanent tooth's developing tooth bud in relation to the primary tooth, the most likely affected area on the permanent tooth is the facial surface. The morphologic and/or mineralization effects of trauma on the permanent successor is highest at an age ranging from 0 to 4 years old and diminishes with aging (6, 11).

As conclusion, within the limitations, this case illustrated the favorable prognosis of two primary teeth with root fractures and severely mobile coronal fragments in addition to alveolar bone fracture by a conservative approach. Root-fractured primary teeth can be maintained by reduction of tooth mobility and immobilization with a semi-rigid splint. The severity of the sequels is directly related to the degree of permanent tooth formation (child's age), type of dental trauma and extent of the impact.

Conflicts of interest

The authors has nothing to disclose.

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المستخلص

المقدمة: تعد إصابة الأسنان الأساسية والدائمة والأنسجة المحيطة أحد أكثر مشكلات الأسنان شيوعاً عند الأطفال. عادة ما يكون من الصعب أو المستحيل القيام بعملية التثبيت في الأسنان الأولية (بسبب حجم الفم الصغير وقلة تعاون المريض). لذلك يجب أن يحدث الشفاء على الرغم من عدم ثبات منطقة الكسر ، مما يؤدي عادةً إلى تداخل الأنسجة الضامة. في بعض الحالات ، سوف تحدث العدوى في لب السن. هذه الدراسة عبارة عن تقرير عن حالة صدمة للأسنان اللبنية الأمامية وعظم الفك عند طفل عمره أربع سنوات. تسببت الصدمة في كسر في تيجان وجذور الأسنان الأمامية اللبنية. تمت معالجة الحالة التالية في إجراء قد يوفر للأسنان اللبنية المعرضة للصدمة فرصة أفضل من قلعه مع نسبة توقع نجاح العلاج أفضل. المواد والطريقة: تعرض طفل في الرابعة والنصف من العمر لاصابة في المنطقة الامامية للفك العلوي. كانت خياطة الأنسجة الرخوة الممزقة هي الخطوة الأولى تليها حشوة تحنيط العصب للسن القاطع اللبني الايسر. تم تثبيت القاطع الوسطي والجانب اللبني الايمن عن طريق تثبيت سلك معدني باستخدام مادة حشوة ضوئية. تم إجراء المتابعة السريرية والإشعاعية لمدة ست سنوات واربعه اشهر. النتائج: لوحظ شفاء الأنسجة الرخوة بعد اسبوع واحد واستكمل بعد شهرين. استمر تثبيت الأسنان لمدة عشرة أشهر. ظلت خطوط الكسر في الجذور ثابتة في موقعها. سريريا لم يكن هناك أي علامة على أي التهاب اللب أو نخر. من الناحية الإشعاعية ، لا يمكن رؤية أي علامات للإصابة بالأنسجة المحيطة ، ولا يحدث ارتشاف في العظم السنخي ، ولا يحدث ارتشاف خارجي أو داخلي للجذر أيضاً. بعد عشرة أشهر انتهى التثبيت وتمت إزالة السلك. في ذلك الوقت كان هناك ارتشاف طبيعي لجذور القواطع الأولية فيما يتعلق بالتطور الطبيعي للقواطع الدائمة. بعد 3 سنوات بزغت القواطع المركزية الدائمة في وضعها الطبيعي. بعد 5 سنوات ، اكتمل بزوغ القواطع الأربعة الدائمة في مكانها الطبيعي. الخلاصة: يمكن علاج الأسنان الأولية التي تعاني من كسور في الجذر وشظايا الاكليلية شديدة الحركة من خلال نهج متحفظ. ترتبط شدة التداعيات بشكل مباشر بدرجة تكوين الأسنان الدائم (عمر الطفل) ونوع صدمة الأسنان ومدى التأثير. الكلمات المفتاحية: الصدمة ، القواطع اللبنية ، التاج المكسور والجذر.



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