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The management-concept of traumatic dental injury in primary tooth: Narrative Review

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Abstract

Traumatic dental injury in primary tooth is an injury which is involving not only the tooth but also supporting tissue around the tooth. This injury often occurs in children after getting accident, doing sport activity or even learning to walk, then the tooth and its supporting tissue getting physical impact. As consequence, this accident causes pain, emotional stress in the patient. Moreover, traumatic dental injury in primary tooth not only damaging the primary tooth which is involved in the physical impact, but also could interfere the development of permanent tooth. Therefore, it is necessary to understand and comprehend the management concept of traumatic dental injury to have excellent result of the treatment.

Keywords: Dental injury; Traumatic dental; Avulsion; Luxation; Human and health

1. Introduction

Dental trauma in primary tooth is an injury of primary tooth and supporting tissues around tooth due to physical impact. This dental trauma usually occurs at an early stage due some reason such as learning to walk, sport activity or getting accident and unexpectedly occurs. Moreover, this traumatic injury requires immediate response by dentist to treat the injury in appropriate way [1]. Interestingly, this incident often occurs between 2 – 6 years, where the main reason due to collision and falls. This accident not only affect to dental structure, but also usually affect to periodontal tissue, including gingiva. Children who have this injury, suffered a lot of pain and interfere their daily activity, hence professional care such as dentist should have good knowledge, skill to treat traumatic dental injury in primary tooth appropriately [2].

Besides result in pain, emotional stress and interfering esthetic, dental trauma in primary tooth may causing damage in permanent tooth due to interfering the developmental stage of permanent tooth. Some variance effect after dental trauma in primary tooth in permanent tooth are hypoplastic defect, dilaceration, hypomineralized enamel. This effect is hardly observed shortly after injury, but observed after permanent tooth erupted. Some study reveals luxation, extrusion, intrusive, extrusion causing some permanent tooth problem such as hypoplastic enamel, root dilaceration and discoloration of enamel [1,3,4].

As it is known that, permanent tooth is also important for mastication, phonetic and also as one of anatomy parts used in daily, however this function probably will be disturbance due to traumatic dental injury [5]. Hence, by understanding

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the knowledge to treat traumatic dental injury in primary tooth appropriately could overcome not only initial complaint of patient such as pain, bleeding and others, but also prevent the effect to the development of permanent tooth.

2. Etiology

Based on common causes, the etiology of traumatic dental injuries in primary teeth can be classified as follows [6–8]:

- Falls
- Accidents
- Sports injury
- Physical abused

While another reference classified the traumatic dental injury into 3 categorize [6]:

- Intentional injuries such as child abuse and neglect
- Unintentional accidents such as falls, road accidents, collision, or handicap children
- Sport activities such as cycling, horseback riding, soccer, or other contact sports

Traumatic dental injury also can be classified into [6] :

- Direct trauma, where the dentition directly contacts or directly impact by some object such as stick, ball, fist, etc.
- Indirect trauma, where the dentition not directly contacts by some object due to fall, accident, etc. In this indirect trauma impact comes first to the chin, then suddenly causing forceful closure of mandibula and maxilla, as consequences it damages the tooth.

3. Predisposing factors

There are some factors which is enlarge the risk occurring of traumatic dental injuries such as [6,8]:

- Children with convex profile. Convex profile is one of factor that may increase the risk of traumatic dental injury. Increasing overjet, protrusion, angle class 2 division 1 are categories of convex profiles.
- Handicapped children and epileptic patients. This factor is associated with abnormal muscle tone and poor skeletal-muscle coordination such as cerebral palsy, intellectual disabilities or epilepsy. They are more susceptible to injuries due to abnormal muscle tone and function in the oral area, which can result in maxillary protrusion , as well as frequent falls caused by poor muscle coordination.
- Dental anomalies and caries. Caries and dental anomalies such as enamel hypoplasia, amelogenesis imperfecta results in weakening of tooth structure, then after getting impact, the tooth is easily broken.
- Mechanical factors. The severity of injury depends on:
    - Energy of impact. The calculation of impact energy based on this calculation, Energy = Mass x Velocity, then greater mass and high velocity will produce more impact
    - Resilience of impacting object. When the tooth impacts with some object, and its contact to the lips firstly, then the risk of crown fracture is reducing, while the risk of luxation and alveolar fracture is increasing. Moreover, more injury is bound to occur in the case of former and less in case of later.
    - Shape of impacting object. Sharp object causes clean fracture with minimum of displacement of tooth, due to energy spread in limited area, while blunt object causes luxation and root fracture.
    - Direction of impacting force. Direction of impacting force play an important role in traumatic dental injury. Type fracture will directly depend on direction.

4. Prevalence of traumatic dental injuries in primary teeth

The prevalence of traumatic dental injuries in primary teeth is variance. Some study showed that prevalence of traumatic dental injuries in primary dentition is between 11 – 47% globally. Geographical, socioeconomic, and behavioral variations between study locations and nations, as well as incoherence in applied trauma classification systems, are likely the causes of the significant variation in reported prevalence of traumatic dental injuries in primary teeth [9]. Fitzigibbon et al. also mention that prevalence of traumatic dental injuries in primary teeth in males (65%) are higher than in females (35%) with 63% affect a single tooth, 26% affect two teeth and 35% affect three and more

teeth. Moreover, 89% classify as single dental trauma, while 11% classify as recurrent dental trauma. Based on figure 1, upper central incisor is the most common traumatic dental injuries in primary teeth, followed by lateral central incisor. While the other primary teeth rarely involves in traumatic dental injuries. Figure 2 shows that most common type of lesions of traumatic dental injuries according to Andreasen's classification. Concussion, root fracture, subluxation, and intrusive luxation are the cost common injuries occurred in children [10].

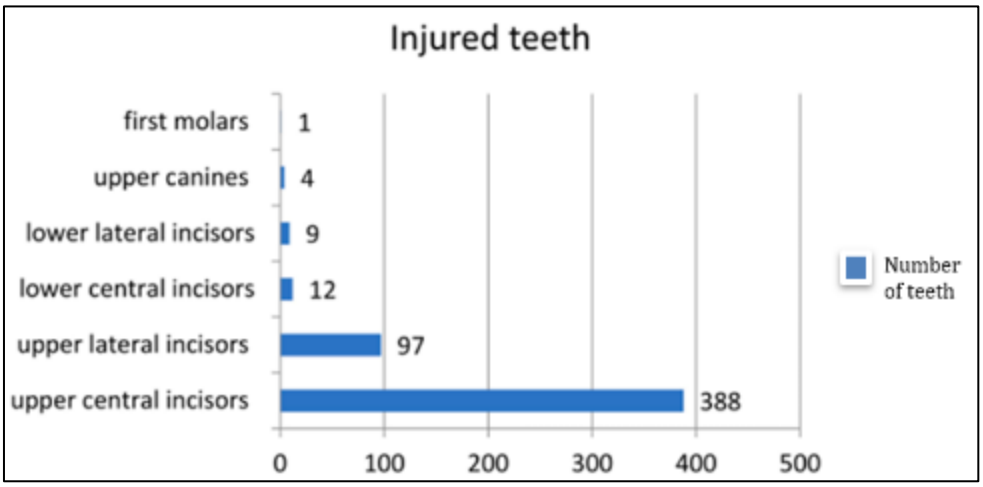

Figure 1 Most common injured teeth [10]

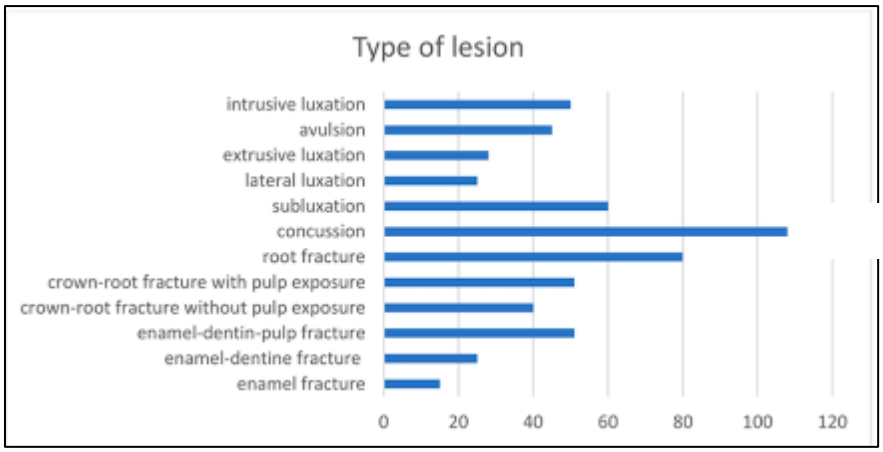

Figure 2 Distribution of dental trauma type [10]

5. Classification of traumatic dental injuries in primary teeth

There are various classifications of traumatic dental injuries. However, one of the most commonly used systems for classify traumatic dental injuries in primary teeth is Andreasen's Modification of World Health Organization (WHO) Classification, which is described as follows [11]:

- Enamel infraction and fracture. Enamel infraction is defect (crack) without enamel fracture, while an enamel fracture is small rupture or crack of the enamel only.
- Crown fracture without pulpal involvement. In this case, there is involvement of enamel and dentin without pulp exposure in crown fracture.
- Crown fracture with pulpal involvement. This is crown fracture with involvement of enamel, dentin and pulp exposure.
- Crown-root fracture. Crown-root fracture is fracture involves enamel, dentin, cementum (root), with or without pulp exposure.
- Root fracture. This fracture involves cementum, dentin and pulp.

- Concussion. Concussion is minor injury of periodontium without displacement of the tooth and no mobility.
- Subluxation. This dental trauma is minor injury of periodontium without displacement of the tooth, but slightly mobility occurred.
- Extrusive luxation. There is displacement of the tooth in extrusive direction, but still in the periodontal socket (the tooth is not totally out from the socket/ not avulsion)
- Lateral luxation. In lateral luxation there is displacement from its long axis, the crown could be going to labial or palatal direction.
- Intrusive luxation. The tooth displaces apically, and could damaging neurovascular bundle entering pulp and severe damage to periodontium and cementum.
- Avulsion. It is completely displacement of tooth, displace from alveolus.

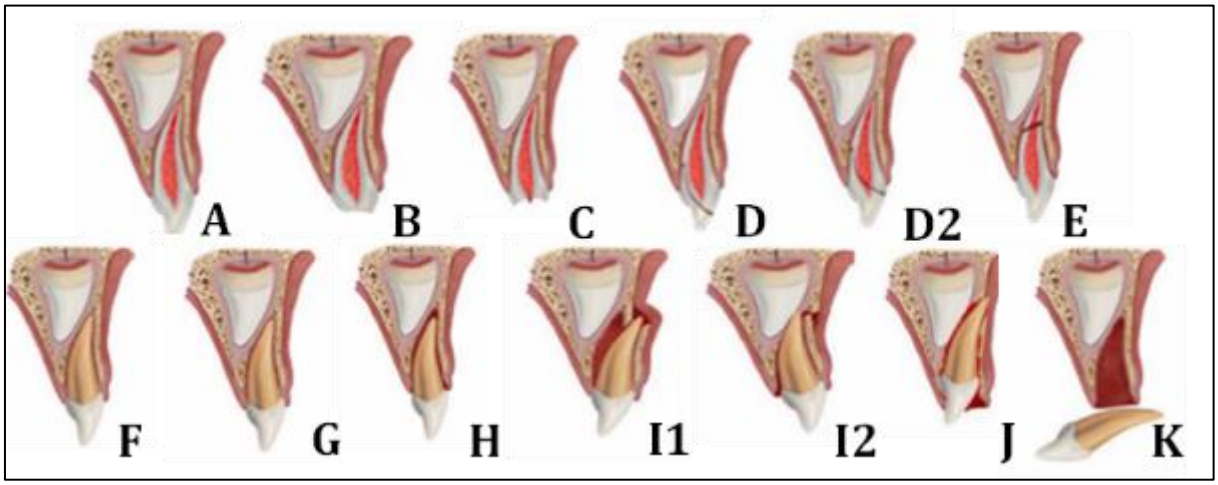

Figure 3 Various traumatic dental injuries, enamel fracture (A), crown fracture without pulpal involvement (B), crown fracture with pulpal involvement (C), crown-root fracture without pulpal involvement (D1), crown-root fracture with pulpal involvement (D2), root fracture (E), concussion (F), subluxation (G), extrusive luxation (H), lateral luxation-crown to palatal (I1), lateral luxation-crown to buccal (I2), intrusive luxation (J), avulsion (K) [2]

6. Management and procedure of traumatic dental injuries in primary teeth

The management and procedure of traumatic dental injuries in primary teeth includes the following steps [2,6]:

- Initial presentation and minimizing anxiety to the child and parent
- Obtaining history (initial assessment)
- Clinical examination (initial assessment)
- Providing first aid
- Treatment of the injury

6.1. Initial presentation and minimizing anxiety the child and parent

Managing dental treatment in children is always challenging, even more so in traumatic dental injury case. It is crucial to reduce the child and parents or caregivers nervousness (anxiety) on the first visit. The children may not cooperate for a thorough examination, radiography, and treatment at this age. Examining from knee-to-knee to this patient may ease the examination [2].

6.2. Obtaining history (initial assessment)

Obtaining history is fundamental step in this case, this step should be done quickly and precisely. Obtaining history consist of personal data (name, age, sex, address), complaint and its history (pain, displacement and mobility of tooth, bleeding, when and where dental trauma occurred; clean or not clean area or wound tetanus prone, history of tetanus vaccine, previous dental history, medicine, sign or symptoms of neurological damage; such as nausea, vomiting, headache, bleeding, inability to sit, etc [6].

6.3. Clinical examination (initial assessment)

Clinical examination, at least consist of extraoral examination and intraoral examination. Extraoral examination consist of hemorrhage (subconjunctival hemorrhage indicating zygomatic fracture), laceration (suspect there is foreign bodies or tooth fragments), deviation in mandible (suspect injury TMJ). Intraoral examination consist of soft tissue examination such as laceration in the oral cavity (gingiva, labial mucosa); tooth fragment; hematoma in the floor mouth (indicating mandible fracture), hard tissue examination such as displacement and mobility of tooth; occlusal abnormalities (suspect fracture dentoalveolar, mandible, maxilla), fracture dental. Panoramic X-ray radiography, maxillofacial CT scan, Cone Beam Computed Tomography (CBCT) could be used to support the examination [6].

6.4. Providing first aid

Trauma of orofacial could create respiratory obstruction due to bleeding into oropharynx and nasopharynx, then make sure that there is no interfering of airway, if needed tracheostomy, endotracheal intubation may have to be performed. Bleeding must be stopped by adequate debridement and apply tampon in bleeding area or using some hemostatic agent, deep cuts and laceration should be sutured. Antibiotic, analgesic, anti-inflammation should be considered to be given in severe cases. Tetanus Prophylaxis (Vaccine Tetanus Toxoid, Human Tetanus Immunoglobulin, antibiotics) should be administered as follows regime [6]:

- There is vaccination tetanus toxoid (TT) history, with booster dose within 12 months, where the wound clean: no additional TT required (intramuscular)
- No vaccination tetanus toxoid (TT) or vaccination was given more than 10 years with or without booster dose within 10 years, where the wound clean: TT required 0.5ml intramuscular
- Vaccination was given more than 10 years, wound is not clean or tetanus prone: Human Tetanus Immunoglobulin (HTIG) 250 IU, TT required 0.5ml intramuscular
- No history of vaccination tetanus toxoid (TT), wound is not clean or tetanus prone: Human Tetanus Immunoglobulin (HTIG) 250 IU, TT required 0.5ml intramuscular, antibiotic such as penicillin also be advised.

7. Treatment of the injury (dental aspect)

7.1. Enamel infraction and fracture

There is no treatment required for enamel infraction [8] if the infraction is mild. However, if a small fracture on enamel occurs, the sharp edges of enamel can be rounded and smoothed. Topical fluoride also can be added after smoothing the enamel. If the defect is extensive, it can be restored by composite resin or glass ionomer cement [2,6–8,11,12].

7.2. Crown fracture without pulpal involvement

If the tooth fragment has been saved, attempt to reattach it using glass ionomer cement or composite resin However, if the tooth fragment has not been saved, restore the tooth by glass ionomer cement, composite or crown (preformed polycarbonate crown or by fabricated acrylic jacket crown). Consider pulp protection such as calcium hydroxide or glass ionomer cement liner if the damage is close pulp chamber [2,6–9,11–13].

7.3. Crown fracture with pulpal involvement

If the tooth is vital, the treatment is variance, such as direct pulp capping, pulpotomy [6], pulpectomy (root canal treatment) [11] even extraction [12]. If the tooth is vital with an open apex, it is advantageous to preserve the pulp vitality by pulp capping or pulpotomy [12]. If the tooth is vital with a closed apex, then pulp capping, pulpotomy or root canal treatment could be option for the treatment [2,6–8,11,12]. If the tooth is non vital with closed apex, then root canal treatment could be an option [6,11]. If the tooth has an advance resorption, extraction should be considered [8,12].

7.4. Crown-root fracture

In crown-root fracture case, there is two conditions including restorable or unrestorable tooth. If restorable without pulp involvement, then exposed dentine can be covered by glass ionomer cement [2]. If restorable with pulp involvement, the treatment can be referred based on crown fracture with pulpal involvement [11]. In it is unrestorable, then extraction the tooth should be considered [2,12]. The extraction must be performed carefully to avoid damaging the permanent successor tooth, leave any firm root fragment in situ or extract the entire tooth [2].

7.5. Root fracture

In root fracture of primary tooth, basically there is three options, depending on the root fracture condition. If the coronal fragment is not displaced (usually in cases of 1/3 apical root fractures), no treatment is required, as the tooth usually maintain its vitality and physiological resorption will occur [2,6,7]. If the coronal fragment is displaced (usually in cases of 1/3 middle or 1/3 coronal fractures), some experts recommend gently repositioning the coronal fragment using a flexible splint for 4 weeks [2] and perfoming root canal treatment on the coronal portion if necrosis pulp around coronal portion is suspected, then allowing the apical segment is resorbed naturally [11] Alternatively, others may choose extract the coronal fragment and root fragment (if possible and the root is not firmly attached) or extract the coronal fragment and leave the root fragment to resorbed naturally [2,6,7,11,12].

7.6. Concussion

In concussion case, no treatment is usually required , only observation. However, the patient should be advised to exercise caution while eating to avoid further traumatizing the injured tooth (keeping it free from occlusion as much as possible) until it returns to normal function. A soft diet should be recommended, along with maintaining good oral health [2,6,8,11,12].

7.7. Subluxation

Basically, the treatment of subluxation is similar to concussion [2,11,12].

7.8. Extrusive luxation

The treatment of extrusive luxation depends on the severity of extrusion. If the extrusion is not severe (minor extrusion; < 3mm), some clinicians suggest careful repositioning and splinting of the tooth for 2-4 weeks [6,11,12], while the others are leaving the tooth for spontaneously repositioning [2,7,12]. If the extrusion is severe (> 3mm), extraction is indicated due to the potential aspiration of mobile teeth (severe mobility), interference the occlusion, potential damage the tooth permanent bud [2,6–8,12].

7.9. Lateral luxation

The treatment of lateral luxation depends on the crown direction and the severity of luxation. Some expert suggest that if the lateral luxation is mild, and there is no occlusal interference, the tooth can be allowed to reposition spontaneously [2]. Other references state that if the crown of tooth is luxated to the palatal direction (root is luxated labially), the tooth should be gently repositioned using combined palatal and labial pressure and then splinted for 2-4 weeks. If the crown is luxated to the labial direction (root is luxated palatally) and the displacement is minor (< 2mm), the tooth should also be gently repositioned using combined palatal and labial pressure then splinted for 2-4 weeks [2,6,8,11,12]. However, if it is severe displacement (>2mm) or the tooth mobility is also severe, extraction is indicated due to the potential damage to the permanent tooth bud or ingestion of tooth [2,6,8,12].

7.10. Intrusive luxation

If the intrusive tooth is mild (less than three-quarter of the crown) and does not interfering the permanent successor, the tooth can be allowed to re-erupt (3-6 months) spontaneously [2,6–8,12], while other reference suggested repositioning and splinting [11]. If the intrusive is severe (more than three-quarter of the crow) or interferes with the permanent successor (apex displace into permanent tooth germ), then extraction the tooth is indicated [6–8,12].

7.11. Avulsion

Avulsion of primary teeth should not be replanted. It can interfere the development of permanent tooth bud and high failure rate because of infection [2,6–8,12]

8. Conclusion

Traumatic dental injuries in primary teeth are the common dental issue in children and requires quick, precise treatment. The treatment must consider all medical aspects which is involving in excellent treatment. Minimizing anxiety, initial assessment, providing first aid, treatment of the injury are some procedure steps to generate the excellent treatment. This narrative review demonstrates the traumatic dental injury cases and its treatment options, depends on the condition and severity of dental trauma. By following these scientific procedures, the excellent treatment should be achieved.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this document

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