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Dental Trauma of Anterior Teeth Among Sample of Iraqi Primary School Students in Karbala City

A Project Submitted to

The College of Dentistry, Al Zahrawi University, Department of Pediatric in Partial Fulfillment for the Bachelor of Pedodontics

By

Noor alhuda Razaq Kadhum

Hawraa Razaq Kadhum

Fatima Razaq Kadhum

Maryam Satar Jalab

Supervised by:

Dr. Rihab Abdul Hussein Ali

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Certification of the Supervisor

I certify that this project entitled " **Dental Trauma of Anterior Teeth Among Sample of Iraqi Primary School Students in Karbala City**

" was prepared by the fifth-year students **Noor alhuda Razaq Kadhum, Hawraa Razaq Kadhum, Fatima Razaq Kadhum, Maryam Satar Jalab** under my supervision at the College of Dentistry/ Al Zahrawi University in partial fulfilment of the graduation requirements for the Bachelor Degree in Dentistry.

Supervisor's name

Dr. Rihab Abdul Hussein Ali

Date

/2025

Dedication:

we would like to dedicate our humble effort to our supportive parents. Their affection, love, encouragement and prays at day and night made us able to succeed with honor.

To my brothers, sisters,
friends, and colleagues who shared their
words of advice and encouragement.

Those who encourage and support us, all the people in my life who touch our heart .

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TDIs	Traumatic dental injuries
CBCT	Cone beam computerized tomography
TIC	time elapsed between the traumatic event and the diagnosis of complications
SPSS	Statistical Package for the Social Sciences
SD	Standard Deviation
ANOVA	Analysis of variance

Introduction

Appearance is very important to gain someone's self-confidence. The condition of the teeth greatly affects a person's appearance, especially the anterior teeth. Aesthetic dentistry has become popular and deals with maintain and enhancement of one's smile, while also playing a major role in the correction of facial profiles and jaw discrepancies **(Aliudin,2018).** Dental abnormalities or anomalies such as changes in shape, size, position, color, or texture of anterior teeth will disrupt the harmony of a person's smile **(Devasya,2016).**

Traumatic dental injuries (TDIs) refer to injuries to the teeth and their supporting structures caused by an external impact. These injuries are common in children and adolescents but can occur at any age. Traumatic dental injuries can involve hard dental tissues (enamel, dentin, cementum), the pulp, periodontal ligament, and alveolar bone. The clinical presentation of Traumatic dental injuries can vary from minor enamel fractures to more severe injuries, such as tooth avulsion or fractures of the supporting bone. Proper diagnosis, classification, and immediate management are critical for ensuring favorable outcomes and minimizing long-term complications, such as pulp necrosis, root resorption, or periodontal disease **(Andreasen,2018)**.

Children with dental traumas are an important concern nowadays, not only for their possible negative outcomes and frequent common occurrence **(Frujeri,2014)** but also because they can reduce quality of life **(Borges,2017 ; Feldens,2020).** In addition, people with untreated dental traumas more often experience chewing problems and difficulties with social interaction, such as excessive concern about what others think, avoiding smiling and laughing, and not talking to other children **(Fakhruddin,2008)**. Children and adolescents experience mild or severe dental traumas from various causes, such as unsafe playing on playgrounds, accidents at schools, accidents in car crashes, or violence **(Glendor,2009).** Traumatic dental injuries in primary dentition can affect the development of permanent teeth. **(Lenzi,2015)** Damage and/or disturbances to permanent teeth and germs, depending on the mouth area affected **(Flores,2019).**

Aims of the study

This project aimed to investigate the prevalence of dental trauma of anterior teeth and causes between primary school aged children.

Chapter One
Review Of Literature

1.1 Dental trauma:

Dental trauma is an impact injury to the teeth and/or other hard and soft tissues within and around the vicinity of the mouth and oral cavity. It is usually sudden, circumstantial, unexpected, accidental and often requires emergency attention. It is not a disease but a consequence of several unavoidable risk factors in life **(Andersson,2012)**.

Although these injuries are more common in certain groups, comprising 17% of all bodily injuries among preschool children. These injuries may render an individual with meticulous oral hygiene and a life experience of only the standard check-up and clean with life-changing dentistry **(Glendor,2007 ; Lam,2008).**

Tooth injury is the damage to the tooth when an excessive force is placed on it. A tooth injury is a fracture, luxation, or avulsion, although a combination of injury may occur in the same tooth **(Karawani,2016).**

1.2 Aetiology of dental trauma:

The child is progressively developing, mentally and physically, characterized by constant change or vigorous activity. Child searches for the ocean, trying to explore, so child 's more likely to fall and be injured. Child quality of life is severely affected by her/his health, especially painful injuries that may directly affect aspects of speech, nutrition, social interaction and psychology. Dental injuries can be caused by an indirect or direct trauma **(Hegde,2017)**.

When the tooth itself is struck, direct trauma occurs. An indirect shock occurs as the lower tooth arch is firmly closed in contrast to the upper part, for instance, a blow to the chin. Direct trauma involves damages in the anterior region, whilst indirect trauma prefers crown or crown root fractures in the premolar and molar regions with the probability of jaw fractures in the condylar regions and symphysis. The extent of the damage is related to such factors as energy of impact, resilience and shape of the impacting object, direction of the impact and the reaction of the tooth surrounding tissues **(Welbury,2005)**.

Studies show that dependency of type and causes of the traumatic dental injuries to permanent and primary dentition exists. This phenomenon might be related to the features of the underlying bone structure which in primary dentition is less mineralized than in permanent. Therefore trauma in primary dentition more often results in displacement of the tooth **(Lam,2008 ; Díaz,2010)**. Traumatic injuries happen more frequently to the upper incisors than to the lower incisors and that the central are more affected than the lateral incisors (**Cavalcanti,2009**).

Dental trauma results from external forces applied to the teeth and their supporting structures, leading to injuries that vary in severity. The causes of dental trauma can be classified into the following categories **(Andreasen,2018)**:

*** Falls :** Falls are the most common cause of dental trauma, particularly among young children. They often occur during early developmental stages as children learn to walk and explore their environment.

*** Sports-Related injuries:** Contact sports, such as football, hockey, and basketball, contribute significantly to dental trauma. Lack of protective equipment, such as mouthguards, increases the risk of injury.

*** Traffic accidents:** Motor vehicle collisions, bicycle accidents, or pedestrian injuries are major contributors to traumatic dental injuries, particularly in adolescents and adults.

*** Interpersonal violence:** Physical altercations, domestic violence, or assault can result in severe dental injuries. These injuries are often associated with fractures of the facial bones.

*** Playground and recreational activities:** Injuries sustained during playground activities, skateboarding, or other recreational activities are common causes of dental trauma in children and adolescents.

*** Occupational hazards:** Certain occupations, such as construction work or manual labor, carry a higher risk of accidental injury to the oral and dental structures.

*** Iatrogenic factors:** Injuries caused by dental procedures, such as improper handling of dental instruments or complications during orthodontic treatment, fall under this category.

Factors predisposing to dental trauma can be associated with a person's anatomical features such as increased overjet, or insufficient lip covering of the upper front teeth **(Artun,2005 ; Traebert,2006).** TDI to primary teeth may finally lead to problems with primary permanent teeth, for instance hypoplasia, discolouration, delayed eruption time, and tooth malformation **(Fontenele,2017).**

Delayed treatment of dental injuries in children is common in many countries. This can be attributed to various factors such as short-lived primary teeth, and the lack of attention required because the child may not show any associated signs or symptoms **(Mattila,2005).**

1.3 Diagnosis of dental trauma:

It is very important to provide first aid for injuries to the dentoalveolar system in children and adolescents. This concerns the collection of data on how the trauma occurred on the one hand this should also include monitoring for any evidence of domestic violence and information from the patient's medical history regarding current immunization status (tetanus) and signs of concussion (amnesia, autonomic symptoms) on the other **(Emerich,2010)**.

Next, the stomatognathic system should be examined for injuries, checking particularly for any direct or indirect signs of fractures to the jawbone. Teeth should also be examined for abnormal mobility, displacement, and sensitivity (using cold spray and a cotton wool ball). The alveolar process should also be palpated to search for irregularities or discontinuities. The diagnosis of dental trauma involves a systematic and comprehensive approach, combining history-taking, clinical examination, and radiographic evaluation. Each step is crucial for determining the type and severity of the injury and planning appropriate treatment. Diagnosis of dental trauma includes the following steps **(Andreasen et al., 2019)**:

1. Patient history:

A detailed history is the first step in diagnosing dental trauma. Information about the time, cause, and mechanism of injury is critical. For instance, a high-impact injury (e.g., a fall or car accident) suggests possible severe damage, such as luxation or alveolar fractures, while sports injuries may commonly result in crown fractures. Questions about symptoms, including pain, sensitivity, or bleeding, can provide insight into pulp and periodontal involvement. Immediate post-trauma management (e.g., how an avulsed tooth was stored) significantly impacts prognosis **(Andreasen,2018**).

2.Clinical examination of dental trauma includes (Andersson,2012):

Pain: The patient may experience immediate or delayed pain depending on the type of injury. Pain may be localized to the affected tooth or generalized if multiple teeth or structures are involved.

Tooth Mobility: Teeth may be loose or displaced from their normal position, indicating trauma to the periodontal ligament or alveolar bone.

Fractures of the Tooth:

- Crown fractures: The visible portion of the tooth may have chipped or cracked.
- Root fractures: Can be harder to identify but may cause pain or swelling.
- Crown-root fractures: Involve both the crown and root, possibly affecting the

tooth's stability.
Swelling and bruising: Soft tissue swelling, ecchymosis (bruising), or lacerations may occur around the injured tooth or gums.
Displacement of teeth:
-Luxation: Teeth may be pushed in or out of their normal position (e.g., intrusion, -extrusion, or lateral displacement).
-Avulsion: A tooth may be completely knocked out of the socket.
Bleeding: Bleeding from the gums or pulp may be evident, particularly in cases of more severe injury.
Sensitivity to temperature or pressure: The injured tooth may become hypersensitive to hot or cold or to pressure during biting.
Fracture of supporting structures: The jawbone (mandible/maxilla) or other facial bones may also be fractured in more severe trauma cases**.**

3. Radiographic examination:
Radiographic examination plays a crucial role in assessing and diagnosing dental trauma of the anterior teeth **(Flores ,2007)**.
The objectives of radiographic examination include:
1. Identify fractures in hard tissues: Detect fractures involving enamel, dentin, pulp, and root structures. Crown fractures are categorized as uncomplicated (enamel and dentin only) or complicated (pulp involvement) **(Andreasen,2018).**
2. Assess luxation and displacement injuries: Evaluate tooth displacement injuries such as intrusion, extrusion, or lateral luxation **(Levin,2020).**
3. Detect alveolar bone and socket wall fractures: Identify fractures in the alveolar bone that may accompany traumatic injuries to anterior teeth **(Flores ,2007).**
4. Evaluate pulp and periapical tissues: Assess pulp chamber size, vitality, and the presence of periapical pathology, such as abscess or inflammation **(Cohenca,2007).**
5. Locate tooth fragments and foreign bodies: Identify displaced tooth fragments, either embedded in soft tissues or within the oral cavity **(Malmgren,2018).**
6. Monitor healing and detect complication: Track the progress of healing and identify potential complications, such as root resorption (external or internal), delayed revascularization or ankylosis and alveolar bone healing **(Levin,2020).**
7. Support treatment planning: Objective is to provide a baseline for treatment decisions, such as splinting in cases of luxation or alveolar fractures, endodontic

treatment for pulp necrosis and surgical intervention for complex fractures **(Andreasen,2018).**

8. Assess socket condition in avulsion cases: Confirm complete avulsion and evaluate the integrity of the socket walls. Radiographs are essential to rule out retained root fragments or damage to the alveolus **(Flores ,2007).**

The clinician should evaluate each case and determine which radiographs are required for the specific case involved. A clear justification for taking a radiograph is essential. There needs to be a strong likelihood that a radiograph will provide the information that will positively influence the selection of the treatment provided. Furthermore, initial radiographs are important as they provide a baseline for future comparisons at follow-up examinations. The use of film holders is highly recommended to allow standardization and reproducible radiographs (**Cohenca,2017)**.

Since maxillary central incisors are the most frequently affected teeth, the radiographs listed below are recommended to thoroughly examine the injured area (**Andreasen et al., 2019)**:

* One parallel periapical radiograph aimed through the midline to show the two maxillary central incisors.
* One parallel periapical radiograph aimed at the maxillary right lateral incisors (should also show the right canine and central incisor).
* One parallel periapical radiograph aimed at the maxillary left lateral incisor (should also show the left canine and central incisor).
* One maxillary occlusal radiograph. At least one parallel periapical radiograph of the lower incisors centered on the two mandibular centrals. However, other radiographs may be indicated if there are obvious injuries of the mandibular teeth (eg, similar periapical radiographs as above for the maxillary teeth, mandibular occlusal radiograph).

The radiographs aimed at the maxillary lateral incisors provide different horizontal (mesial and distal) views of each incisor, as well as showing the canine teeth. The occlusal radiograph provides a different vertical view of the injured teeth and the surrounding tissues, which is particularly helpful in the detection of lateral luxations, root fractures, and alveolar bone fractures. The above radiographic series is provided as an example. If other teeth are injured, then the series can be modified to focus on the relevant tooth/teeth. Some minor injuries, such as enamel infractions, may not require all of these radiographs **(Molina,2008 ; Cohenca,2017 ; Andreasen et al., 2019).**

Radiographs are necessary to make a thorough diagnosis of dental injuries. Tooth root and bone fractures, for instance, may occur without any clinical signs or symptoms and are frequently undetected when only one radiographic view is used. Cone beam computerized tomography (CBCT) provides enhanced visualization of TDIs, particularly root fractures, crown/root fractures, and lateral luxations. CBCT helps to determine the location, extent, and direction of a fracture. In these specific injuries, 3D imaging can be useful and should be considered, if available**.** A guiding principle when considering exposing a patient to ionizing radiations (eg, either 2D or 3D radiographs) is whether the image is likely to change the management of the injury **(Cohenca,2007 ; Cohenca,2017)**.

4- Pulp status evaluation (sensibility and vitality testing):

Sensibility tests:

Sensibility testing refers to tests (cold test and electric pulp test) used to determine the condition of the pulp. It is important to understand that sensibility testing assesses neural activity and not vascular supply. Thus, this testing might be unreliable due to a transient lack of neural response or undifferentiation of A-delta nerve fibers in young teeth **(Fulling,1976 - Gopikrishna,2007)**.

The temporary loss of sensibility is a frequent finding during post-traumatic pulp healing, especially after luxation injuries **(Bastos,2014).** Thus, the lack of a response to pulp sensibility testing is not conclusive for pulp necrosis in traumatized teeth**.** Despite this limitation, pulp sensibility testing should be performed initially and at each follow-up appointment in order to determine if changes occur over time **(Zadik,1979 ; Dummer,1980 ; Bastos,2014)**. It is generally accepted that pulp sensibility testing should be done as soon as practical to establish a baseline for future comparison testing and follow up. Initial testing is also a good predictor for the long-term prognosis of the pulp **(Fulling,1976 ; Bastos,2014 ; Alghaithy,2017).**

Vitality tests:

The use of pulse oximetry, which measures actual blood flow rather than the neural response, has been shown to be a reliable non-invasive and accurate way of confirming the presence of a blood supply (vitality) in the pulp.The current use of pulse oximetry is limited due to the lack of sensors specifically designed to fit dental dimensions and the lack of power to penetrate through hard dental tissues.

Laser and ultrasound Doppler flowmetry are promising technologies to monitor pulp vitality **(Gopikrishna,2007)**.

1.4 Classification of the dental trauma:

In the 1950, Pediatric dentist G.E. Ellis was the first person to promote a universal classification of dental injuries. Dental injuries have been classified according to a variety of factors, such as aetiology, anatomy, pathology or therapeutic considerations.

1.4.1 Classification by Ellis (1970) **(Enrique Basrani,1982)**

It is a simplified classification, which groups many injuries and allows for subjective interpretation by including broad terms such as simple or extensive or extensive fractures.

Class I - Simple crown fracture with little or no dentin affected.
Class II - Extensive crown fracture with considerable loss of dentin, but with the pulp not affected.
Class III - Extensive crown fracture with considerable loss of dentin and pulp exposure.
Class IV - A tooth devitalized by trauma with or without loss of tooth structure.
Class V - Teeth lost as a result of trauma.
Class VI - Root fracture with or without the loss of crown structure.
Class VII - Displacement of the tooth with neither root nor crown fracture.
Class VIII - Complete crown fracture and its replacement.
Class IX - Traumatic injuries of primary teeth.

1.4.2 Classification by Ellis and Davey (1970) **(Shobha Tandon,2009)**

Class 1 - Simple fracture of the crown-involving little or no dentin.
Class 2 - Extensive fracture of the crown – involving considerable dentin, but not the pulp .
Class 3 - Extensive fracture of the crown – involving considerable dentin, and exposing the dental pulp.
Class 4 - The traumatized tooth which becomes nonvital-with or without loss of crown structure .
Class 5 - Teeth lost as a trauma.
Class 6 - Fracture of the root - with or without loss of crown structure.
Class 7 - Displacement of the tooth-without fracture of crown or root.
Class 8 - Fracture of the crown masse and its replacement.

1.4.3 WHO classification (WHO, 1978) (Shobha Tandon,2009)

1- **Enamel fracture**: Tooth not painful, no color change but rough edges.
2- **Crown fracture without pulpal involvement**: Fracture runs through enamel and dentin layer, Tooth sensitive to touch and airflow.
3- **Crown fracture with pulpal involvement:** Fracture runs through enamel and dentin layer, nerve exposed, Tooth highly sensitive, Pulp tissue shows pink in the center of the tooth, or bleeding in the center of the tooth.
4- **Root fracture Only visible on X-ray**: Tooth may be loosened.
5- **Crown root fracture**: Crown may have fracture lines.
6- **Fracture of tooth**, unspecified .
7- **Tooth luxation**: Increased mobility of tooth.
8- **Intrusion or extrusion**: Change in axial height, Intruded teeth are more deeply embedded and seem ankylotic, Extruded teeth seem longer and are highly mobile.
9- **Avulsion**: The tooth is completely outside the alveolum.
10- **Other injuries** associated with laceration of the oral soft tissues.

1.4.4 Classification by Andreasen (1981) (Shobha Tandon,2009)

A. Injuries to the hard dental tissues and pulp:
1. Crown infarction.
2. Uncomplicated crown fracture.
3. Complicated crown fracture.
4. Uncomplicated crown root fracture.
5.Complicated crown root fracture.
6. Root fracture.

B. Injuries to the periodontal tissues:
1. Concussion.
2. Subluxation.
3. Intrusive Luxation (central dislocation).
4. Extrusive luxation (peripheral dislocation partial avulsion).
5. Lateral Luxation.
6. Exarticulation (complete avulsion).

C. Injuries of the supporting bone:
1. Comminution of alveolar socket (Mandible, Maxilla) Crushing and compression of the alveolar socket.
2. Fracture of the alveolar socket wall (Mandible , Maxilla).

3. Fracture of the alveolar process (Mandible, Maxilla).
4. Fracture of the Mandible and Maxilla(Mandible. Maxilla).

D. Injuries to gingiva or oral mucosa:
1. Laceration of gingiva or oral mucosa.
2. Contusion of gingiva or oral mucosa.
3. Abrasion of gingiva or oral mucosa:.

1.4.5 Classification by World Health:

Organization in its International Diseases of Dentistry and Stomatology (1994).This classification is based on a system adopted by the WHO in its application of the International classification of Disease to Dentistry and Stomatology **(Andreasen,1994)**.

A. Injuries to the hard dental tissues and the pulp:
1) Enamel infraction.
2) Enamel fracture.
3) Enamel- Dentin Fracture (Uncomplicated Crown fracture).
4) Complicated crown fracture.
5) Uncomplicated Crown- Root Fracture.
6) Complicated Crown-Root fracture.
7) Root Fracture.

B. Injuries to the periodontal tissues:
1) Concussion.
2) Subluxation.
3) Extrusive Luxation(Peripheral Dislocation, Peripheral Avulsion).
4) Lateral Luxation.
5) Intrusive Luxation.
6) Avulsion.

C. Injuries to the supporting bone:
1) Communution of the mandibular.
or Maxillary (Alveolar Socket).
2) Fracture of the Mandibular or Maxillary (Alveolar Socket Wall).
3) Fracture of the Mandibular or Maxillary (Alveolar process).
4) A fracture involving the base of the mandible or maxilla and often the alveolar

process (jaw fracture).

D. Injuries to gingiva or oral mucosa:
1) Laceration of gingival or oral mucosa.
2) Contusion of gingiva or oral mucosa.
3) Abrasion of gingival or oral mucosa.

1.4.6 Classification by Hamilton, et al. (1997) **(Bastone B,1997)**

* Fracture confined to enamel.
* Fracture involving dentin.
* Fracture with pulp exposed.
* Intrinsic discoloration.
* Abnormal mobility.
* Infraocclusion.

1.6 Complications of dental trauma:

Not all sequelae of trauma are immediate and many of them can occur months or years after the initial incident thus required prolonged follow-up. Common complications are pulpal necrosis, pulpal obliteration, root resorption and damage to the successors teeth in primary teeth dental trauma. The most common complication was pulp necrosis (34.2%), while 50% of the tooth that have trauma related to avulsion experienced ankylotic root resorption after a median TIC (time elapsed between the traumatic event and the diagnosis of complications) of 1.18 years. Teeth that have multiple traumatic events also showed to have higher chance of pulp necrosis (61.9%) compared to teeth that experienced a single traumatic injury (25.3%) in the studies **(Lin et al., 2016).**

1.7 Prevalence of Dental Trauma:

- Global Prevalence in Primary School Children

A systematic review revealed that the prevalence of dental trauma in primary school children globally ranges from 5% to 58%, depending on the region and study design. Falls and collisions during playtime were identified as the most common causes of trauma, primarily affecting the maxillary central incisors **(Glendor,2008).**

Dental trauma is a significant public health issue, with studies in Iraq revealing varying prevalence rates across different populations and regions. In

Erbil City Research conducted among 12-year-old children in Erbil city showed a prevalence of 16.3% for dental trauma. The study emphasized the need for preventive educational programs to address this issue **(Ismail,2021).** While in Baghdad Studies between Primary School Children A study conducted in Al-Dora city, Baghdad, reported a dental trauma prevalence of 10.9% among primary school children. The maxillary central incisors were the most commonly affected teeth (83.7%). Boys exhibited higher rates of dental trauma compared to girls **(Abdul-Rahman,2022).** In Sulaimani City A cross-sectional survey in Sulaimani city involving 4,015 children aged 6–13 years found a prevalence rate of 6.1%. The study showed that dental trauma was more common in males and increased with age. Enamel fractures were the most common injury, with falls during play identified as the leading cause **(Al-Kubaisy,2009).**

In India, a study of primary school children in urban areas found a dental trauma prevalence of 20.6%, with malocclusion being a significant risk factor. Outdoor play and contact sports were leading causes of injury **(Tandon,2001).**

In Brazil, a study among primary school children aged 6–12 years found a prevalence of 15.1% for dental trauma. Boys were more likely to experience dental injuries than girls, and sports activities and falls were the leading causes **(Andreasen,2010).**

Study in South Africa among children aged 6–12 years reported a prevalence of 18.5% for dental trauma. Most injuries occurred during school hours, emphasizing the need for school-based preventive programs **(Naidoo,2001).**

Chapter Two
Materials And Method

2.1 The sample:

This cross-sectional study was carried out among 400 urban students of primary Iraq schools in Karbala city of Karbala governorate to estimate the prevalence of TDI among them. The examination continued for one month started at the 5th of January till the 5th of February.

2.2 Criteria for the sample selection:

Before sampling, the following criteria were used to constitute the eligibility of sample' individuals to the dental examination carried out by the researcher:

1- An Iraqi student.
2- Aged between (10-11).
3- Who has not undergone trauma treatment before.
4- Do not have any chronic disease.
5- Only anterior teeth.
6- Only male.

***Any student do not have these criteria mentioned above is excluded. This study was conducted with a written informed consent obtained from each student.**

2.3 Material:

Instruments and equipment:
The following materials were used during dental examination of sample individuals and considered in this research work:

1- Disposable dental mirrors, probes and tweezers for clinical examination.
2- Medical gloves and masks.
3- Portable torch-light.
4- Case sheet to register the information obtained.

Figure (1) : Torch-light

Figure (2) : Disposable dental mirror

Figure (3) : Disposable gloves

2.4 Methods:

This cross-sectional study was conducted among 400 students aged between 10 and 11 years old in four primary schools in the city of Karbala. All those examined were male. The students of these schools were examined with the use of disposable dental mirrors, disposable dental probes, disposable tweezers, gloves, and masks. Each student was seated at a height suitable for examination.

Data were obtained by intraoral examination of eligible students sitting on their chairs in classrooms, with two or three examiners standing in front of the chair, making the clinical assessment. The type of dental injury was determined using visual and tactile investigations; since no radiographs were taken; the root fracture and uncooperative students were not documented. Tooth type, fracture type, causes of trauma, and upper or lower jaw position were all documented.

In the case that the light is not sufficient enough, a portable torch-light is used to enable the examiner to continue his examination. An examination was designed to meet the aims of this study mentioned previously, The examination done on 400 student and just 60 students were found to have trauma.

2.5 Classification of dental trauma:

In this study Ellis and Davey Classification was used for classifying the type of dental trauma which is one of the most widely accepted systems for categorizing traumatic dental injuries. It is based on the extent and type of injury to the tooth structure, pulp, and surrounding tissues, and it provides a clear framework for diagnosis and treatment. Below are detailed explanations of each classification **(Ellis and Davey,1970):**

1. Class I (Enamel Fracture) (Ellis and Davey,1970)
Description: This type of injury involves a fracture limited to the enamel without affecting the underlying dentin.
Clinical Features: Presents as smooth or sharp enamel edges. No discoloration or sensitivity since the dentin and pulp are intact. Aesthetic concerns may arise in anterior teeth.
Management: Smoothing of sharp edges using a polishing bur. Composite resin restoration may be indicated for aesthetic reasons. Regular follow-up to monitor for complications.
In the present study Class I fracture was recorded as S1.

2. Class II (Enamel and Dentin Fracture) (Uncomplicated Crown Fracture): (Andreasen,2018)
Description: This category includes fractures involving both enamel and dentin but without pulp exposure.
Clinical Features: Dentin exposure causes yellow discoloration. Increased sensitivity to thermal or mechanical stimuli due to exposed dentin tubules.
Management: Cover exposed dentin with a protective material (e.g., calcium hydroxide or glass ionomer).Restore the tooth with composite resin or crowns for aesthetics and function.
In the present study Class II fracture was recorded as S2.

3. Class III (Enamel, Dentin, and Pulp Fracture) (Complicated Crown Fracture) (Levin,2020)
Description: This type of fracture involves enamel, dentin, and the pulp, leading to pulp exposure.

Clinical Features: Pulp bleeding and pain are present. Sensitivity to temperature, air, and touch. Risk of pulp necrosis or infection if left untreated.
Management: Perform direct pulp capping or pulpotomy for immature teeth with open apices. Root canal treatment is indicated for mature teeth. Restore the tooth using composite resin or a crown.
In the present study Class III fracture was recorded as S3.

4. Class IV (Crown-Root Fracture) (Flores ,2007)
Description: Fracture involving the crown and extending into the root, often below the gingival margin. It may or may not expose the pulp.
Clinical Features: Pain during chewing or biting.
Crown mobility may be observed if the fracture extends subgingivally.
May involve bleeding if the pulp is exposed.
Management: Perform a gingivectomy or orthodontic extrusion to expose the fracture line for restoration. Extraction may be necessary for severe fractures.
In the present study Class IV fracture was recorded as S4.

5. Class V (Root Fracture) (Cohenca,2017)
Description: Root fractures are confined to the root and can occur in the apical, middle, or cervical thirds.
Clinical Features: Mobility of the coronal fragment. Pain on percussion or biting. Radiographic examination is essential to locate the fracture line.
Management: Reposition and splint the fractured tooth for 4-8 weeks. Monitor for pulp vitality; initiate root canal treatment if necrosis develops.

6. Class VI (Tooth Displacement) (Luxation) or Avulsion: (Malmgren,2012)
Description: This class includes partial or complete displacement of the tooth from its socket.
Clinical Features: Luxation injuries present with mobility or displacement of the tooth. Avulsion injuries leave an empty socket. Bleeding and pain are common.
Management: Reposition the tooth immediately in luxation cases and stabilize with splinting. For avulsed teeth, reimplantation within 60 minutes is crucial, followed by splinting. Root canal treatment is typically required.

7. Class VII (Tooth Displacement Without Fracture) (Andreasen,2018)
Description: Refers to displacement of the tooth (e.g. , extrusion, intrusion, or lateral luxation) without associated fractures.
Clinical Features: Visible displacement with altered occlusion.

Tooth mobility and tenderness.
Management: Reposition the tooth to its original position and splint it.
Monitor pulp vitality during follow-up visits.

8. Class VIII (Complete Crown Loss) (Ellis,Davey,1970)
Description: Involves the complete loss of the crown structure, leaving only the root intact.
Clinical Features: Root often lies at or below the gingival margin.
Aesthetic and functional impairment.
Management: Consider endodontic treatment followed by restoration with a post and crown. Extraction may be necessary if restoration is not feasible.

9. Class IX (Injuries to Deciduous Teeth) (Flores ,2007)
Description: Includes traumatic injuries in primary teeth, with special consideration for the developing permanent tooth germ.
Clinical Features: Luxation or fractures are common. Risk of damage to the permanent successor.
Management: Conservative treatment to retain the primary tooth if possible.
Extraction if the injury endangers the permanent tooth germ.

Chapter Three

Results

The sample of the present study consisted of 60 out of 400 males school students. Results show that students participated in this study aged 10 years old were (32,53.33%) and 11 years old were (28, 46.67%) with mean ±SD (10.47±0.503).

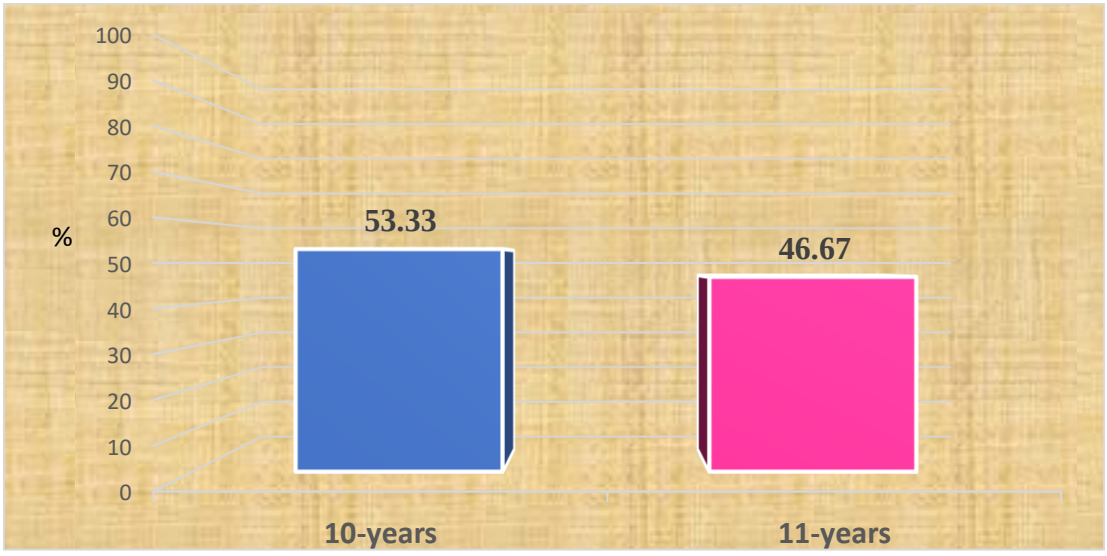
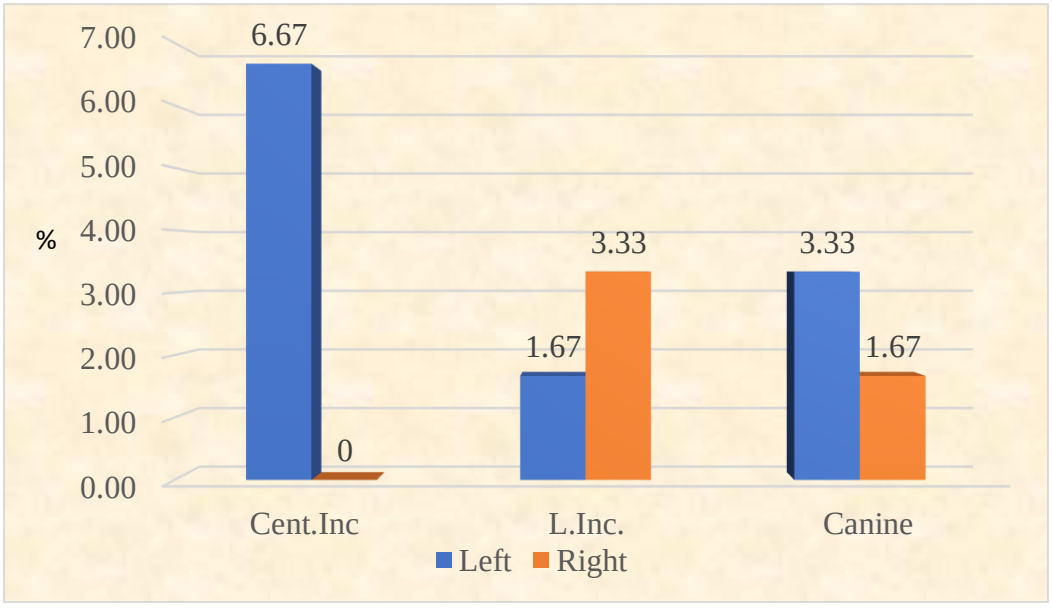
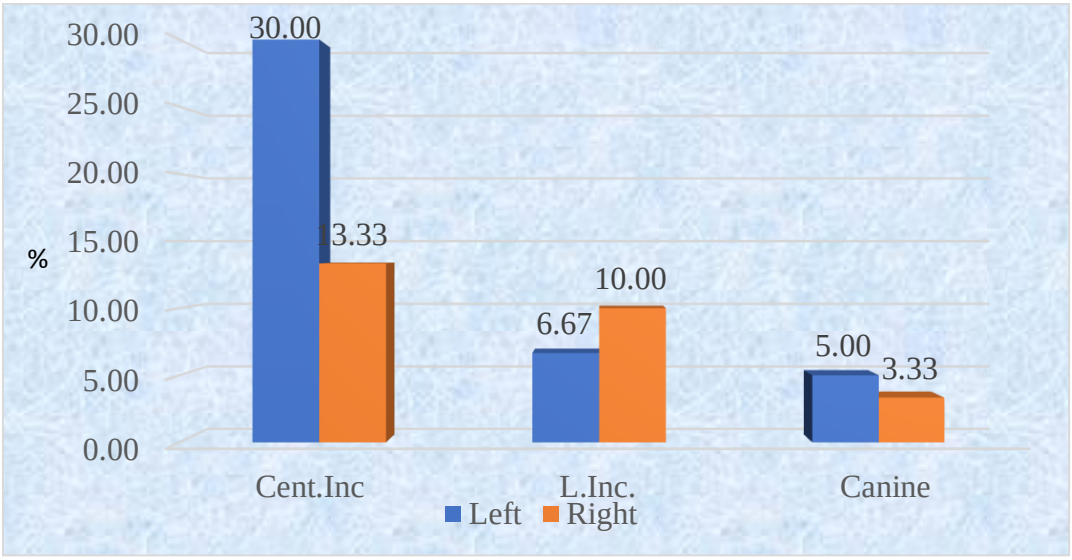


Figure (4): Distribution of subjects by age.



Figure(5): Distribution of subjects by tooth in Mandibular jaw.

Figure(5) showed that in the mandibular jaw the left central incisor was the most tooth affected by trauma (4, 6.67%) followed by left canine and right lateral incisor (2, 3.33%) while lower in left lateral incisor and right canine (1, 1.67%).



Figure(6): Distribution of subjects by tooth in Maxillary jaw.

Figure (6) displayed that the left and right central incisors were the most predominant teeth in maxillary jaw affected by trauma (18, 30%) and (8,13.33%) respectively followed by right and left lateral incisors (6.10%) and (4,6.67%) respectively while lower in left and right canine (3, 5%) and (2, 3.33%).

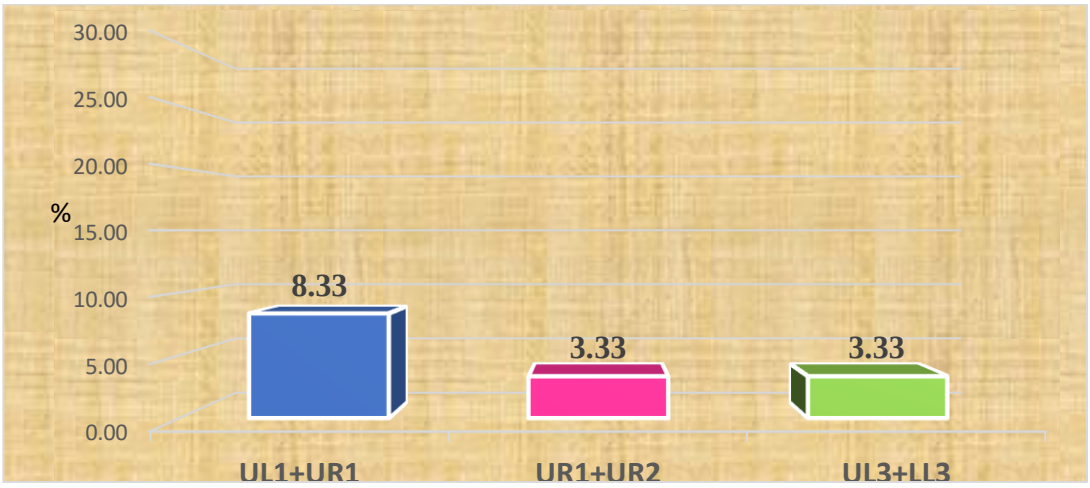
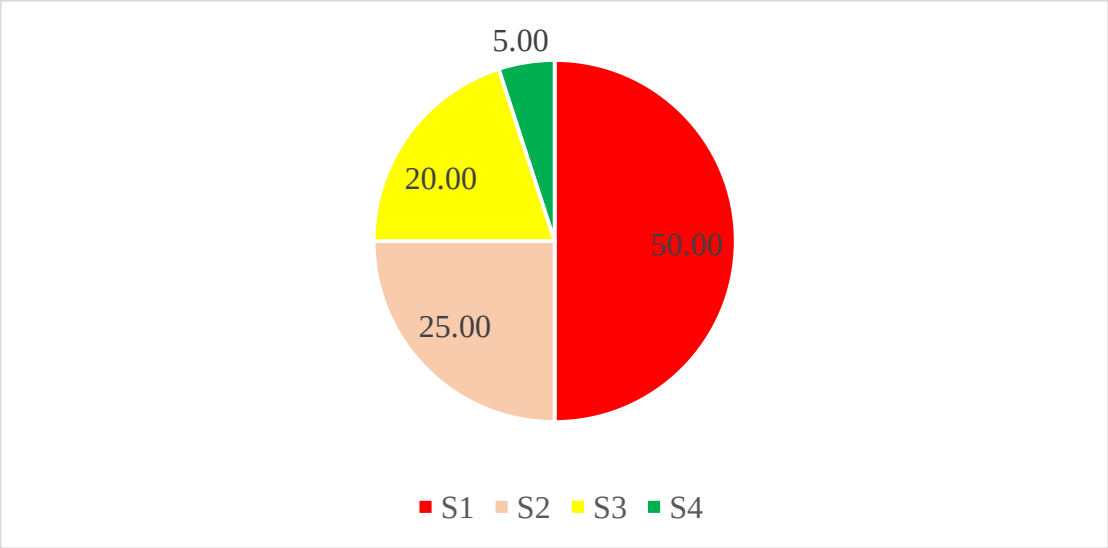


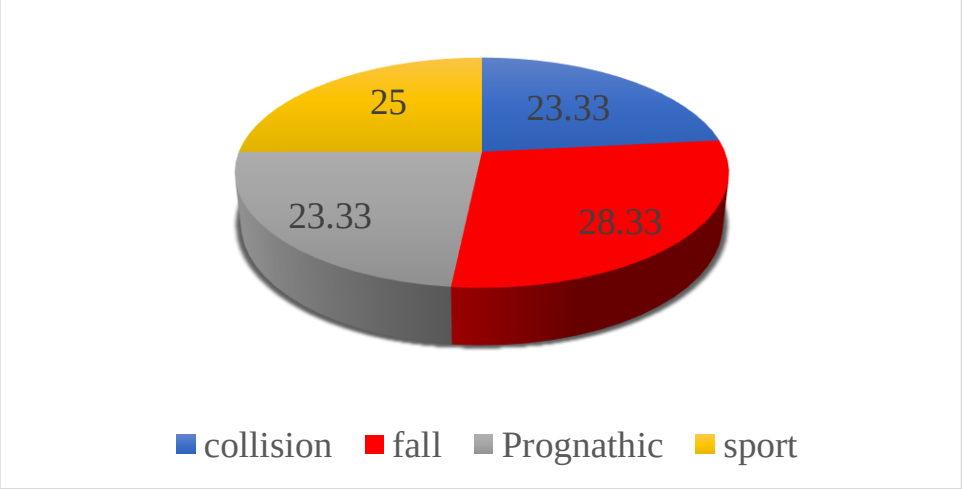
Figure (7): Distribution of subjects by two teeth affected by trauma.

Results above showed that in maxillary jaw both left and right central incisors were the most commonest paired teeth affected by trauma as (5, 8.33%) followed by both right central and lateral incisors (2, 3.33%) and both maxillary and mandibular left canines (2, 3.33%).



Figure(8): Distribution of subjects by trauma scores.

Figure(8) showed that S1 was the most predominant score of trauma (30, 50%) followed by S2 (15, 25%) and S3 (12 , 20%) while lower in S4 (3, 5%).



Figure(9): Distribution of subjects by causes of trauma.

Findings above showed that fall was the commonest cause of trauma (17, 28.33%) followed by sport (15, 25%) while lower in collision and prognathic of anterior teeth (14, 23.33%).

Table 1: Association between trauma scores and cause.

	collision		fall		Prognathic		sport		Fisher exact
	N.	%	N.	%	N.	%	N.	%	
S1	8	57.14	8	47.06	5	35.71	9	60.00	0.621 NS
S2	3	21.43	3	17.65	4	28.57	5	33.33	
S3	3	21.43	5	29.41	3	21.43	1	6.67	
S4	0	.00	1	5.88	2	14.29	0	.00	

NS=not significant at p>0.05.

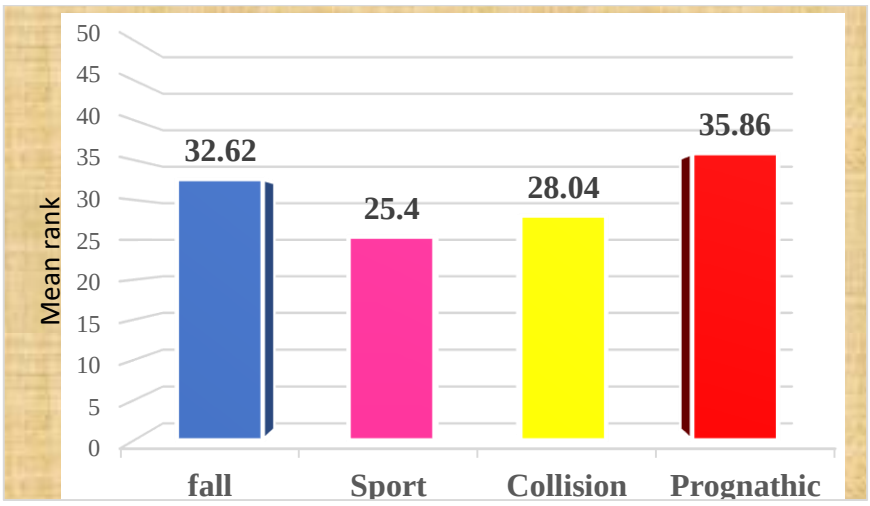
Table (1) showed that there is no significant association between trauma scores and causes of trauma (p>0.05).

Table 2: Descriptive and statistical test of trauma scores among causes.

Causes	Minimum	Maximum	Median	Mean rank	P value
fall	1	4	2.00	32.62	0.299 NS
Sport	1	3	1.00	25.40	
Collision	1	3	1.00	28.04	
Prognathic	1	4	2.00	35.86	

Kruskal-Walli's test, NS=not significant at p>0.05.

Results above showed that trauma scores were higher in prognathic of anterior teeth followed by fall and collision while lesser in sport but with no significant difference (p>0.05).



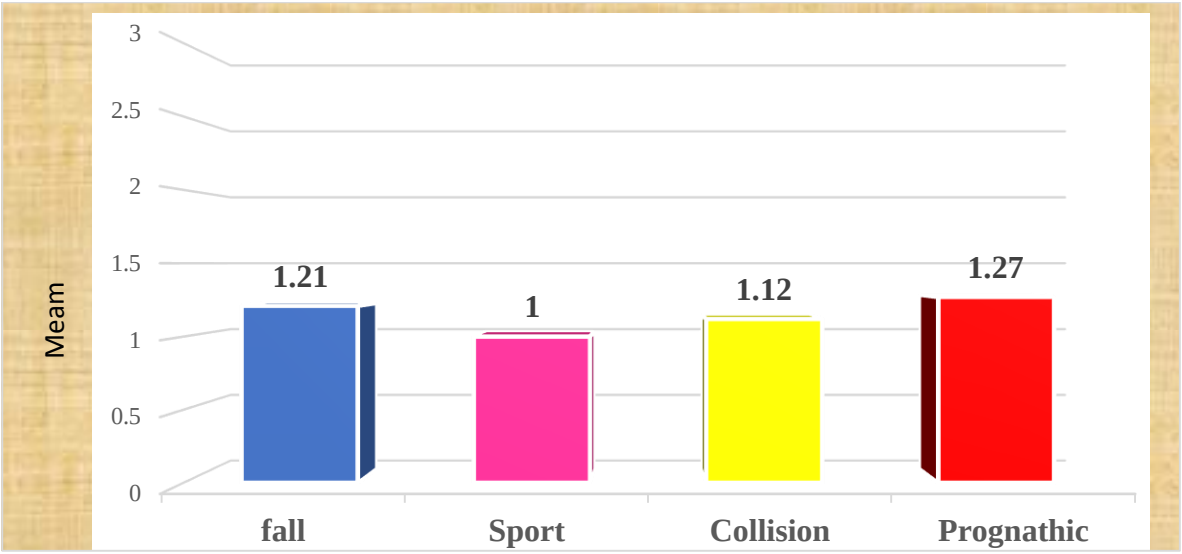
Figure(10): Mean rank of traumatic scores among causes.

Table 3: Descriptive and statistical test of teeth number among causes of trauma.

Causes	Minimum	Maximum	Mean	±SD	P value
fall	1.00	2.00	1.21	.33	0.206 NS
Sport	1.00	2.00	1.00	.46	
Collision	1.00	1.00	1.12	.00	
Prognathic	1.00	2.00	1.27	.43	

One Way ANOVA, NS=not significant at p>0.05.

Findings above showed that number of teeth affected by trauma is higher in prognathic of anterior teeth followed by fall and collision while lesser in sport but with no significant difference (p>0.05).



Figure(11): Mean of teeth number affected by trauma among causes.

Data description, analysis and presentation were performed using Statistical Package for social Science (SPSS version -22, Chicago, Illionis, USA), including Pie chart bar, simple and cluster chart bar, frequency, percentage, minimum, maximum, mean, standard deviation, Fisher exact , One Way ANOVA and Kruskal-Wallis test, level of significance is when p value less than 0.05.

Chapter Four

Discussion

4.1 Discussion:

This study focused on anterior teeth only, since the size of these teeth is related to a child's age and body size **(Yang et al.2023).** In this cross-sectional study, students in primary schools between the ages of 10 and 11 were examined for the prevalence of anterior dental trauma, of male, in karbala city. It was found that the prevalence of dental trauma in the current study was recorded to be about 15% and this was higher that recorded by some studies **(Rai,1998 ; Al-Kassab,2005).** This difference may be attributed to the age range differences from other studies. Males were highly significantly affected by dental trauma, This result was in agreement with many studies **(Baghdadi,1981 ; Al-Sayyab,1992 ; Al-Hayali,1998 ; Marcenes,2000 ; Al-Kassab,2005)** and this is may be due to the fact that males tend to participate in more strenuous activities with higher trauma risk, such as contact sports and more aggressive types of playing.

Dental trauma because of falls tended to be more frequent than the other causes of dental trauma followed by sport. This was obvious in the results of the current study and was in agreement with other investigations **(Baghdadi,1981 ; Yagot,1988 ; Wilson and Smith,1997).**

Results of the present study showed that the prevalence of traumatized children was highest with class II malocclusion (14%) which showed most of traumatized children had prognathic jaw. The explanation of this result is that in cases with normal occlusion, the energy of the trauma is decreased by the larger contact area, the incisal contact of the upper and lower teeth and the protecting effect of the lip closure. While in cases with class II malocclusion, the lack of incisal contact, the location of this contact in the cervical part of the upper incisors or the uncompleted lip closure, all increases the risk of being traumatized in children with class II malocclusion **(Jarvinen,1978).**

Data analysis showed that maxillary central incisors were the most common teeth affected by dental trauma and low percentage was mandibular canine. This result agrees with most previous studies regarding the maxillary central incisors were the most common teeth to receive trauma **(Al-Sayyab,1992 ; Al-Hayali 1998 ; Yagot,1998 ; Al-Obaidi,2002).** The prominent and vulnerable position of the maxillary incisors in the face is responsible for their more frequent involvement in fractures than the lower teeth **(Falomo,1986).**

In conclusion, the present study revealed a relatively low prevalence of dental trauma, but still this figure represents a large number of children and also a high prevalence of dental treatment need due to trauma is presented. Prevention of dental injury is considered to be more important from every aspect of the problem than its treatment similar to other general and oral health problems. Therefore, educational programs are to be initiated for the community regarding causes, prevention and treatments of traumatic dental injuries.

Chapter Five

Conclusion And Suggestions

5.1 Conclusion:

Traumatic dental injury is considered a serious public health problems especially in children; parents and teachers should be informed on prevention and emergency management of traumatic dental injuries.

The consequences of dental injuries are significant and many times result in eruption disturbances during mixed and permanent dentition. Therefore, an approach should be initiated by combining education and prevention to reduce the risks of dental trauma among Iraqi school boys and girls. Children should be educated to keep their mouths clenched in risky situations to protect their lips and cheeks in fall accidents. Such an approach will warrant treatment provided immediately. Additionally, the two trauma centers would have strengthened the prevalence data reported here. In addition, the findings showed that initial treatment after dental trauma should be as quick as possible.

In this study, it was found:

1- The prevalence of TDI in primary Iraqi school was (15%) (60 out of 400 students).

2- The prevalence of TDI in the current study was found higher in central incisor more than lateral incisors and canine and in the left side more than right side.

3- Fall was the most common cause for the trauma.

5.2 Suggestions:

The school holds a relevant authority and obligation to control the occurrence of dental trauma in the succeeding students. The school is recommended to:

1- Organize and adjust the playing activities and grounds.

2- Provide children's knowledge on balancing and posting steps on the right way to jump and fall.

3- Control physical aggression among students.

4- Train staff and post graduates students in school health.

5- Parents and parents-to-be are advisable to: Give children advice and demonstration on how to adopt safeguarding reaction in risky situations.

6- Ask dental clinics and centers about how to treat dental injuries.

7- Healthcare providers are recommended to screen traumatized children before complete the development of their permanent teeth.

8- Educate parents and caregivers on how to handle traumatic situations

and the recommendations for researchers:

A- Increase the sample number to include all Iraqi schools.

B- Increase the range of the age of selected sample.
C- The physical, social, and psychological effects of TDI need to be investigated further to understand.
D- The effect of TDI on the anterior teeth on the smile and face especially if the teeth is fracture can be investigated.

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