

## Review Article

# An overview of classification of dental trauma

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## Abstract

Minor falls, local accidents, while participating in sports or childish pranks that are not intended to harm produce greatest number of teeth fractures and teeth displacements in children. From these seemingly benign accidents, child's facial appearance becomes so altered as to make an attractive child appear unattractive. Dental injuries are considered emergency situation that require immediate care. The purpose of this article is aimed to overview the classification of the traumatized teeth.

## Key words

Fracture, Dental trauma, Luxation, Concussion.

## 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 etiology, anatomy, pathology or therapeutic considerations.

## Classification of anterior teeth trauma by Sweets (1955) [1]

It is mainly based on the anatomy and morphology of the tooth structure. The disadvantages of this classification are that no

stress has been laid on injuries to supporting structures soft tissue and bone. It indicates more towards the permanent teeth than primary teeth as injury to periodontium is more common in primary teeth as compared to permanent.

**Class I** – A simple of crown exposing no dentition.

**Class II** – A parallel of crown involving little dentin.

**Class III** – Extensive fracture of crown involving more dentin bur no pulp exposure.

**Class IV** – Extensive fracture of crown exposing pulp.

**Class V** – Complete fracture of crown exposing pulp.

**Class VI** – Fracture of root with or without loss of crown structure.

**Class VII** – Tooth loss as a result of trauma.

### **Classification by Rabinowitch (1956) [2]**

1. Fractures of the enamel or slightly into the dentin
2. Fractures into the dentin
3. Fractures into the pulp
4. Fractures of the periodontium
5. Comminuted fractures
6. Displaced teeth.

### **Benetts Classification (1963) [3]**

Benetts classification is according to injuries to periodontium and alveolus considering the anatomy and morphology of the teeth which can be applied partially for primary and permanent teeth.

**Class I** – Traumatized tooth without coronal or root fracture.

- a) Tooth from in alveolus.
- b) Tooth subluxated in alveolus.

**Class II** – Coronal fracture

- a) Involving enamel
- b) Involving enamel + dentin.

**Class III** – Coronal fracture with pulp exposure.

**Class IV** – Root fracture

- a) Without coronal fracture.
- b) With coronal fracture.

**Class V** – Avulsion of tooth.

### **Classification by Ulfohn (1969) [4]**

Ulfohn examines a classification of crown fracture from a clinical endodontic point of view based on three fundamental aspects.

- 1) The possibility of identifying the clinical state of the pulp.
- 2) The absolute conviction that it is impossible to view the dentin and the pulp as separate organs and that they constitute one organ. Considering this, any attack on the dentin represents indirect damage to the pulp.
- 3) Determination of treatment.

This classification tends to simplification. It does not take into account large or small amount of indirect pulp exposure, for from the prevention aspect, the protection of any amount of exposed dentin is equally important.

Crown fractures: -

- a) Of enamel
- b) With indirect pulp exposure through the dentin.
- c) With direct pulp exposure

The shape of the fracture may encompass an angle or more thirds of the crown. The pulp may be clinically normal, hyperemic, inflamed, or dead. The apical foramina may or may not have completed its physiologic calcification.

### **Classification by Ellis (1970) [4]**

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.

### **Classification by Ellis and Davey (1970) [2]**

**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 en masse and its replacement.

**Class I** - No fracture or fracture of enamel only, with or without loosening or displacement of the tooth

**Class II** - Fracture of the crown involving both enamel and dentin without exposure of the pulp and with or without loosening or displacement of the tooth

**Class III** - Fracture of the crown exposing the pulp, with or without loosening or displacement of the tooth

**Class IV** - Fracture of the root with or without coronal fracture, with or without loosening or displacement of the tooth

**Class V** - Total displacement of the tooth.

### Classification by Hargreaves and Craig (1970) [5]

Proposed a simplified classification of trauma to anterior teeth.

### Application of international classification of diseases to dentistry and stomatology (WHO, 1978) [2]

Classification	Description	Tissues involved
S.O.25	Fracture of tooth (primary and secondary teeth)	
S.02.50	Fracture of enamel of tooth only+ Enamel infraction	Enamel
S.02.51	Fracture of crown of tooth without pulpal involvement	Enamel, Dentin
S.02.52	Fracture of crown of tooth with pulpal involvement	Enamel, Dentin, pulp
S.02.53	Fracture of root of tooth	Cementum, Dentin, Pulp
S.02.54	Fracture of crown with root of tooth, with or without pulpal involvement	Enamel, Cementum, dentin, +Pulp
S.02.57	Multiple fracture of tooth	Unspecified
S.02.59	Fracture of tooth, Unspecified	Unspecified

### Classification by Garcia – Godoy (1981) [6]

Enamel crack  
 Enamel fracture  
 Enamel Dentine fracture without pulp exposures  
 Enamel Dentine fracture with pulp exposure  
 Enamel- Dentine-cementum fracture without pulp exposure  
 Enamel- Dentine-cementum fracture with pulp exposure  
 Root fracture  
 Concussion  
 Luxation  
 Lateral displacement  
 Intrusion  
 Extrusion  
 Avulsion.

### Classification by Andreasen (1981) [2]

#### A. Injuries to the hard dental tissues and pulp.

1. Crown infarction N873.60. An incomplete fracture (crack) of the enamel without loss of the tooth substance.
2. Uncomplicated crown fracture. A fracture contained to the enamel (N 873) or involving enamel and dentin, but not exposing the pulp (N 873.61)
3. Complicated crown fracture N873.62. A fracture involving enamel and dentin and exposing the pulp.
4. Uncomplicated crown root fracture. N873.64. A fracture involving enamel, dentin and cementum but not involving the pulp.

5. Complicated crown root fracture N873.64. A fracture involving enamel, dentin and cementum and exposing pulp.
6. Root fracture N873. A fracture involving dentin, cementum and the pulp.

#### **B. Injuries to the periodontal tissues.**

1. Concussion N873.66. An injury to the tooth supporting structures without abnormal loosening or displacement of the tooth, but with marked reaction to percussion.
2. Subluxation N873.66. An injury to the tooth supporting structures with abnormal loosening but without displacement of the teeth.
3. Intrusive Luxation (central dislocation) N873.66. Displacement of the tooth into the alveolar bone. This injury is accompanied by comminution or fracture of the alveolar socket.
4. Extrusive luxation (peripheral dislocation partial avulsion) N873.66. Partial displacement of the tooth out of its socket.
5. Lateral Luxation N873.66. Displacement of the tooth in a direction other than axially. This is accompanied by comminution or fracture of the alveolar socket.
6. Exarticulation (complete avulsion) N873.68 Complete displacement of the tooth out of its socket.

#### **C. Injuries of the supporting bone**

1. Comminution of alveolar socket (Mandible N802.20, Maxilla 802.40) Crushing and compression of the alveolar socket. This condition is found together with intrusive and lateral luxation.
2. Fracture of the alveolar socket wall (Mandible N802.20, Maxilla N802.40). A fracture contained to the facial or lingual socket wall.
3. Fracture of the alveolar process (Mandible N802.20, Maxilla N802.40). A fracture of the alveolar process, which

may or may not involve the alveolar socket.

4. Fracture of the Mandible and Maxilla (Mandible N802.21). Maxilla N802.42). A fracture involving the base of the mandible or maxilla and often the alveolar process (jaw fracture). The fracture may or may not involve the alveolar socket.

#### **D. Injuries to gingiva or oral mucosa.**

1. Laceration of gingiva or oral mucosa N873.69. A shallow or deep wound in the mucosa resulting from a tear and usually produced by a sharp object.
2. Contusion of gingiva or oral mucosa N 902.00: A bruise usually produced by an impact from a blunt object and not accompanied by a break of the continuity in the mucosa, causing submucosal hemorrhage.
3. Abrasion of gingiva or oral mucosa N 910.00: A superficial wound produced by rubbing or scrapping of the mucosa leaving a raw bleeding surface.

#### **Classification by Basrani (1982) [4]**

Based on the anatomy of the teeth

- a) Crown fracture
  - i) Fracture of the enamel
  - ii) Fracture of the enamel and dentin.  
Without pulp exposure  
With pulp exposure
- b) Root fractures
- c) Crown-root fractures

#### **Classification by Galea (1984) [7]**

- Crown fracture without pulp exposure
- Crown fracture with pulp exposure
- Crown –Root fractures
- Root fractures
- Subluxation
- Subluxation with intrusion
- Subluxation with extrusion
- Luxation
- Fracture of the alveolar socket
- Dento- alveolar fracture

Fractures to the maxilla and mandible  
Injuries to the soft tissues  
Other injuries.

Root fracture  
Crown-root fracture  
Alveolar bone fracture

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**Classification by Burton, et al. (1985) [8]**

Fracture involving dentin and/or pulp  
Devitalization  
Avulsion

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**Classification by Forsberg and Tedestam (1990) [13]**

Enamel fracture  
Enamel dentin fracture  
Fracture involving pulp  
Root fracture  
Luxation, Subluxation  
Exarticulation  
Discolouration

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**Classification by Stockwell (1988) [9]**

Fracture of enamel only  
Fracture of crown involving enamel and dentin, but not the pulp  
Fracture of the crown with exposure of the pulp  
Fracture of the root  
Luxation of the tooth without fracture  
Avulsion of the tooth  
Concussion without fracture, displacement or avulsion, but loss of vitality during survey period  
Trauma to a previously traumatized tooth resulting in either dislodgement of the restoration, or further fracture, dislodgement or avulsion of the tooth

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**Classification by Perez, et al. (1991) [14]**

Intra-oral and / or extra-oral soft tissue injury  
Presence or absence of fracture/displacement to teeth  
Alveolar fracture  
Crown fracture were analyzed according to Ellis classification system

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**Classification by Lee-Knight, et al. (1989) [10]**

Tooth infraction  
Chipped tooth  
Fractured tooth  
Lacerated lip  
Traumatized TMJ

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**Classification by Zerman and Cavellari (1993) [10]**

Fracture of enamel including enamel chipping  
Fracture of enamel- dentine without pulpal involvement  
Fracture of enamel- dentine with pulpal involvement  
Fracture of root  
Crown-root fracture with pulpal involvement  
Concussion  
Subluxation  
Intrusive luxation  
Extrusive luxation  
Latetral luxation  
Avulsion

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**Classification by Hunter, et al. (1990) [11]**

Fracture  
Discolouration  
Absence of any maxillary incisor teeth

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**Classification by World Health Organization in its application of International Diseases of Dentistry and Stomatology (1994) [15]**

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**Classification by Bijella, et al. (1990) [12]**

Crown fracture  
Concussion  
Subluxation  
Subluxation with enamel fracture  
Subluxation with lingual or labial displacement  
Intrusion  
Extrusion  
Full displacement

This classification is based on a system adopted by the WHO in its application of the International classification of Disease to Dentistry and Stomatology. Certain trauma

entities were not defined and included in the WHO system. The following classification includes injuries to the teeth, supporting structures, gingival and oral mucosa and is based on anatomical, therapeutic and prognostic considerations. This classification can be applied to both the primary and the permanent dentition.

Includes injuries to the teeth, supporting structure, gingival, and oral mucosa which is based on anatomical, therapeutic and prognostic considerations and applied to both the permanent and the primary dentition. The code number is according to the international classification of diseases to dentistry (1992).

#### **A. Injuries to the hard dental tissues and the pulp**

- 1) Enamel infraction (N 502.50) An incomplete fracture (crack) of the enamel without loss of tooth substance.
- 2) Enamel fracture (uncomplicated crown fracture) (N 502.50) A fracture with loss of tooth substance confined to the enamel.
- 3) Enamel- Dentin Fracture (Uncomplicated Crown fracture) (N 502.51) A fracture with loss of tooth substance confined to enamel and dentin, but not involving the pulp.
- 4) Complicated crown fracture (N 502.52) A fracture involving enamel and dentin, and exposing the pulp.
- 5) Uncomplicated Crown- Root Fracture (N 502.54) A fracture involving enamel, dentin and cementum, but not exposing the pulp.
- 6) Complicated Crown-Root fracture (N 502.54) A fracture involving enamel, dentin and cementum, and exposing the pulp.
- 7) Root Fracture (N 502.53) A fracture involving dentin, cementum, and the pulp. Root fracture can be further classified according to displacement of the coronal fragment, as Horizontal, Oblique, and Vertical.

#### **B. Injuries to the periodontal tissues.**

- 1) Concussion  
(N 503.20) An injury to the tooth-supporting structures with abnormal loosening or

displacement of the tooth, but with marked reaction to percussion.

- 2) Subluxation (Loosening)  
(N 503.20) An injury to the tooth-supporting structures with abnormal loosening, but without displacement of the tooth.
- 3) Extrusive Luxation(Peripheral Dislocation, Peripheral Avulsion)  
(N 503.20) Partial displacement of the tooth out of its socket.
- 4) Lateral Luxation  
(N 503.20) Displacement of the tooth in a direction other than axially. This is accompanied by comminution or fracture of the alveolar socket.
- 5) Intrusive Luxation (Central dislocation)  
(N 503.21) Displacement of the tooth into the alveolar bone. This injury is accompanied by comminution or fracture of the alveolar socket.
- 7) Avulsion (Exarticulation)  
(N 503.22) Complete displacement of the tooth out of its socket.

#### **C. Injuries to the supporting bone**

- 1) Comminution of the mandibular (N 502.60) or Maxillary (N 502.40) Alveolar Socket  
Crushing and compression of the alveolar socket. This condition is found concomitantly with intrusive and lateral luxations.
- 2) Fracture of the Mandibular (N 502.60) or Maxillary (N 502.40) Alveolar Socket Wall  
A fracture confined to the facial or oral socket wall.
- 3) Fracture of the Mandibular (N 502.60) or Maxillary (N 502.40) Alveolar process  
A fracture of the alveolar process which may or may not involve the alveolar socket.
- 4). A fracture involving the base of the mandible or maxilla and often the alveolar process(jaw fracture).The fracture may or may not involve the alveolar socket.

#### **D. Injuries to gingiva or oral mucosa**

- 1) Laceration of gingival or oral mucosa (S 01.50) A shallow or deep wound in the mucosa resulting from a tear, and usually produced by a Sharp object

2) Contusion of gingiva or oral mucosa (S00.50)  
A bruise usually produced by impact with a blunt object and not accompanied by a break in the mucosa, usually causing sub mucosal hemorrhage.

3) Abrasion of gingival or oral mucosa (S 00.50)  
A superficial wound produced by rubbing or scraping of the mucosa leaving a raw, bleeding mucosa.

### **Classification by Burden (1995) [10]**

Fracture (enamel)  
Fracture (enamel and dentin)  
Fracture (involving pulp)  
Discoloration  
Acid etch resoration  
Other restoration

### **Classification of dental trauma of primary teeth by Fried and Erickson (1995) [10]**

1. Classification of hard tissue fractures

**Class I** - Simple fracture of enamel only.

**Class II** - Fracture involving enamel and dentin.

**Class III** - Fracture extends farther into the tooth, with a small pulpal exposure

**Class IV** - Fracture involves significant amount of pulpal exposure

**Class V** - Complete loss of the tooth

**Class VI** - Fracture of the root

2. Trauma affecting the periodontium

Concussion - Sensitivity of the tooth to trauma without abnormal loosening or mobility

Subluxation - Loosening of the tooth without mobility

Luxation - Displacement of the traumatized teeth.

### **Classification by Hamilton, et al. (1997) [10]**

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

Presence of sinus or swelling in the mucosa over a tooth.

### **Classification by Spinus (2002) [16]**

It is an "easy to use" classification of dental crown lesions that helped to gather data easily, to choose the right materials, to improve communication among practioners including by electronic means.

It consist of 4 classes (A-B-C-D) and 3 subclasses (b1-c1-d1)

**Class A:** All the simple enamel lesions, which involve a mesial or distal crown angle, or only the incisal edge.

**Class B:** All the enamel dentin lesions, which involve a mesial or distal angle and the incisal edge. When a pulp exposition exists defined as a subclass b1.

**Class C:** All the enamel dentin lesions, which involve the incisal edge and at least a third of the crown surface. In case of pulp exposure defined as subclass c1

**Class D:** All the enamel dentin lesions, which involve a mesial or distal crown angle and the incisal or palatal surface, with root cement involvement (crown root fracture) in case of pulpal exposure exists defined as subclass d1.

### **Classification by McDonald (2004) [17]**

**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 dental pulp

**Class 3** - Extensive fracture of the crown with an exposure of the dental pulp

**Class 4** - Loss of the entire crown.

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