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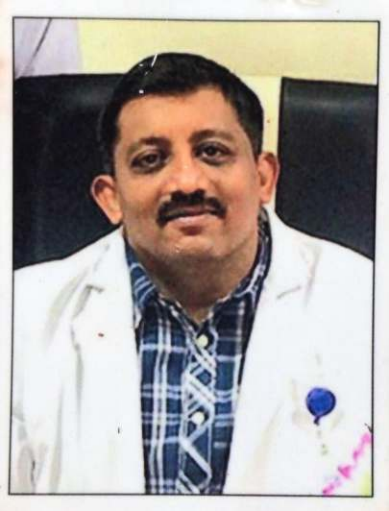

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Topic : MouthGuard

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Subject :	Topic :	Speaker :

MOUTHGUARDS

INTRODUCTION

- Sports dentistry has recently emerged as one of the most popular areas in dentistry. It involves the prevention and treatment of orofacial athletic injuries.
- Participation in sports carries a considerable risk of sustaining dental injury, especially with the increased popularity of contact sports and greater encouragement for children to participate at an early age
- In the case of dentofacial trauma, the following situations may be seen: crown fracture, crown-root fracture, root fracture, tooth concussion and subluxation, extrusion and lateral luxation, intrusion, avulsion injuries, and fracture of the alveolar process, based on who's classification system modified by Andreasen and Andreasen

Tuna EB, Ozel E. Factors affecting sports-related orofacial injuries and the importance of mouthguards. Sports medicine. 2014 Jun 1;44(6):777-82.

According to the American Dental Association and the International Academy of Sports Dentistry, mouthguards should be used in the following 29 sports or exercise activities:

- Acrobatics,
- Basketball,
- Bicycling,
- Boxing,
- Equestrian events,
- Extreme sports,
- Field events,
- Field hockey,
- Football,
- Gymnastics,
- Handball,
- Ice hockey,
- Inline skating,
- Lacrosse,
- Martial arts,
- Racquetball,
- Rugby,
- Shot putting,
- Skateboarding,
- Skiing,

Skydiving,

Soccer,

Softball,

Squash,

Surfing,

Volleyball,

Water polo,

Weight lifting, and

Wrestling

American Academy of Pediatric Dentistry. Policy on prevention of sports-related orofacial injuries. http://www.aapd.org/media/ Policies_Guidelines/P_Sports.pdf. Accessed 23 Aug 2013.

First introduced in boxing in the **1920s** and were later used in American Football due to their effectiveness at reducing oral injuries.

Josell and Abrams report that mouthguards may help prevent concussion, cerebral hemorrhage, and possibly death by separating the jaws and thus preventing the mandibular condyles from being displaced upward and backward against the wall of the glenoid fossa.

However, **Labella et al** stated that custom-fitted mouthguards do not significantly reduce rates of concussion or oral soft-tissue injury but can significantly reduce the morbidity and expense resulting from dental injuries among men who play basketball.

Josell SD, Abrams RG. Traumatic injuries to the dentition and its supporting structures. Pediatr Clin North Am. 1982;29:717–43.

Labella CR, Smith BW, Sigurdsson A. Effect of mouthguards on dntal injuries and concussions in college basketball. Med Sci Sports Exerc. 2002;34:41–4.

DEFINITION

- A mouthguard is defined as ‘a resilient device or appliance placed inside the mouth to reduce oral injuries, particularly to teeth and surrounding structures.’

Parker K, Marlow B, Patel N, Gill DS. A review of mouthguards: effectiveness, types, characteristics and indications for use. British dental journal. 2017 Apr;222(8):629.

CRITERIA

According to **Scott *et al***., The following criteria should apply to mouthguards used in contact sports:

(1) They should enclose the maxillary teeth to the distal surface of the second molars;

(2) Thickness should be 3 mm on the labial aspects, 2 mm on the occlusal aspect, and 1 mm on the palatal aspect, and the labial flange should extend to within 2 mm of the vestibular reflection;

(3) The palatal flange should extend about 10 mm above the gingival margin; and

(4) When a maxillary guard is constructed, it should be articulated against the matching mandibular model for optimum comfort.

Scott J, Burke FJT, Watts DC. A review of dental injuries and the use of mouthguards in contact team sports. Br Dent J. 1994:176:310–4.

PROPERTIES OF MOUTHGUARD MATERIAL

Essential properties include water absorption,

Density & thickness,

Temperature transmission,

Energy absorption, and

Drawing strength (tensile

Currently,

Polyvinyl acetate-polyethylene copolymer or

Ethylene vinyl acetate (EVA) copolymer and

Polyvinyl chloride are used.

Silicone rubber, natural rubber, soft acrylic resin,

Latex rubber was a popular material used in early mouthguards, but it has

Lower shock absorbency,

Lower hardness, and

Less tear and tensile strength than EVA or polyurethane

Badel T, Jerolimov V, Panduric´ J, et al. Custom-made mouthguards and prevention of orofacial injuries in sports. Acta Med Croatica. 2007;61:9–14.

Auroy P, Duchatelard P, Zmantar NE, et al. Hardness and shock absorption of silicone rubber for mouth guards. J Prosthet ent. 1996;75:463–71.

CLASSIFICATION

- **The ASTM in Designation: F697-80 (Reapproved 1986)** established the classification system for athletic mouthguards as follows:
- **Type I: Stock mouthguards**
- **Type II: Mouth-formed mouthguards**
- **Type III: Custom-fabricated mouthguards**

TYPE I: STOCK MOUTHGUARDS

- Pre-fabricated mouthguards not fitted specifically or adapted to the patient.
- Available in different sizes with the patient choosing their own ‘best fit’ size. There are three types of pre-fabricated mouthguard:

Single jaw

- Can be made for the upper or lower jaws,
- More commonly for upper jaw (more susceptible trauma)

Bimaxillary

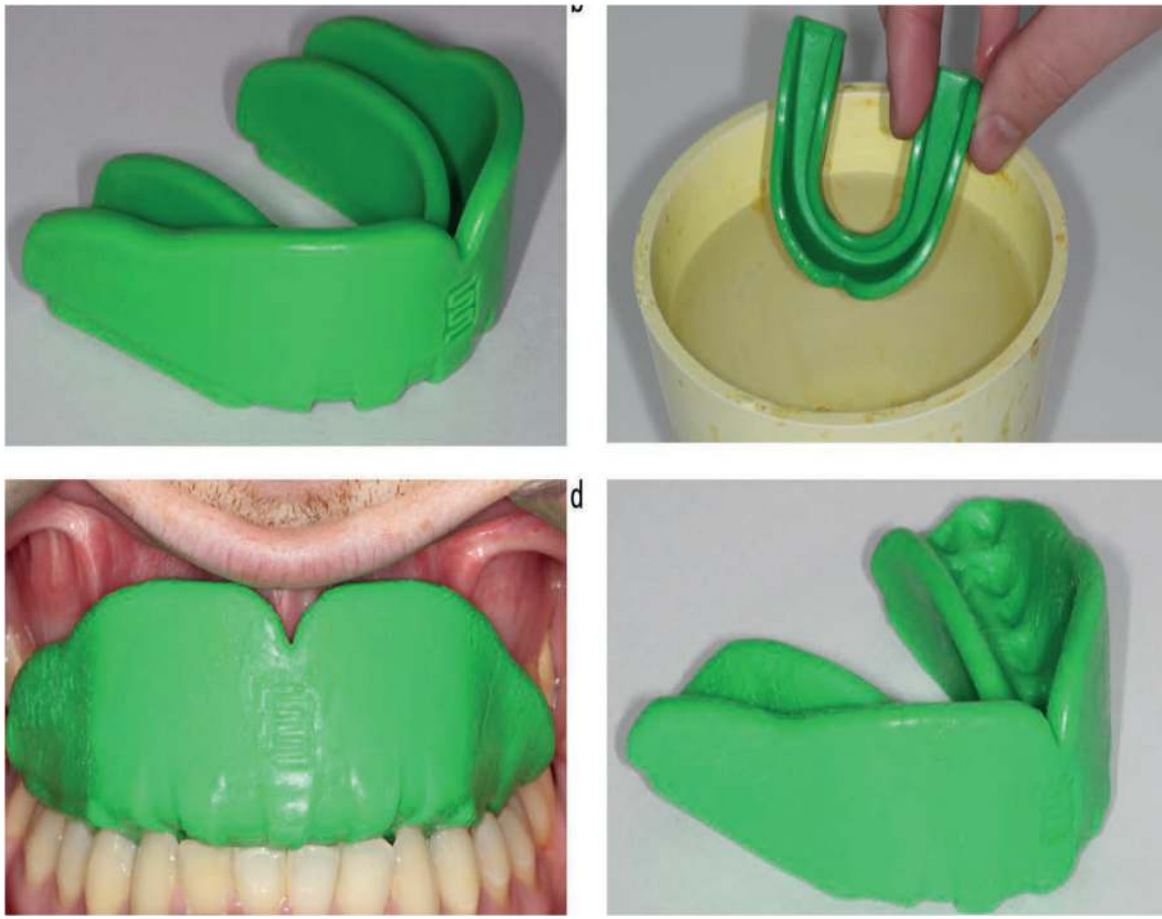
- Cover both the upper and lower jaws in one single appliance and
  thus offer protection to both the upper and lowe
- Bulky, can affect speech and difficult to tolerate.

Orthoguard

- Mouthguards for patients undergoing fixed appliance orthodontic treatment.
- They have a cut away channel on the fitting surface to accommodate the fixed appliances and any tooth movement.
- Need to be changed as the orthodontic treatment progresses.

TYPE II: MOUTH FORMED MOUTHGUARDS

- Commonly referred to as ‘boil-and-bite’.
- Made from thermoplastic material



A mouth-formed mouthguard before, during and

TYPE III: CUSTOM FABRICATED MOUTHGUARDS

- Fabricated by dental laboratories from dental impressions.
- Made from polyethylene vinyl acetate (EVA) and are suitable for both orthodontic and non-orthodontic patients.
- The fit of the mouthguard is checked by the dentist or orthodontist and they generally have a better fit than mouth-formed and pre-fabricated mouthguards
- Drawbacks involve at least one dental appointment and they are the most expensive type available.

Single Jaw

- Similar to pre-fabricated mouthguards
- Can be fabricated for the upper or lower jaws and therefore provide protection to the teeth

b

Bimaxillary

- Can be fabricated to cover both the upper and lower jaws in o appliance.
- Often incorporate holes in the anterior region to facilitate air flow during use.

ADVANTAGES & DISADVANTAGES

TYPE OF MOUTHGUARDS	COST	RETENTION AND FIT	PROTECTION	CONTACT WITH DENTIST	OTHER FACTORS
Pre-fabricated	Cheap	Poor	Poor	Minimal	Readily available from retailers, not adaptable
Mouth-formed	Moderate	Average	Average	Minimal	Readily available from retailers, adaptable
Custom made	Expensive	Good	Good	Required	Can be made to allow orthodontic tooth movement, not adaptable
Orthoguard	Moderate	Average	Average	Minimal	Better fit around fixed orthodontic appliances, allows movement of teeth, adaptable
Bimaxillary	Moderate	Average	Average	Minimal	Difficult to source, not adaptable

Parker K, Marlow B, Patel N, Gill DS. A review of mouthguards: effectiveness, types, characteristics and indications for use. British dental journal. 2017 Apr;222(8):629.

ADJUSTMENTS

- Overextended mouthguard:

  Adjusted by the clinician or the laboratory

  Flanges can be reduced to their correct extension and correct fit.

- Under extended mouthguard:

  New, fully extended, impressions are taken so that a new mouthguard can be made with fully extended flanges

Parker K, Marlow B, Patel N, Gill DS. A review of mouthguards: effectiveness, types, characteristics and indications for use. British dental journal. 2017 Apr;222(8):629.

GRADING SYSTEM

In 2005, **Patrick *et al*** proposed a grading system for mouthguard protection, Ranging from 0 (no mouthguard) to 10 (custom-made mouthguard with optimal design and materials that has passed an effective instrumented test).

Other custom-made mouthguards less than 2 years old were rated between 5 and 9 on the scale, depending on their thickness, newness, use of improved materials and design, and text results.

Older custom-made mouthguards were rated 3 and 4, depending on whether they were less or greater than 5 years old.

Stock mouthguards and boil and bite mouthguards had low ratings (1 and 2, respectively) on this scale.

Patrick DG, van Noort R, Found MS. Scale of protection and the various types of sports mouthguard. Br J Sports Med. 2005;39:278–81.

MOUTHGUARD CARE

- Mouthguards are cared for properly to ensure their longevity and continued effectiveness.
- Before and after use mouthguards should be rinsed in cold water.
- Hot or warm water should not be used because this can cause distortion.
- A small toothbrush and water, with or without toothpaste can be used to clean mouthguards to maintain freshness.
- When not being worn, mouthguards should be stored in a secure container to prevent loss or damage
- Kept away from heat and direct sunlight to prevent distortion.
- Mouthguards should be regularly checked by the patient's dentist or orthodontist and they can advise when they need replacing.

Parker K, Marlow B, Patel N, Gill DS. A review of mouthguards: effectiveness, types, characteristics and indications for use. British dental journal. 2017 Apr;222(8):629.

ADVANTAGES

- ✓ Protects lips and intra-oral soft tissues from bruises and lacerations
- ✓ Protects teeth from crown and root fractures, dislocations and avulsions
- ✓ Reduces the risk of jaw fracture and dislocation
- ✓ Provides support to edentulous patients
- ✓ Improves confidence of players

RECOMMENDATIONS

- Clinicians should routinely ask their patients, about any sports they participate and should recommend the use of a mouthguard if needed.
- Advocacy should also focus on sports coaches, sporting organisations and governing bodies.
- Coaches and teachers should be encouraged to insist on players wearing mouthguards for training as well as matches, even if the rules of the game do not stipulate their mandatory use.

Parker K, Marlow B, Patel N, Gill DS. A review of mouthguards: effectiveness, types, characteristics and indications for use. British dental journal. 2017 Apr;222(8):629.

Factors identified as BARRIERS

- Poor retention
- Intra-oral dryness
- Nausea
- Interference with breathing
- Interference with speaking
- Athletes priding themselves on not wearing a mouthguard
- Increased cost of custom-made mouthguards

Parker K, Marlow B, Patel N, Gill DS. A review of mouthguards: effectiveness, types, characteristics and indications for use. British dental journal. 2017 Apr;222(8):629.

CONCLUSION

Due to the increasing participation in athletic activities, the need for mouthguard implementation is of critical importance. All healthcare professionals need to work more closely together in the reporting of sports-related dental injuries in an effort to help us to better assess the situation. The literature views mouthguards as offering considerable protection against sports-related dental injuries. There is a need

INTRODUCTION

- Trauma is one of the most common presentations of young children to a paediatric dentist and can be distressing for both child and parent.
- The treatment of injuries should always be commenced as early as possible following the accident.
- **TRAUMATIC DENTAL INJURY(TDI)** is a common oral disorder in preschool children, since, during this period , the young child is learning to crawl, stand, walk and run. The rudimentary stage of development of reflexes and the lack of motor coordination may leads to fall; principal cause of TDI in this population.

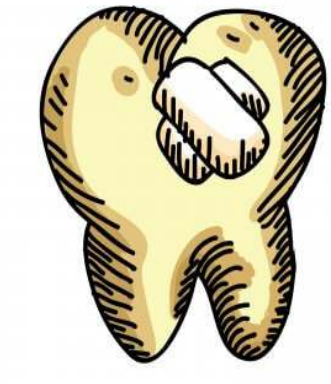
EPIDEMIOLOGY

- Traumatic dental injuries account for 5% of the events that led people to seek dental care and are part of a growing problem in public health (Andreason et al.,2007)
- **Sex distribution:**

i. Males experienced significantly more dental trauma to the permanent dentition than females in all Australian and most international surveys cited.

ii. The male: female ratio ranged from 1.3-2.3:1

iii. The proportion of men and women suffering from dental injuries is changing over the years, with an increasing number of females, sometimes reaching male to female proportions of 1.3 to 1.5(Borss'en & Holmes, 1997; Filippi et al., 1997; Noori & Al-Obaidi,2009).



- **Tooth involved:**

a) Most affected teeth- Maxillary central incisors – upper lateral incisors. (Galea ,1984, Campbell 1990, Caliskan & Tutkan 1995).

b) Second most frequently injured teeth were maxillary lateral incisors in all studies except that by Forsberg and Tedestam where mandibular central incisors were the second most frequently injured teeth.

- **Age:**

a) **20% -30%** of all children under **12 years** old have already suffered traumatic dental injuries

b) Boys account for 70% of the involved patients, usually presenting coronary fratures without pulp exposure(Andreason et al.2000; Tolentino et al., 2008; Noori & Al-Obaidi,2009)

c). First peak – appears at 2 to 4 years of age. By the age of 7 years 28% girls and 32% boys have sufferred a traumatic dental injury to the primary dentition.

d). Injuries varied by age, being more common in boys in the first two decades of life due to their intense participation in physical activities, contact sports and rougher plays using toys and equipments with higher risk.

PREDISPOSING AND RISK FACTORS

- Important predisposing factor-maxillary overjet and incomplete lip closure
- Multiple injuries to incisors:

  19.2%- normal overjet

  22.2%- increased overjet

  46.7%- extreme overjet

- Important factor found to risk the dental trauma while playing sports was the lack of a properly fitted mouthguard and/ or faceguard.

ETIOLOGY

- The following are the most common causes of dental traumatic injuries:

✓ **Home accidents**

All types of dental fractures occurred most commonly at home (68%) followed by school (20%). The playgroundand road accidents account for the remaining 10%.

✓ **Automobile accidents**

This pattern of injury is seen when the passenger, not wearing a seat belt, is suddenly thrown against the dashboard.

✓ **Playground accidents**

Falls and collisions, bicycle injuries, sports injuries form the bulk of playground injuries.

✓ **Abuse**

An alarming cause of dental trauma is child abuse.

Suspicion of abuse should be aroused if there is

- A substantial delay between the time of injury and presentation for treatment.
- Evidence of repeated injuries.
- Previous history of abuse.

✓ **Horseback riding injuries:**

Horseback riding is a popular sport in many countries and a major source of injury. This sports causes not only ental injuries but also complex maxillofacial trauma.

✓ **Torture:**

Almost unheard of, bus shockingly true source of dental trauma is torture.

Most common type of torture was beating that resulted in loosening, avulsion or fracture of teehand laceration of soft tissue**.**

- ✓ **Mental retardation**

  Lack of motor coordination, crowded conditions of institutions and concomitant epilepsy – various factor result in a high frequency of dental traumatic injuries .

- ✓ **Epilepsy**
- ✓ **Dentinogenesis imperfecta**

  Decreased micro hardness of the dentin and tapered anatomy of the roots results in spontaneous root fracture affecting individuals with dentinogenesis imperfecta.

- ✓ **Drug related injuries**
- ✓ **Biting hard items**

CLASSIFICATION

- In 1950 pediatric dentist **G.E.ELLIS** was the first to report universal classification of dental injuries.
- Since traumatic injuries often have medico-legal implications, it is essential to maintain accurate documentation by using a simple and systemic method for recording the injuries,

CLASSIFICATION BY ELLI"S AND DAVEY(1960):

- Class 1 - Simple crown fracture involving little or no dentin
- Class 2 - Extensive # of crown with considerable amount of dentine without exposing pulp.
- Class 3 – Extensive # of crown with considerable amount of dentine & exposing the dental pulp.
- Class 4 - Traumatised tooth that has become non-vital with or without loss of crown structure.
- Class 5 - Tooth loss due to trauma (Avulsion)

- Class 6 - # of root with or without loss of crown structure.
- Class 7 – Displacement of tooth without loss of crown fracture.
- Class 8 – Fracture of crown en mass.
- Class 9- Traumatic injuries to primary dentition.

CLASSIFICATION BY RABINOWITCH (1956):

- Fracture of enamel or slightly into dentine.
- Fracture into dentin
- Fracture into pulp.
- Fracture of root.
- Comminuted fracture.
- Displaced tooth (Exarticulation).

- Modification of Elli"s classification by Mc Donald, Avery & Lynch (1983):

  Class 1 – Simple # of crown involving little or no dentin.

  Class 2 - Extensive # of crown involving considerable dentin, but not pulp.

  Class 3 – Extensive # of crown with an exposure of pulp.

  Class 4 – Loss of entire crown

- Classification by Ulfohn(1985):

  This classification is evolved from a clinical endodontic point of view:

  A - # of enamel.

  B - # of crown with indirect pulp exposure through dentin.

  C - # of crown with direct pulp exposure.

ANDREASEN CLASSIFICATION(1981)

- Injuries to hard dental tissues & pulp.
- Injuries to periodontal tissues.
- Injuries to supporting bone.
- Injuries to gingiva & oral mucosa.

➢ Injuries to hard dental tissues & pulp:

i. Enamel infarction (502.50): Incomplete # (crack) of enamel without loss of tooth substance.

ii. Enamel fracture (502.50) (Uncomplicated crown #) :

A # with loss of tooth substance confined to enamel only.

iii. Enamel- Dentine # (502.51) (Uncomplicated crown #):

A # with loss of tooth substance confined to enamel & dentine but not involving pulp.

iv. Complicated crown #(502.2) : # involving enamel, dentin and cementum but not exposing pulp.

v. Uncomplicated crown –root # (502.54)- # involving enamel, dentin & cementum but not exposing pulp.

vi. Complicated crown root # (502.54) - # involving enamel, dentin & cementum but not exposig pulp.

vii. Root # (502.53) - # involving cementum, dentine and pulp. They can also be classified according to displacement of coronal fragment.

- Injuries to periodontal tissues:

i. Concussion (503.20) An injury to tooth supporting structures without abnormal loosening or displacement of tooth but with marked reaction to percussion.

ii. Subluxation (503.20) An injury to tooth supporting structures with abnormal loosening but without displacement of tooth.

iii. Extrusive luxation (503.21) (Peripheral dislocation, partial avulsion)- Partial displacement of tooth out of its socket.

iv. Lateral luxation(503.20)- Displacement of tooth in any other direcion than axial , accompanied by # of alveolar socket.

v. Intrusive luxation (503.21) (Central dislocation) : Displacement of tooth into alveolar socket accompanied by # of alveolar socket

vi. Avulsion (503.22) (Exarticulation)- Complete displacement of tooth out of its socket.

- Injuries to supporting bone:

i. Comminution of maxillary / mandibular alveolar socket: Crushing and compression of alveolar socket found mostly with intrusive & lateral luxation.

ii. # of maxillary(502.40) / mandibular (502.60) socket wall: # confined to Facial or lingual socket wall.

iii. # of maxillary (502.40)/ mandibular (502.60) alveolar process: # involving the base of the maxill or mandible & often the alveolar process . May or may not involve alveolar socket.

- Injury to Gingiva & Oral mucosa:

  Laceration(501.50)– Shallow or deep wound in the oral mucosa resulting from a tear usually produced by sharp object.

  Contusion(501.50) – A bruise caused by contact with blunt object without any tear but cause sub mucosal haemorrhage.

  Abrasion (501.50) – Superficial wound produced by rubbing or scrapping of mucosa leaving a raw bleeding surface.

HARGREAVES & CRAIG"S CLASSIFICATION;

Class I : No # or # of enamel only with or without displacement of tooth.

Class II : # of crown involving enamel & dentin without exposure of pulp , with or without displacement of teeth.

Class III: # of crown exposing the pulp with or without displacement of tooth

Class IV: # of root with or without crown # , with or without displacement of teeth.

Class V : Total displacement of teeth.

- **W.H.O CLASSIFICATION (1993):**

873.60 - Enamel #

873.61 - Enamel ,dentin # without pulp exposure.

873.62 - Enamel , dentin # with pulp exposure.

873.63 - Root #

873.64 - Crown- root#

873.66 - Concussion, Luxation

873.67 - Intrusion, Extrusion

873.68 - Avuksion

873.69 - Soft tissue injury

- **SPINA AND ALTANA"S CLASSIFICTION:**

A class: Simple enamel lesions involving one proximal angle or only incisal edge

B class : Enamel – dentin lesions involving 1 proximal angle or only one incisal edge.

Subclass b1- with pulp exposition.

C class : Enamel- dentin lesion involving incisal edge & at least a third of crown.

Subclass c1 –with pulp exposition.

D class : Enamel – dentin lesions involving mesial or distal angle & the incisal or palatal surface & root involvement.

Subclass d1 –with pulp exposition

When the necotic pulp is present, the letter ' h" is placed after the main classification.

- **Baratieri ,montiero & Andrada"s classification(1998):**

A class Enamel fracture,

B class Enamel-dentin # b1- without pulpal & biologic width involvement..

b2- without pulpal involvement but biologic width violation (violation at or coronal to bone crest level).

b3- with pulpal involvement & no biologic width violation.

b4- With pulpal involvement & biologic width violation (at or coronal to bone crest level)

- **Garcia-Godoy classification(1981)**:

0 - Enamel crack

1 - Enamel fracture

2 – enamel- dentin# without pulp exposure.

3 - enamel – dentin # with pulp exposure.

4 - enamel- dentin- cementum # without pulp exposure.

5- enamel –dentin- cementum # with pulp exposure

6- Root #

7 – Concussion

8 – Luxation

9 – Lateral displacement

10- Intrusion

11- Extrusion

12 - Avulsion

- **Bennet"s classification:**

Class I - Traumatised tooth

Ia – tooth is firm in alveolus.

Ib – tooth is subluxed in alveolus.

Class II – Coronal #

II a - # of enamel

II b - # of enamel & dentin

Class III –Coronal # with pulp exposure

Class IV - Root #

IV a – Without coronal #

IV b – With coronal #

Class V – Avulsion of tooth.

- **Hithersay & morile(1982)** – Recommended classification of sub gingival # based on level of tooth # in relation to various horizontal planes of periodontium:
- **Class1 -** # line doesnot extend below level of attaached gingiva.
- **Class 2 -** # line extends below level of attached gingiva, but not below the level of alveolar crest.
- **Class 3 -**# line extends below alveolar crest.
- **Class 4 -** # line is within the coronal 3 rd of root but below the alveolar crest.

TYPES OF TRAUMATIC DENTAL INJURY

MECHANISM OF TRAUMATIC DENTAL INJURIES

- Trauma to the dentition can be of two types:

  Direct trauma

  Indirect trauma.

Direct trauma:

- involves the tooth directly
- favours anterior teeth

Indirect trauma:

- seen when the lower arch forcefully close against the upper arch
- favours crown and crown-root fracture of the premolar and molar region

FACTORS THAT CHARACTERIZE THE IMPACT AND EXTENT OF INJURY

- Energy of impact- mass and velocity
- Resilience of impact
- Shape of impacting object
- Direction of impacting force- facially or perpendicular to the long axis of the root.
    - horizontal crown fractures
    - horizontal fractures at the neck of teeth
    - oblique crown root fractures
    - oblique root fractures