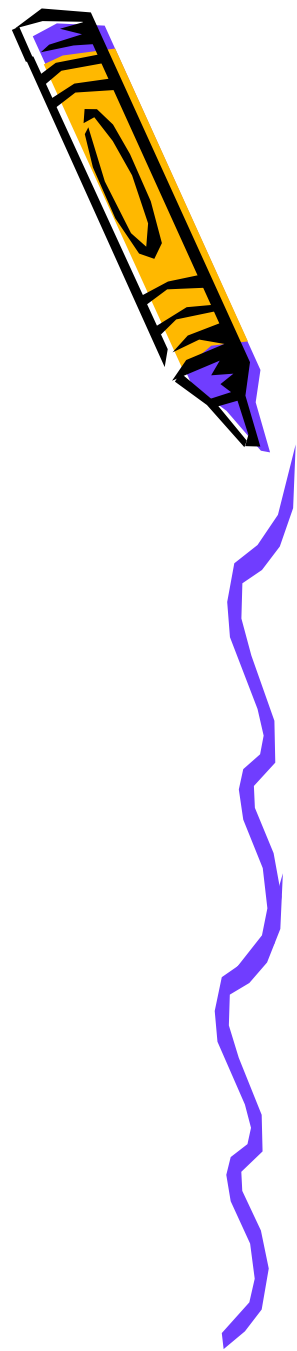




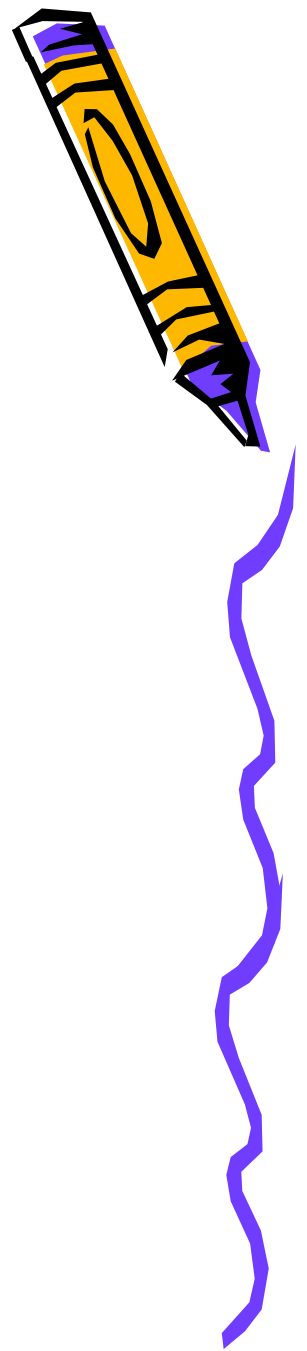
Traumatic Injuries

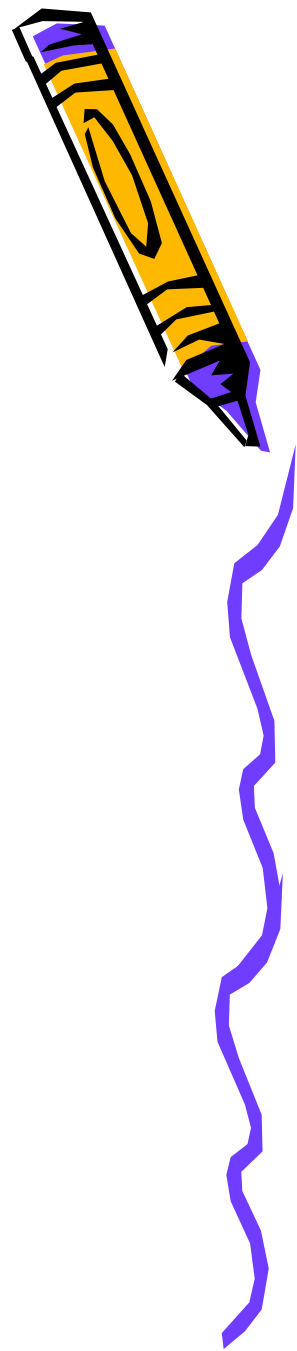
- Introduction
- Etiology
- Incidence
- Predisposing factors
- Mechanism of dental injury
- History and clinical examination
- Wound healing and treatment principles



Classification

- WHO classification (1995)
- Andreasen & Andreasen classification (1993)
- Ellis & Davey's classification (1970)
- Modified Ellis classification
- Busrani classification (1985)
- Heithersay and Morile (1982)
- Spinass & Atlantas classification (2002)





- Crown fractures (diagnosis, treatment, prognosis)

 - Enamel infraction

 - Enamel fracture

 - Enamel-dentin fracture

 - Enamel-dentin fracture with pulpal involvement

- Crown root fractures (diagnosis, treatment, prognosis)

 - Uncomplicated

 - Complicated

- Root fractures (diagnosis, treatment, prognosis)

- Luxation injuries (diagnosis, treatment, prognosis)

 - Concussion

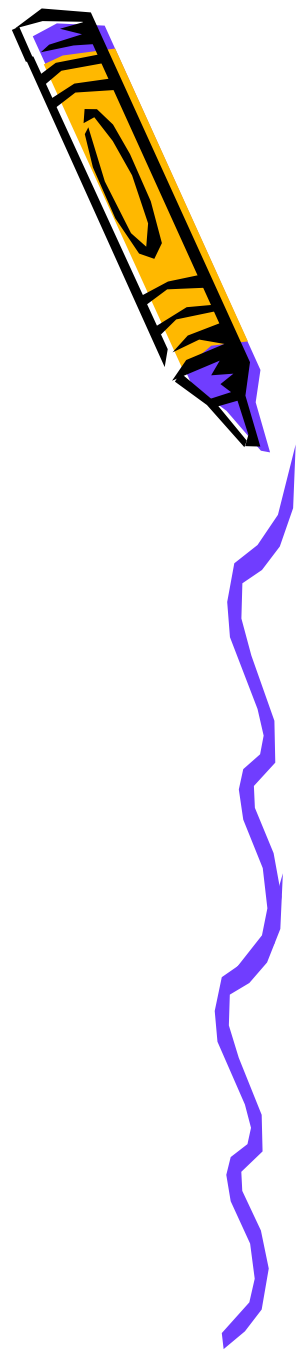
 - Subluxation

 - Extrusive luxation

 - Lateral luxation

 - Intrusive luxation





•Avulsion

Incidence

Mechanism

Healing pattern

Therapeutic protocols

- Treatment at the site of accident
- Storage media
- Extra-oral dry time (less or more than 60min)
- Repositioning of the tooth
- Splints
- Pharmacological treatment
- Endodontic treatment
- Crown restoration
- Follow up

•Soft tissue injuries (diagnosis, treatment, prognosis)

Abrasion

Contusion

Laceration



•Injuries to the supporting bone (diagnosis, treatment, prognosis)

•Traumatic injuries of the primary dentition

Incidence

Diagnosis

Damage to the developing tooth bud

Treatment

Prognosis

•Prevention of dental injuries

Face guards

-prefabricated

-custom made

Mouth guards

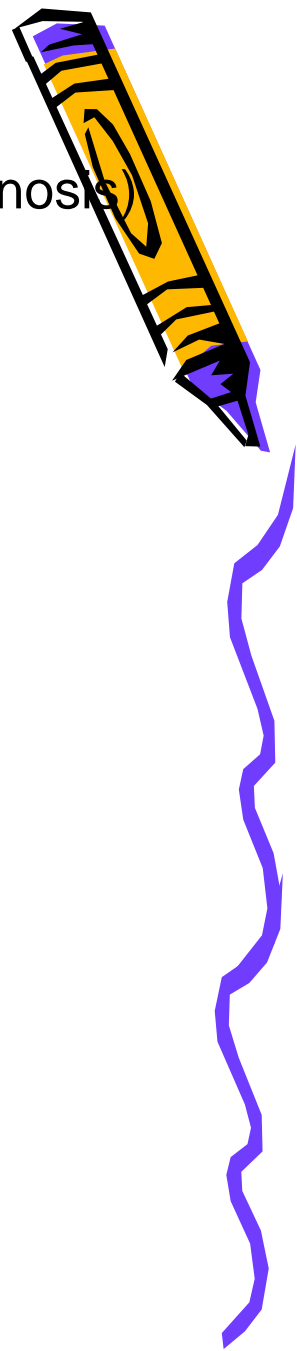
-stock


-mouth formed or boil and bite

-custom made

Advantages & Disadvantages

•Summary and conclusion





➤ Incidence of dental trauma due to automobile accidents and violent sports has increased significantly during the last decade causing anterior teeth of children and teenagers to be commonly affected.

➤ Mean prevalence of dental and oral injuries is between 14% and 27%.

➤ Quality and timeliness of initial care contribute to a desirable outcome by promoting healing.



- Long term outcome of success is related to the response of tooth pulp-thus the importance of endodontic consideration in dental trauma.
- Incidence of dental trauma will overtake the incidence of caries and periodontal disease in children and teenagers. (Andreasen 1993)



Classification

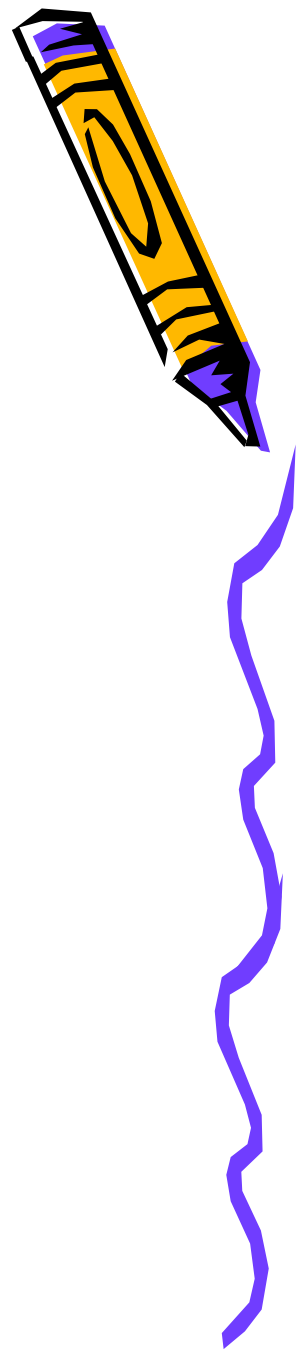
WHO classification and modified by Andreasen & Andreasen (1995)
Used by the International Association of Dental Traumatology

Type of injuries	Code
Enamel infarction	N 502.50
Enamel fracture	N 502.50
Enamel- dentin fracture (uncomplicated)	N 502.51
Enamel - dentin fracture (complicated)	N 502.52
Root fracture	N 502.53
Crown- root fracture (uncomplicated)	N 502.54
Crown- root fracture (complicated)	N 502.54
Multiple fracture	N 502.57
Fracture of tooth unspecified	N 502.59



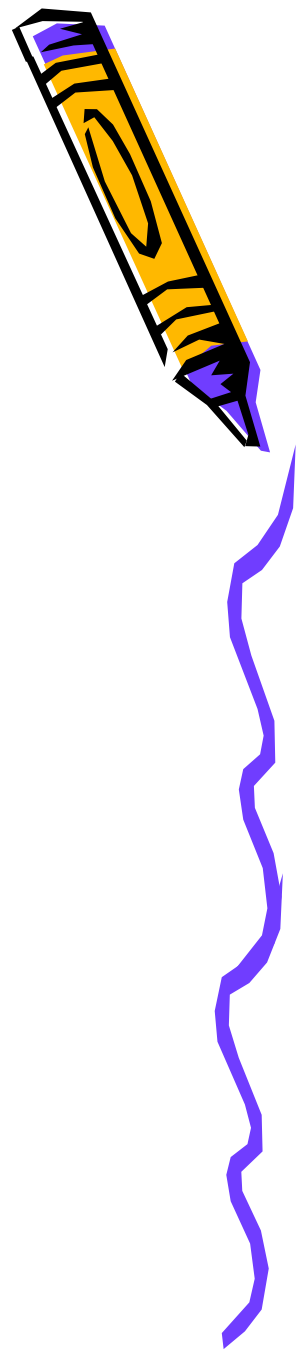
Injuries to the Periodontium

- Concussion
 - Subluxation
 - Extrusive luxation
 - Lateral luxation
 - Intrusive luxation
 - Avulsion
- N 503.20
 - N 503.20
 - N 503.20
 - N 503.20
 - N 503.21
 - N 503.22



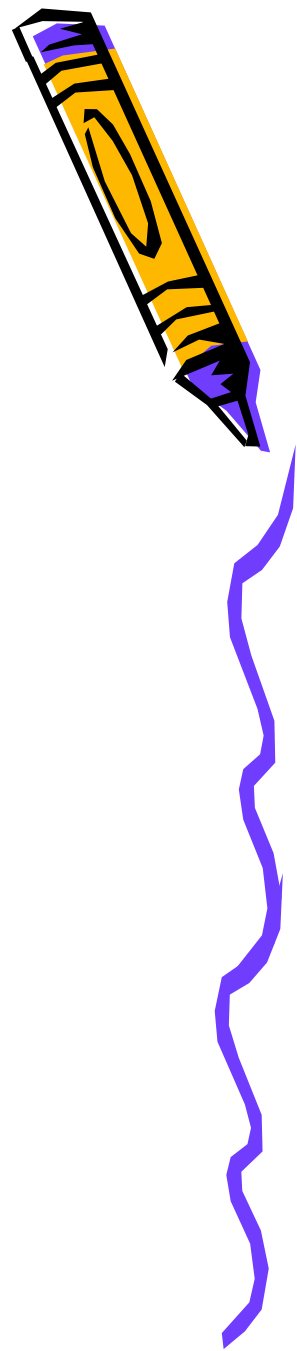
Injuries to the supporting bone

- N 502.60
- Communion of mandibular alveolar socket
- N 502.40
- Communion of maxillary alveolar socket
- N 502.60
- Fracture of mandibular alveolar socket wall
- N 502.40
- Fracture of maxillary alveolar socket wall
- N 502.61
- Fracture of mandible
- N 502.42
- Fracture of maxilla



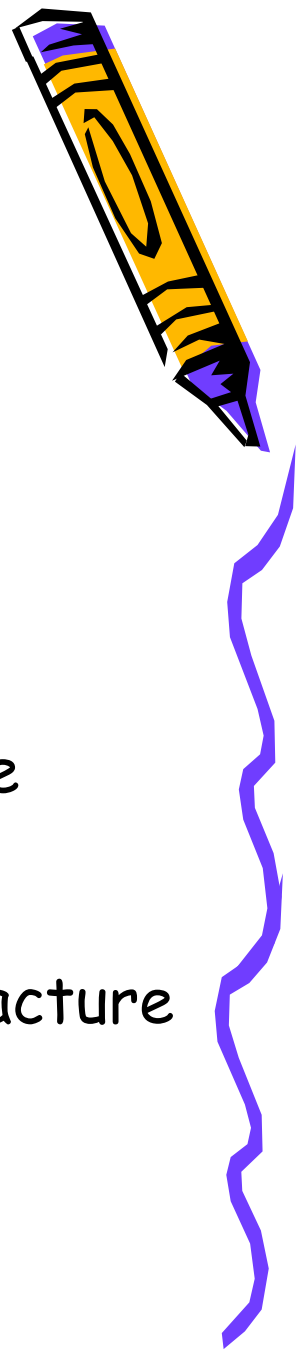
Injuries to gingiva or oral mucosa

- Laceration • N 801.50
- Contusion • N 800.50
- Abrasion • N 800.50



Andreasen and Andreasen classification (1993)

- Class I enamel infraction
- Class II enamel fracture
- Class III enamel dentin fracture
- Class IV complicated crown fracture
- Class V crown root fracture
- Class VI complicated crown-root fracture
- Class VII root fracture



Ellis and Davey's classification (1970)

Class I -Fracture involving enamel

Class II -Fracture involving enamel & dentin

Class III -Fracture involving enamel, dentin & pulp

Class IV -Teeth that lost their vitality with or without loss of crown

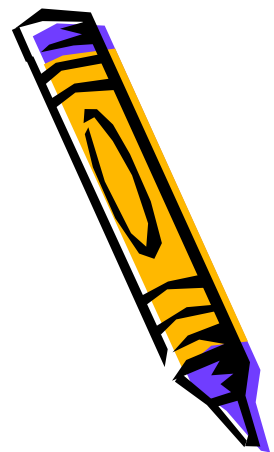
Class V -Traumatically avulsed tooth

Class VI -Fracture of the root with or without crown fracture

Class VII -Displacement of the tooth without crown/root fracture

Class VIII -Cervical crown fracture

Class IX -Fracture of deciduous teeth



Modified Ellis classification

Class I - tooth traumatized, crown or root intact

- a) pulp may be devitalized
- b) internal resorption may develop
- c) external resorption may develop

Class II - coronal fracture , pulp not exposed

Class III - coronal fracture , pulp exposed

Class IV - coronal fracture extending subgingivally

Class V - root fracture with or without loss of crown structure

- a) horizontal fracture
- b) vertical fracture

Class VI - displacement of teeth with or without fracture

- a) partial displacement
- b) lingual displacement

Class VII - injuries to deciduous teeth



Heithersay and Morile (1982)

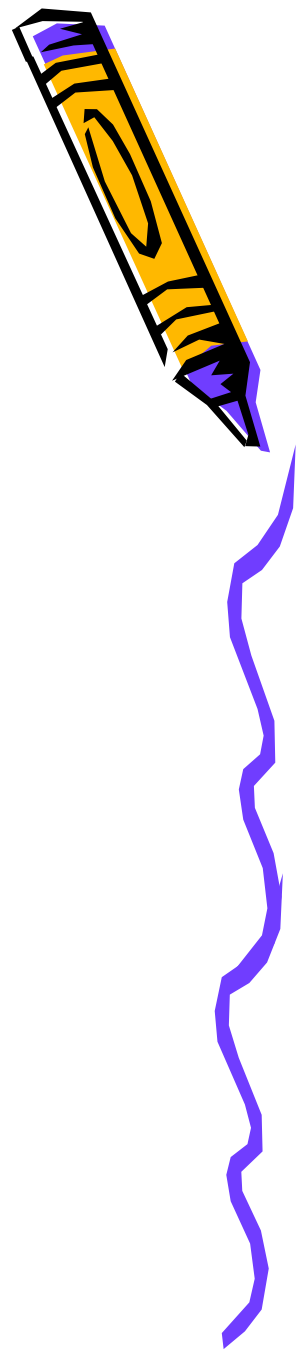
Classification of subgingival fractures based on level of teeth fracture in relation to various horizontal planes of the periodontium

Class I : fracture line does not extend below the level of attached gingiva

Class II : fracture line extends below the level of attached gingiva but not below the level of the alveolar crest

Class III : fracture line extends below the level of alveolar crest

Class IV : fracture line is within the coronal third of the root but below the level of alveolar crest



Classification by Basrani 1985

Crown fracture

1. Fracture of enamel
2. Fracture of enamel and dentin
 - without pulp exposure
 - with pulp exposure

Root fracture

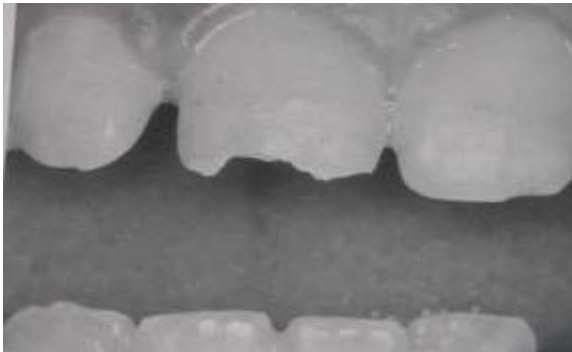
Crown root fracture



Spinas and Atlanta's classification(2002)

- A Class • Simple enamel lesions involving one proximal angle or only incisal edge
- B Class • Enamel- dentin lesions involving one proximal angle or only an incisal edge

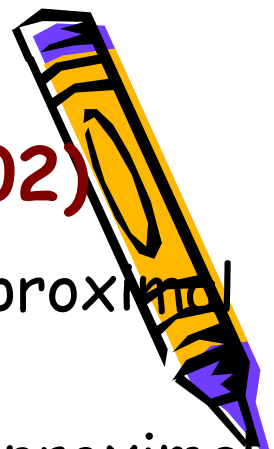
subclass b1-with pulp exposition



A Class



B Class in 11 & C Class in 21



- C Class

- Enamel- dentin lesions involving the incisal edge and at least a third of the crown

subclass c1-with pulp exposition

- D Class

- Enamel- dentin lesion involving the mesial or distal angle and and the incisal or palatal surface and root involvement

subclass d1-with pulp exposition



Subclass c1

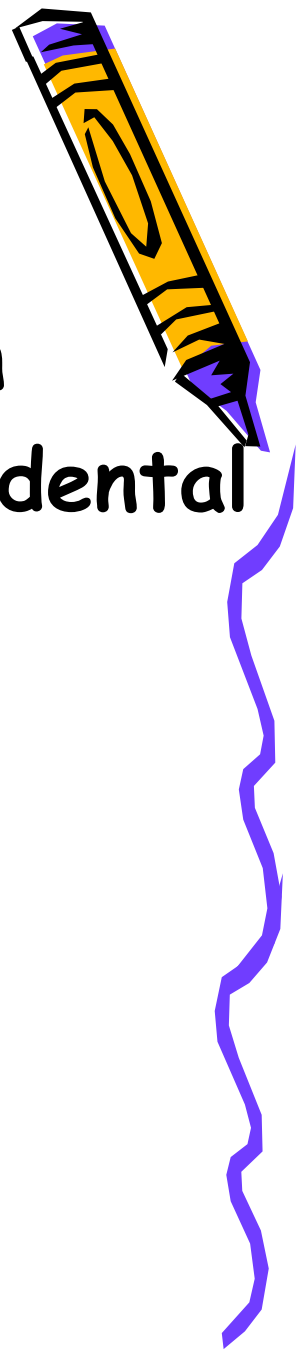


Subclass d1



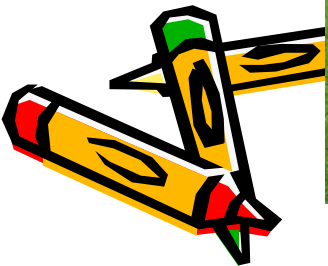
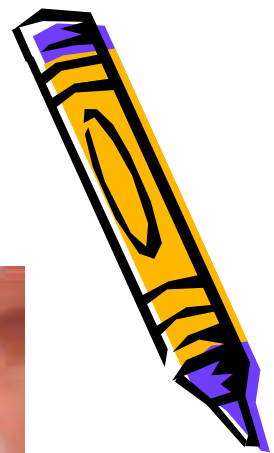
Etiology

- Iatrogenic injuries in new born
- Child physical abuse (Non-accidental injuries, NAI)



Etiology

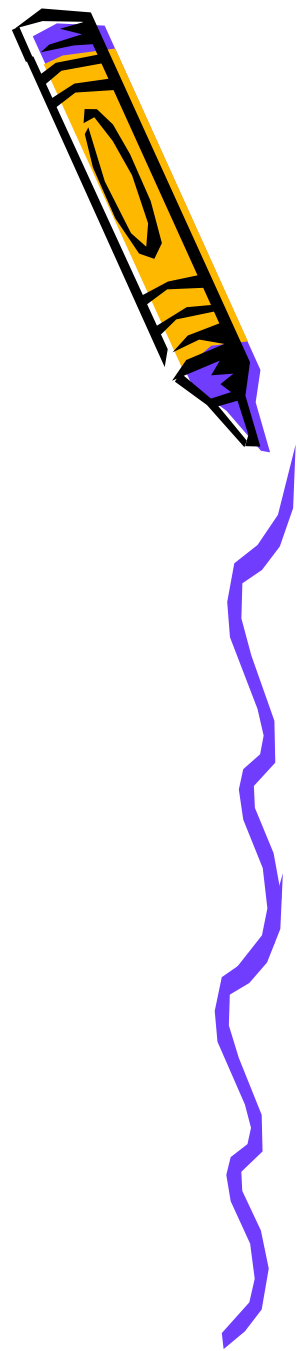
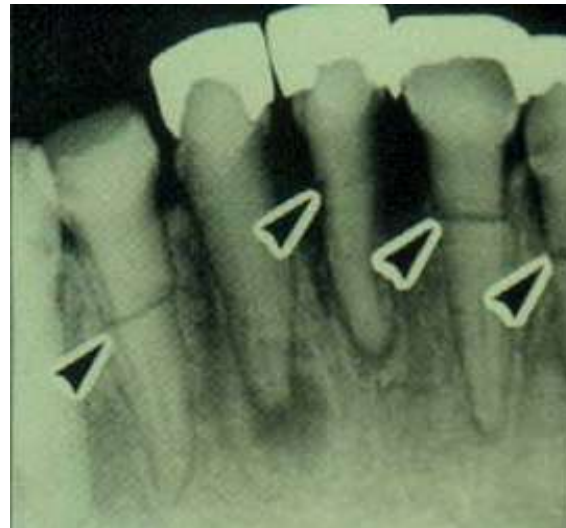
- Falls & Collisions
- Sports



- Automobile Injuries
- Assaults

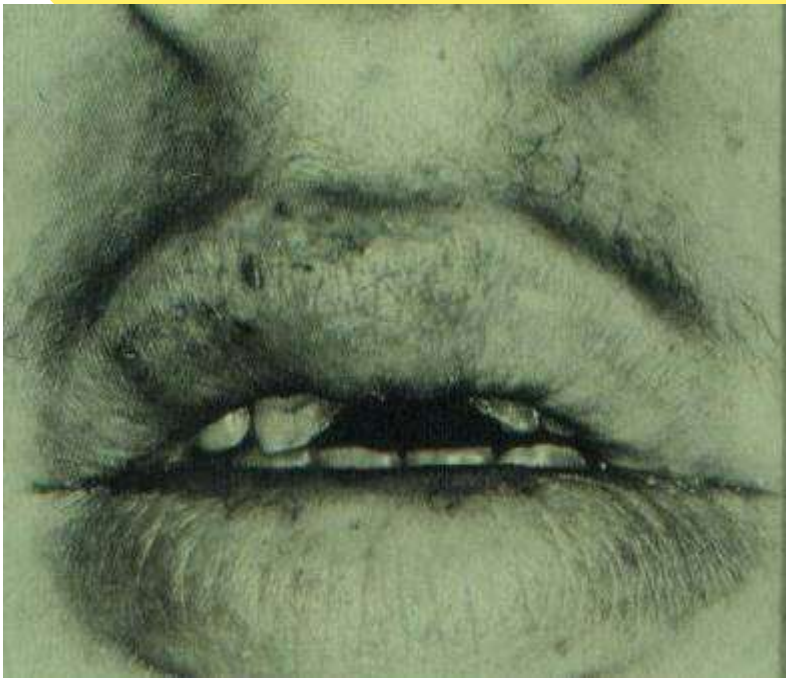


- Mental retardation
- Epilepsy
- Drug-Related injuries
- Dentinogenesis Imperfecta

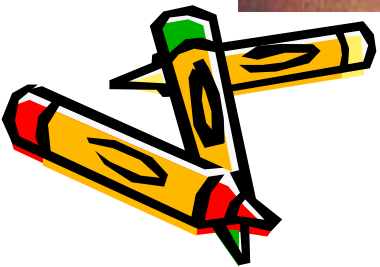
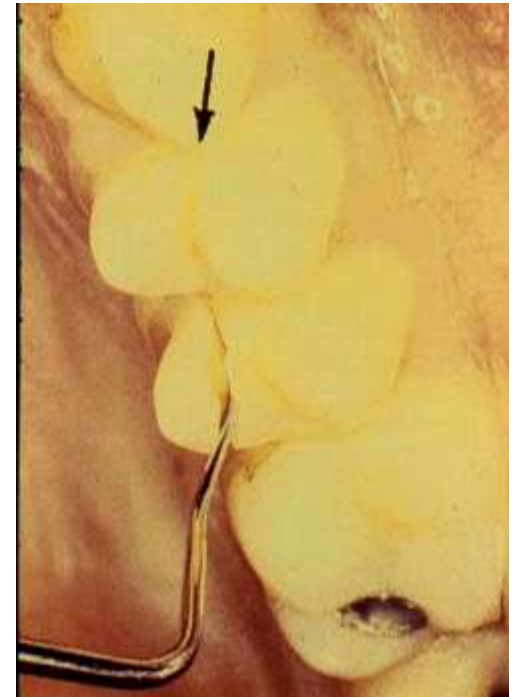
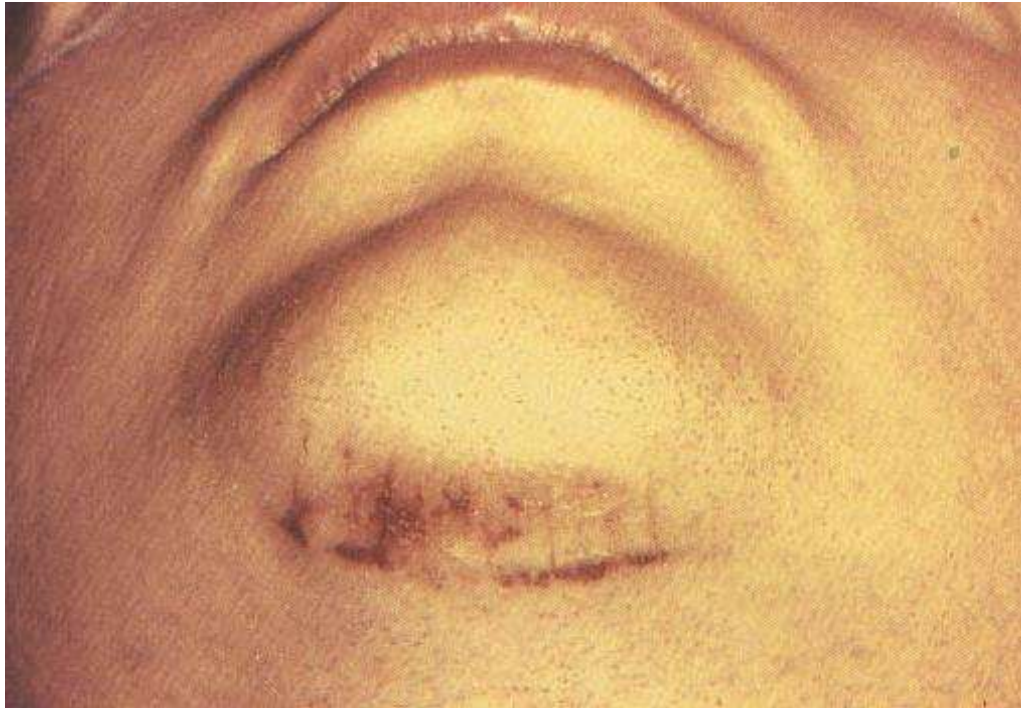


Mechanism of dental injuries

Direct Trauma

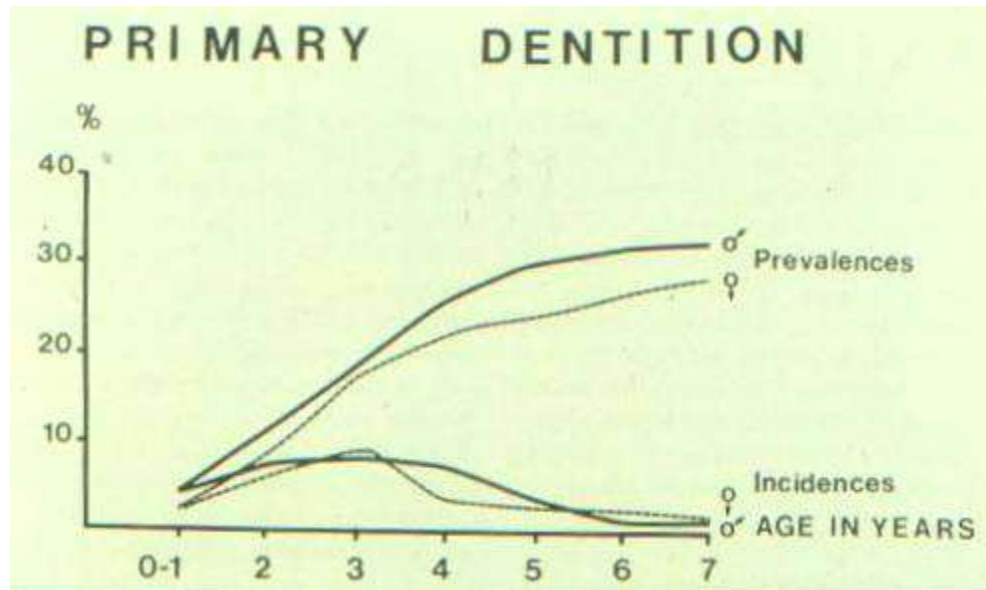


Indirect Trauma



Prevalence of dental injuries

- Primary dentition (5yr of age)
- Boys (31-40%)
- Girls (16-30%)

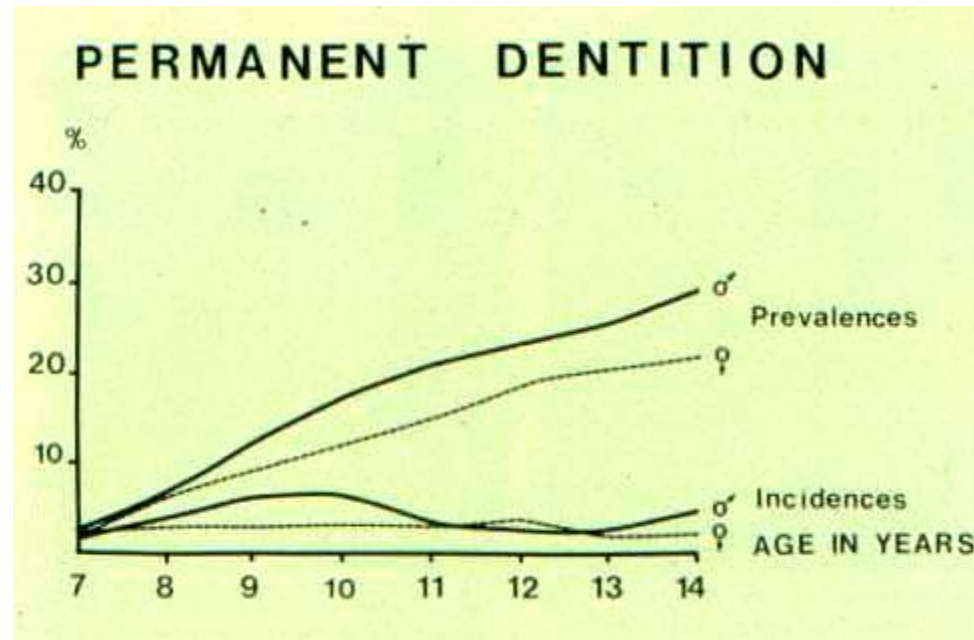


Andreasen 1972

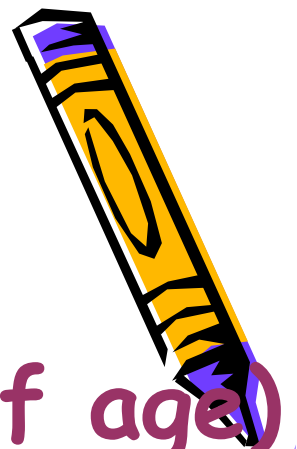


Prevalence of dental injuries

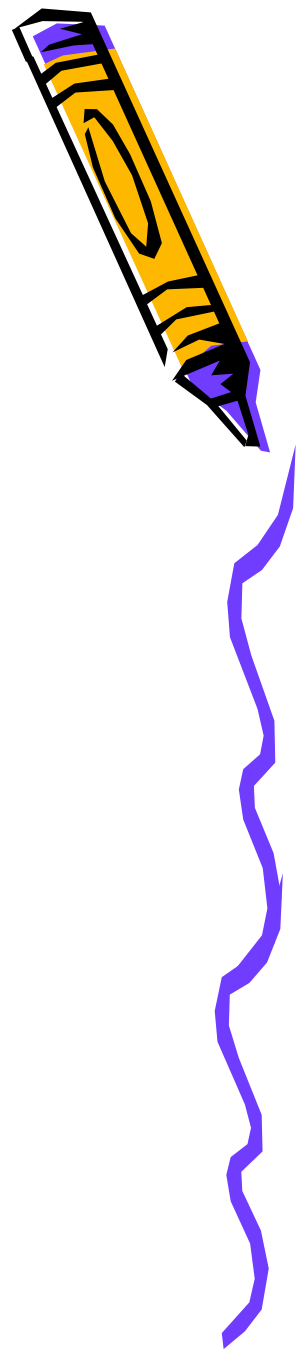
- Permanent dentition (12yr of age)
- Boys (12-33%)
- Girls (4-19%)



Andreasen 1972



Pathogenesis and sequelae of traumatic injury

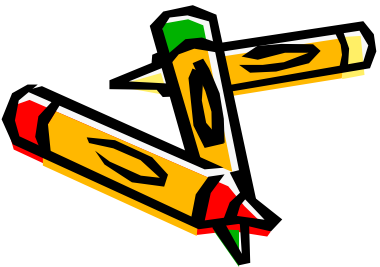


- Repair vs Regeneration
- Progenitor cells- Stem cells
- Cell cycle
- Cell migration
- Dynamics of wound repair
- Inflammatory phase





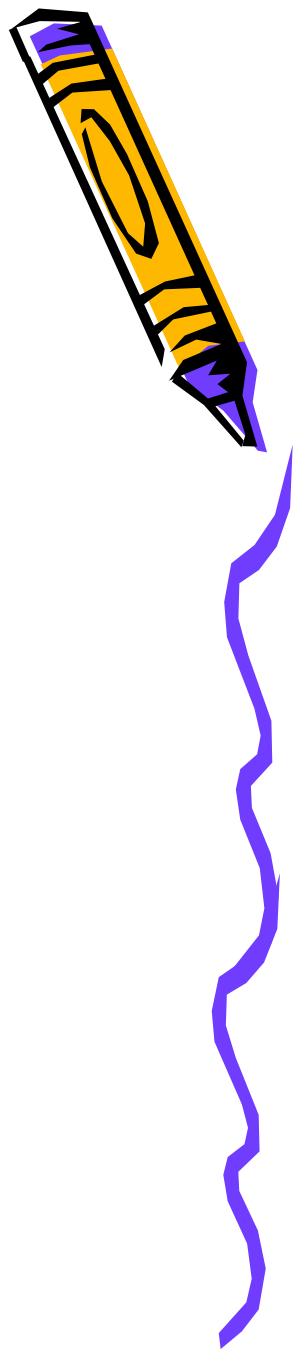
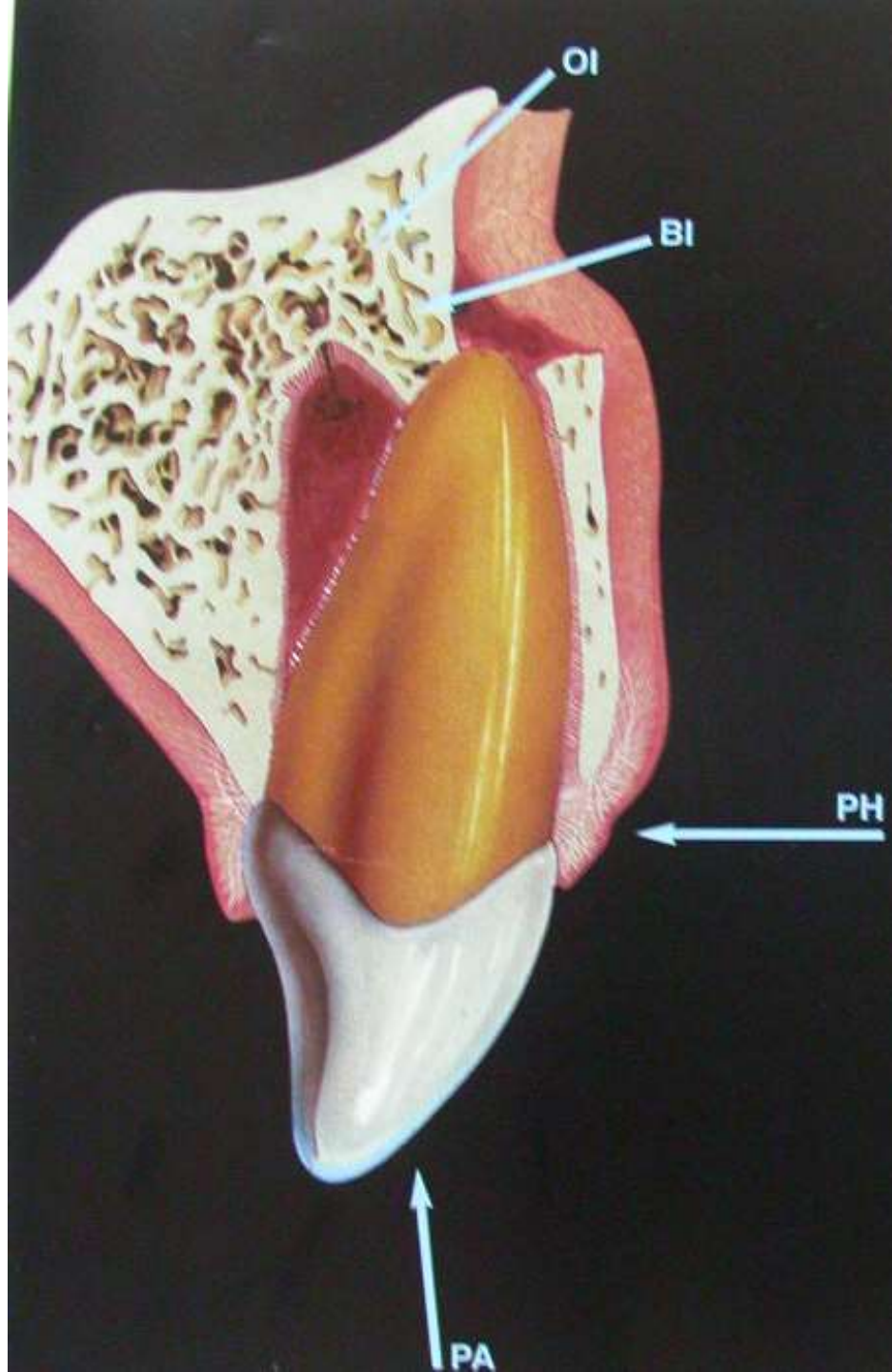
- Cells in wound repair
- Phase of remodelling
- Microenvironment in wounds
- Factors affecting the wound healing process
- Effects on the developing teeth





- Teeth with developing roots
- Response of the dentin pulp complex
- Response of the oral mucosa and skin
- Mediators of inflammation and factors promoting root resorption

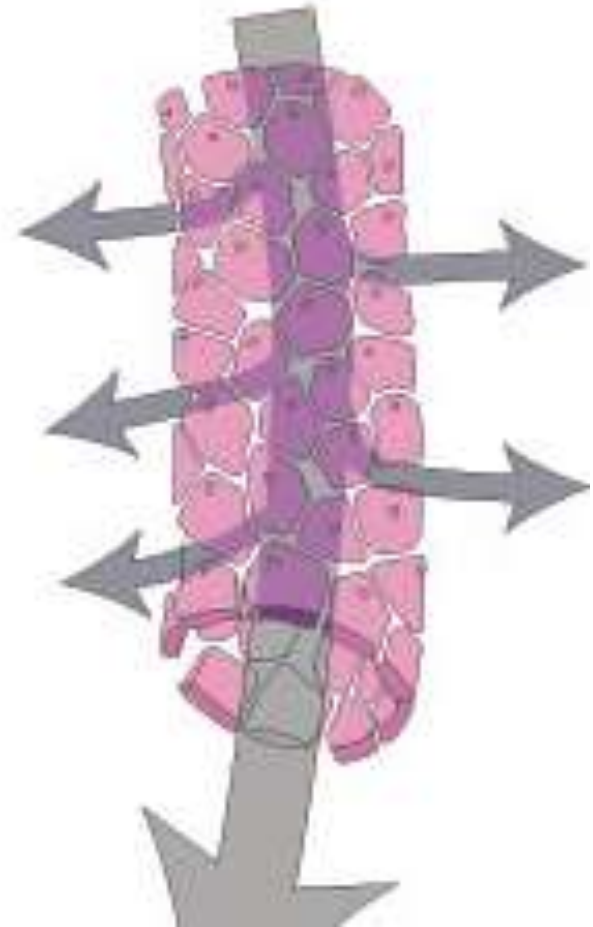
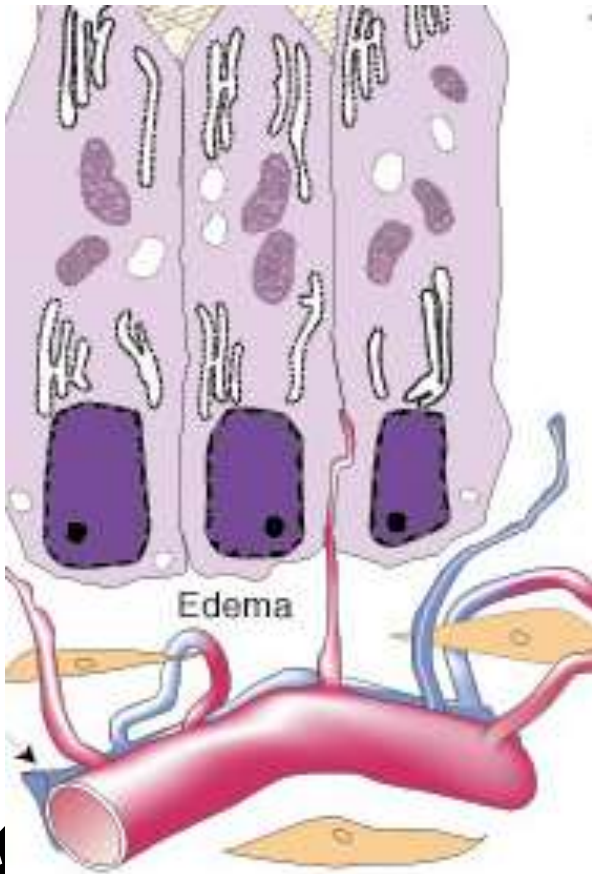




Vascular events in inflammation

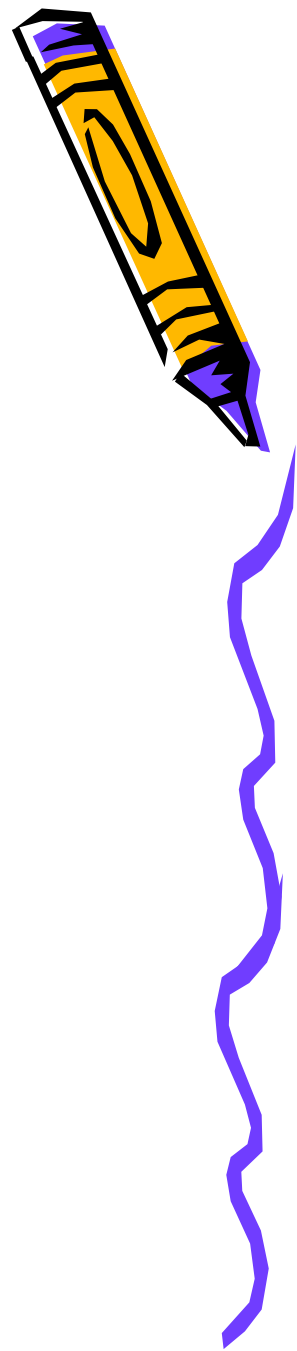


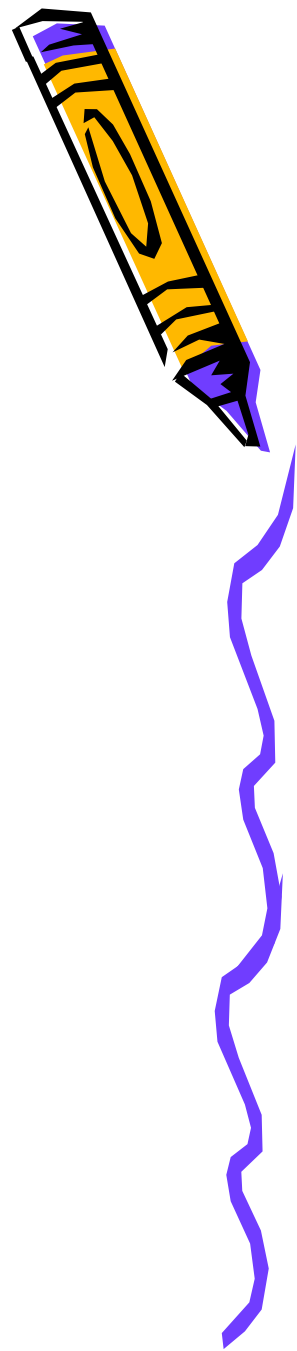
Changes in capillary permeability



Cell mediators

- Histamine
- Serotonin (5HT)
- Prostaglandins
- Leukotriens
- Lysosomal components
- Cytokines





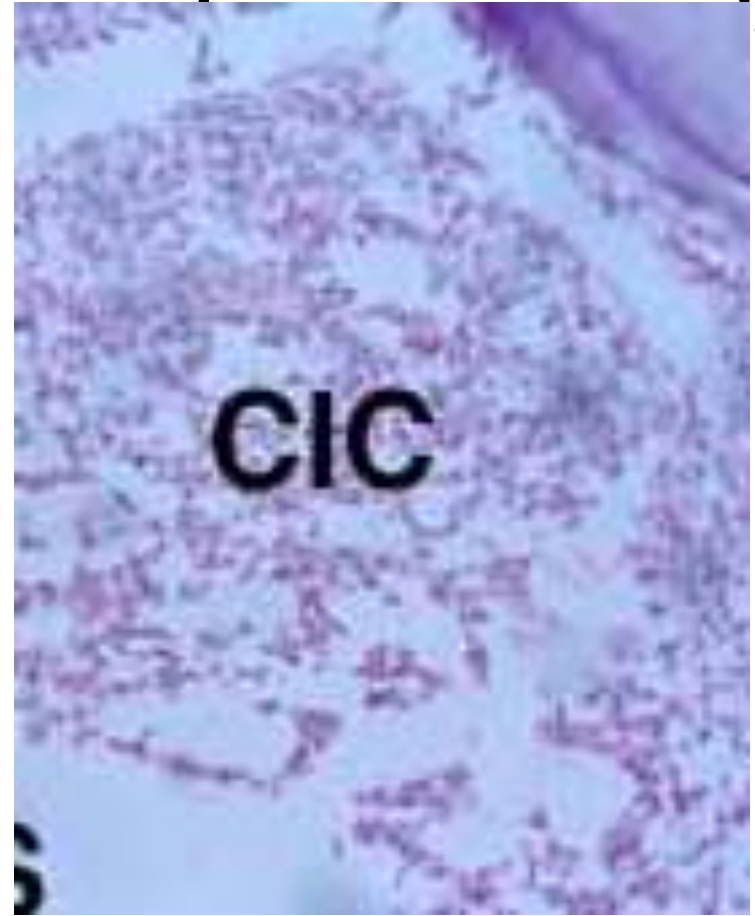
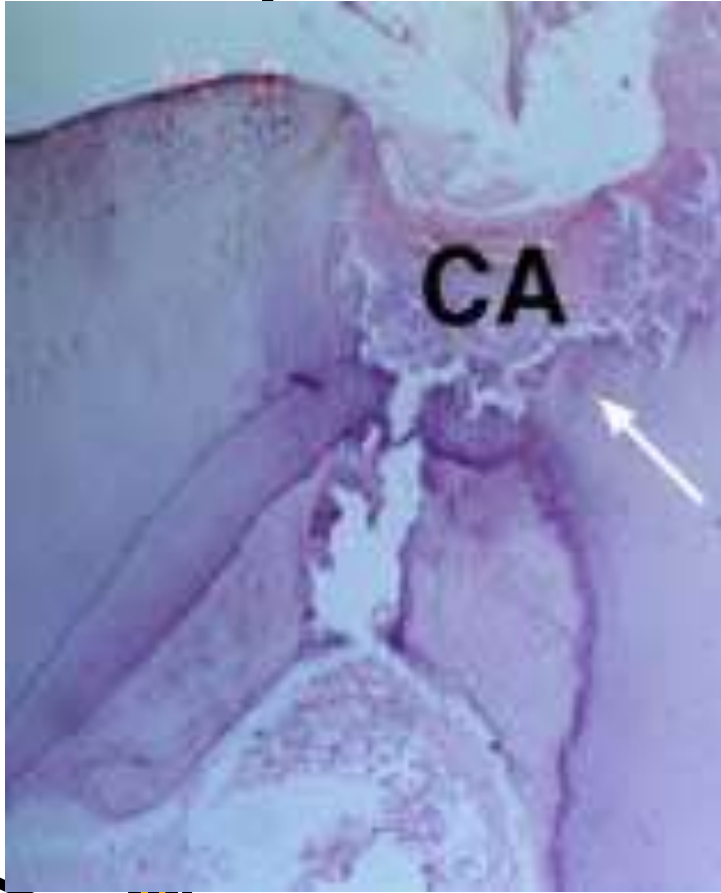
- Role of the granulocytes
 1. Eosinophils
 2. Basophils
 3. Neutrophils
- Role of cyclic nucleotides
 1. Cyclic AMP
 2. Cyclic GMP



Repair

vs

Regeneration

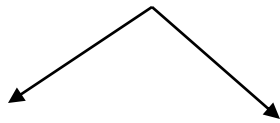




Wound healing and treatment principles

Traumatic dental injury represents acute transmission of energy to the tooth and supporting structures

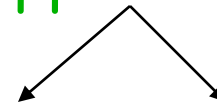
Tooth



Fracture

Displacement

Supporting tissue



Separation

Crushing



Separation



- extrusive luxation
- Cleavage of intercellular structures
- Limited damage to cells
- Wound healing by the existing cellular system with minimum delay.

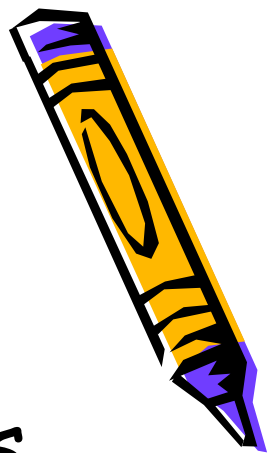
Crushing



- Intrusive luxation
- extensive damage to cellular & intercellular system
- wound healing by removal of damaged tissue by macrophages & osteoclasts before restoration of traumatized tissue
- delayed healing (splinting period)

Pulpal Hyperemia

- May lead to infarction and necrosis



Internal Hemorrhage

- Capillary rupture due to increased pressure
- Within 2-3 weeks

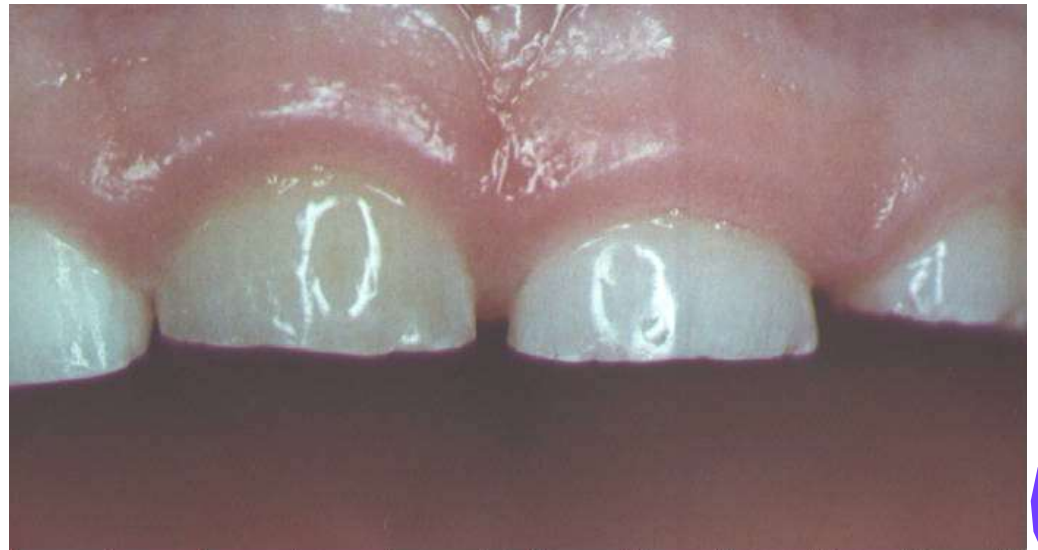
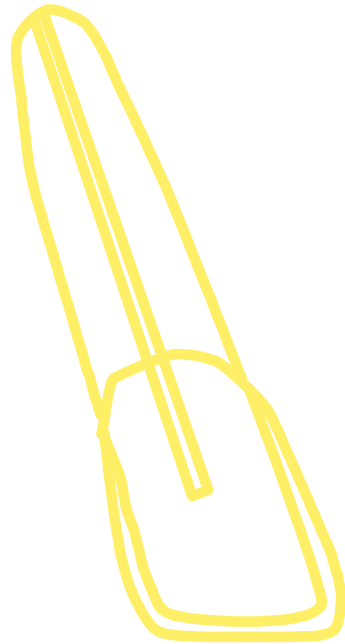


Internal Resorption

- Due to osteoclastic action
- Institute endodontic treatment. immediately
- "Pink spot" perforation may occur



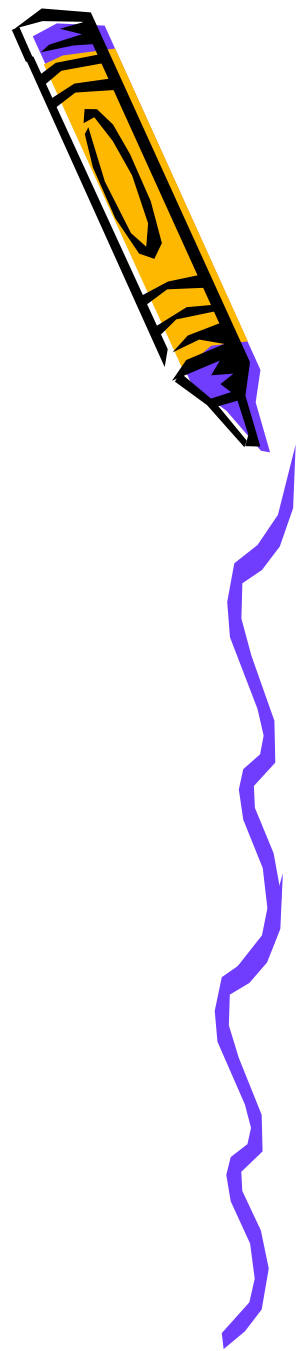
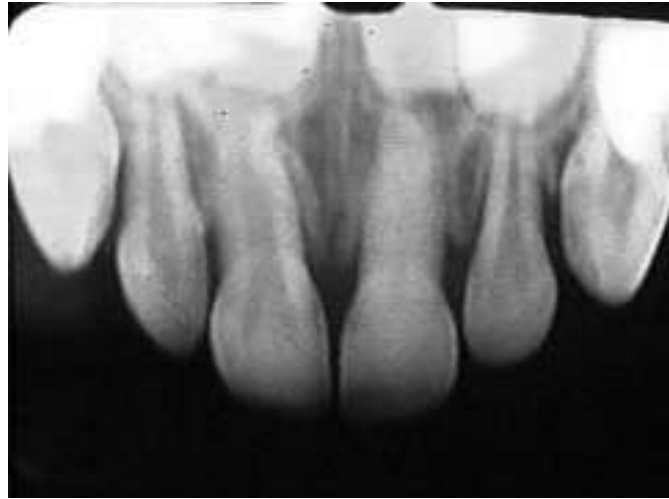
Calcific Metamorphosis



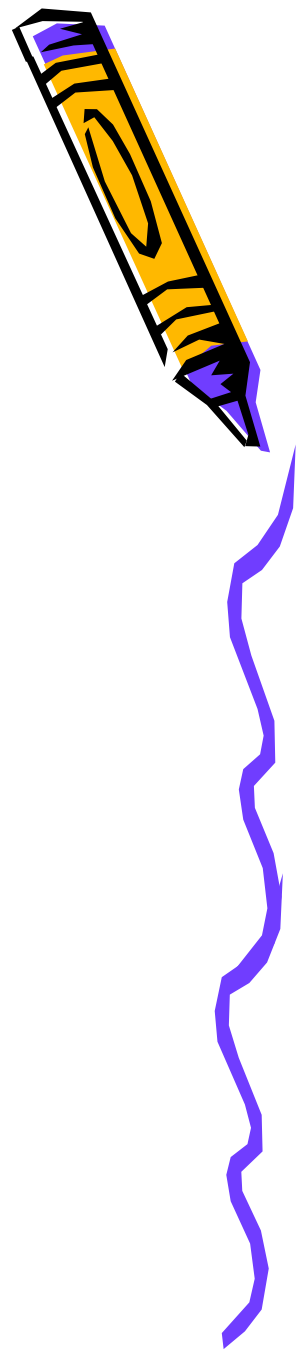
Calcific Metamorphosis



Calcific Metamorphosis



Peripheral Root Resorption



- Due to damage of peridontal structures
- Usually in severe injuries with displacement of the tooth
- Types
 - surface - normal PDL, small areas
 - replacement - ankylosis
 - inflammatory - granulation tissue, radiolucency



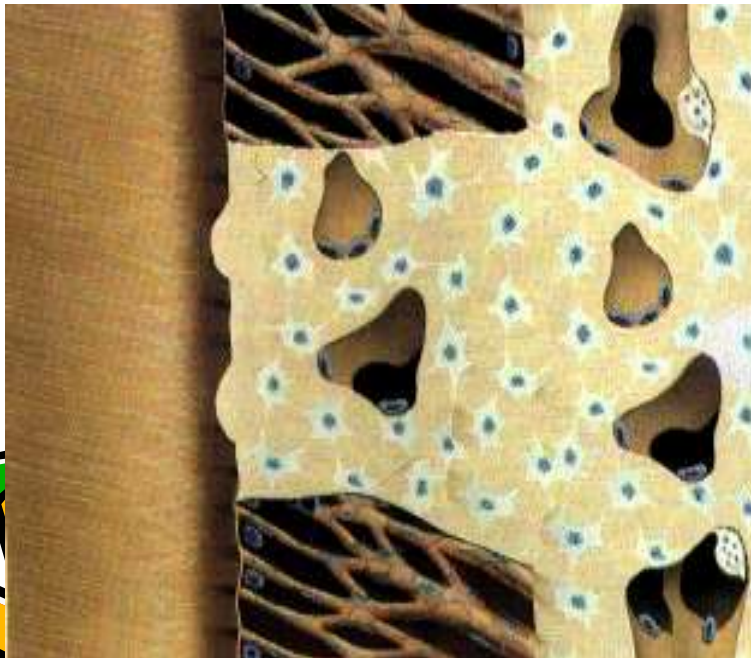
Pulpal necrosis

- Due to severing of apical vessels or prolonged hyperemia and strangulation
- May not occur for several months

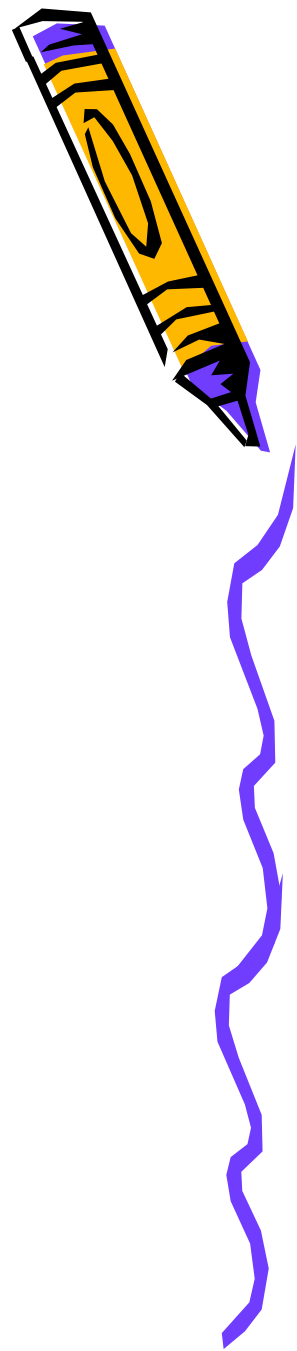


Ankylosis

- PDL injury > inflammation > osteoclastic activity > fusion between bone and root surface



Reaction of the Permanent Tooth Buds

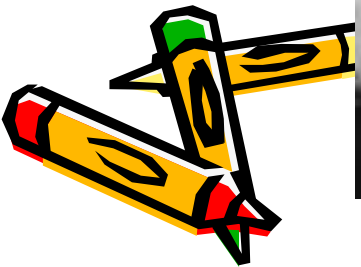
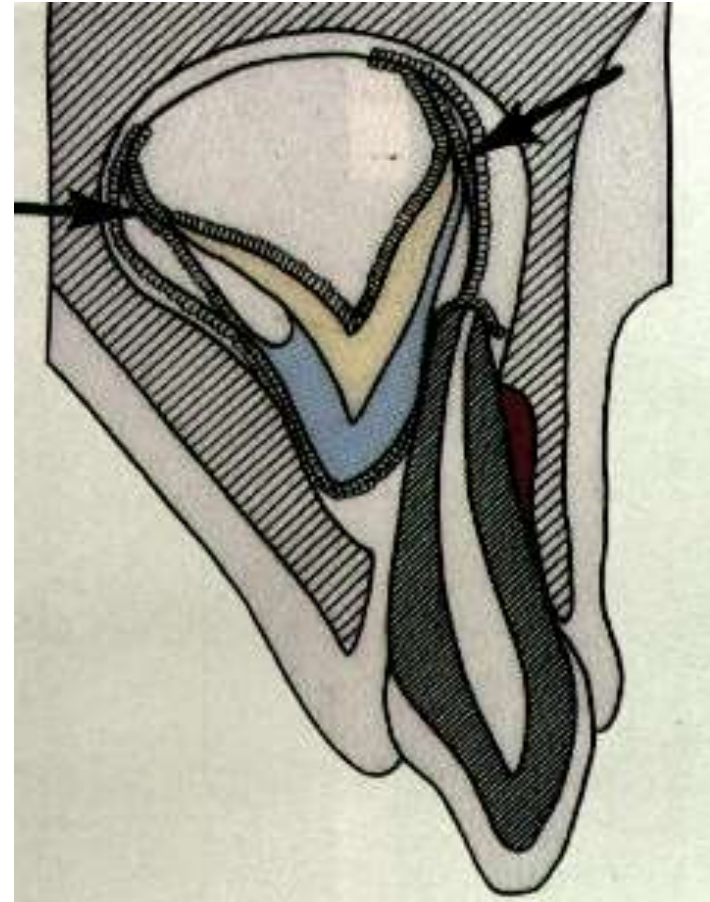


- Hypocalcification/hypoplasia
(Turner's tooth - due to trauma,
infection, or both)
- Reparative dentin
- Dilaceration
- Sequelae of chronic infection





Position of Primary Teeth



Dilaceration/Turner's Tooth



Dilaceration



Focal Hypoplasia & Hypocalcification





Examination of the traumatized patients

- How did the injury occur?
- Where did the injury occur?
- When did the injury occur?
- Has there been previous injury to the teeth?
- Is there any disturbance in the bite?
- Is there any reaction in the teeth to cold and/or heat?

Has there been any treatment before?

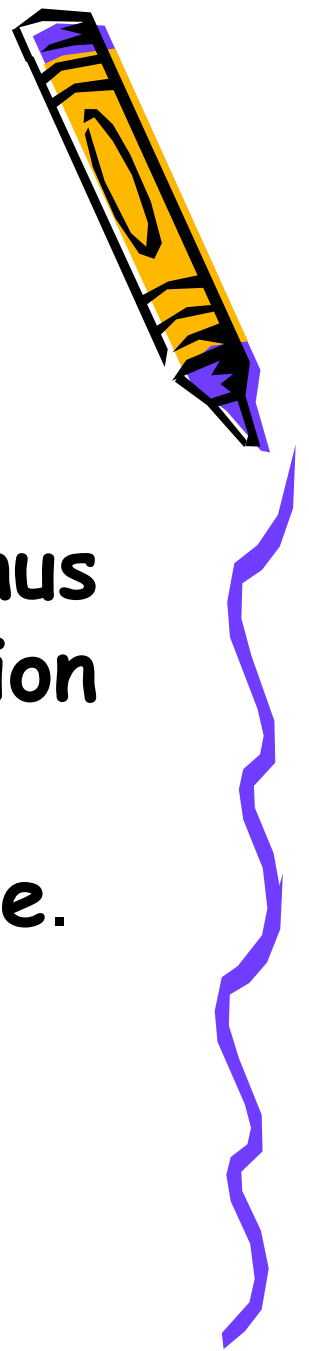


How did the injury occur?

- Assist the clinician in locating specific injury.
- A blow to the lips & anterior teeth could cause crown, root, or bone fx to the ant^r teeth.
- A blow under the chin or jaw could cause fx to any tooth.
- A padded blow could cause a root fx or tooth displacement. (a fall against a covered chair arm)
- A hard blow would tend to cause coronal fx. (a fall on a concrete walk)



Where did the injury occur?



- Important for prognosis.
- Necessary for prophylactic tetanus toxoid influenced by the location of accident.
- For insurance or litigation purpose.



Examination

Patient history

- Is there any reaction in the teeth to cold and/or heat?
- Has there been any treatment before?

Time is essential because it affects prognosis

Storage medium for avulsed tooth



Examination

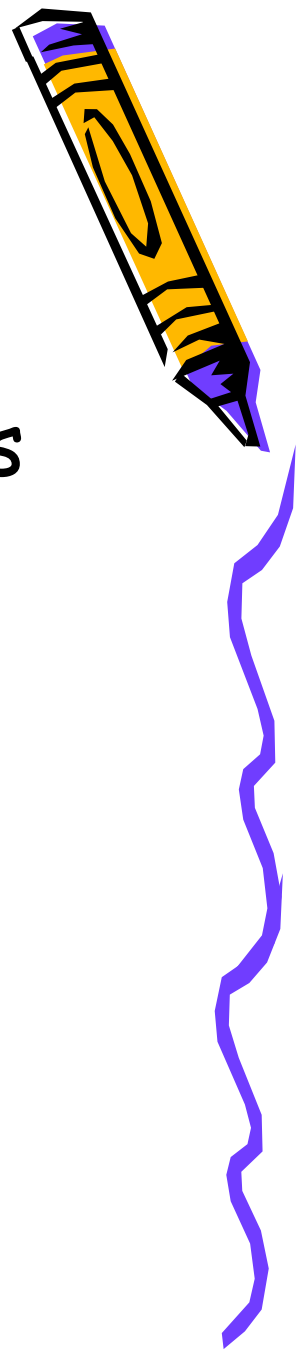
Clinical examination

- Chief complaint
- Neurologic examination
- External examination
- Intraoral soft tissue examination
- Examination of hard tissue
- Mobility testing
- Percussion testing
- Thermal and Electrometric testing



Soft Tissue Injuries

- Examine lacerations and contusions of the face, lips, and gingivae
- Remove any tooth fragments or debris embedded in the tissue
- Gently cleanse the area to aid in visual examination (topical anesthetic, soaked gauze sponges)
- Develop treatment plan

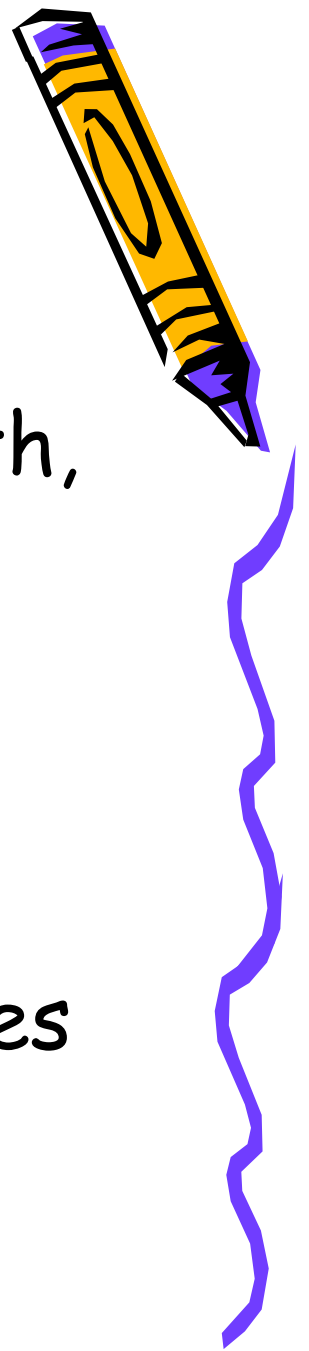


Hard Tissue Injuries

- Examine teeth and alveolar process
- Note extent of crown fracture, if any
- Check for displaced or avulsed teeth
- Note amount of mobility
- Check for pulp exposures

Examine adjacent/opposing teeth for injury



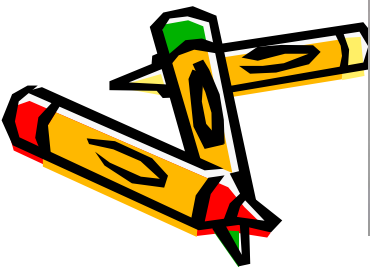
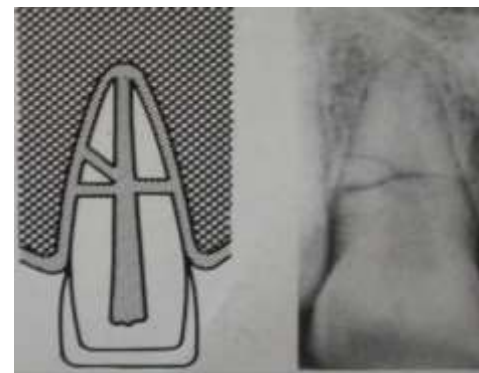
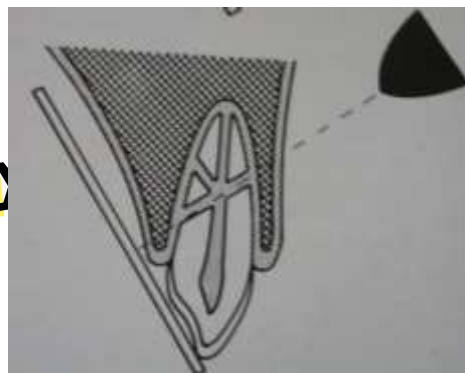
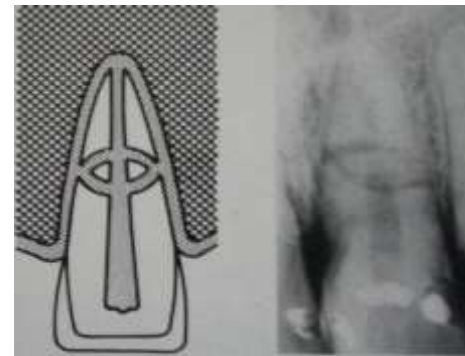
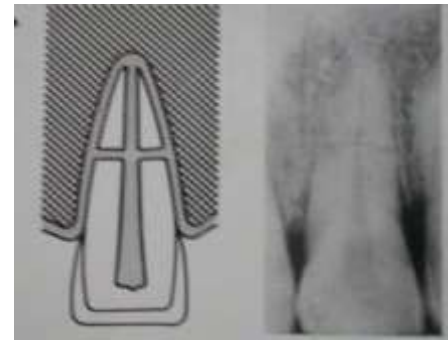
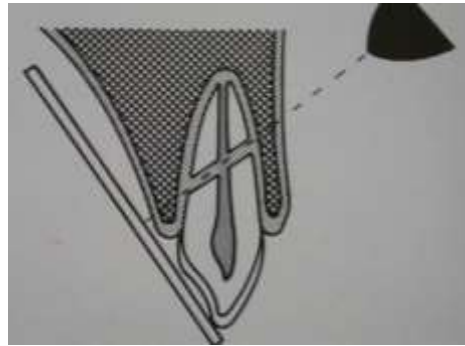


Radiographic Examination

- X-ray injured tooth, adjacent teeth, and opposing teeth
- Evaluate proximity of fracture to pulp
- Estimate root development
- Look for root and alveolar fractures
- Note any periapical pathology
- Note previous treatment



Overcoming the disadvantages of conventional radiography



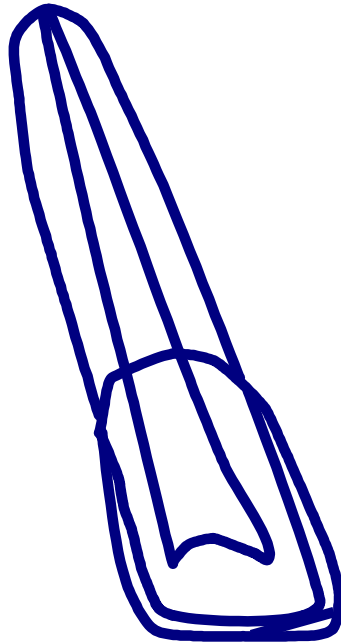
Other Diagnostic Tests

- Wait at least 2 weeks
- Electrical and thermal tests may be unreliable in primary teeth
- If a tooth is incompletely erupted or is being orthodontically treated, the tooth may be normal even if there is little sensitivity to EPT - 20% of normal patients with 3/4 erupted teeth show no response to the electric pulp tester.

Traumatic injuries to the primary teeth

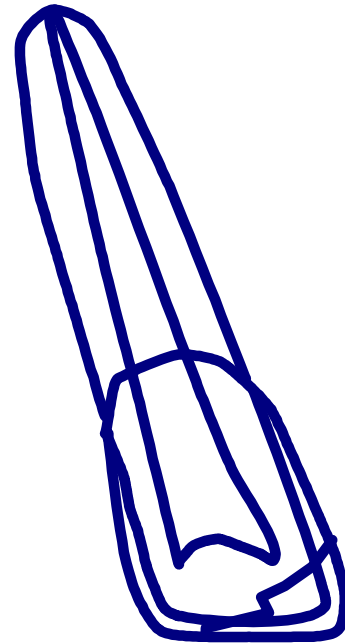
Class I Primary (enamel fracture)

- Smooth enamel
- Check vitality in 6-8 weeks



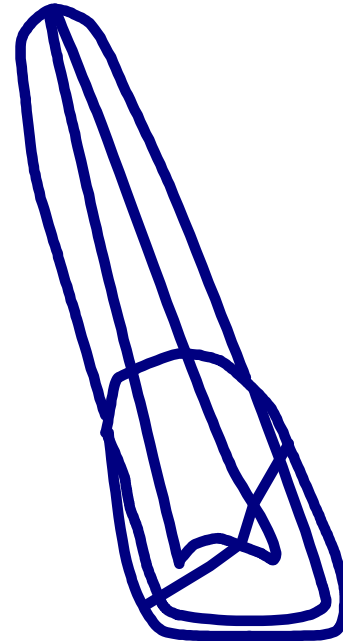
Class II Primary (dentin involved)

- Dycal
- Restore
- Check in 6-8 weeks



Class III Primary (pulp involved)

- Formocresol pulpotomy, at least
- Restore
- Check in 6-8 weeks



Class IV Primary (pulp necrotic)

- Formocresol pulpectomy, in absence of significant internal or external root resorption
- Extraction +/- space maintainer if endodontic treatment not possible

Extraction and Space Maintainer



Extraction and Space Maintainer



Extraction and Space Maintainer



Class V Primary (avulsion)

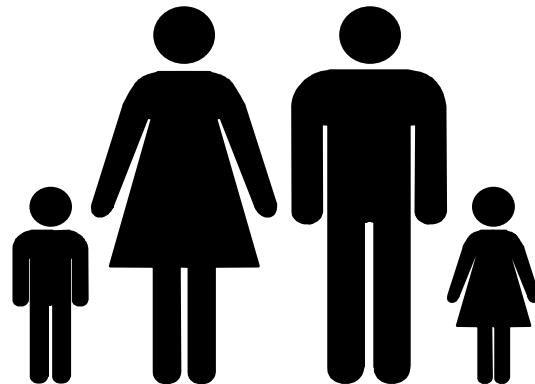
- Poor prognosis
- If within 30 minutes, replant, splint if necessary, soft diet, follow with primary endodontic treatment
- Space maintainer if endodontic treatment not possible

Cleaning an Avulsed tooth

- Saline to remove foreign bodies and bacteria
- Flush alveolus with saline to remove coagulum; failure to do this increases chance of ankylosis
- Avoid scraping the root surface; this removes periodontal fibers and denudes the cementum

What to Tell Parents

- Clean tooth under tap water
- Replant and maintain pressure for 5-10 minutes
- Bring child to office immediately
- If parent can't replant, put tooth into a cup of milk



Replantation

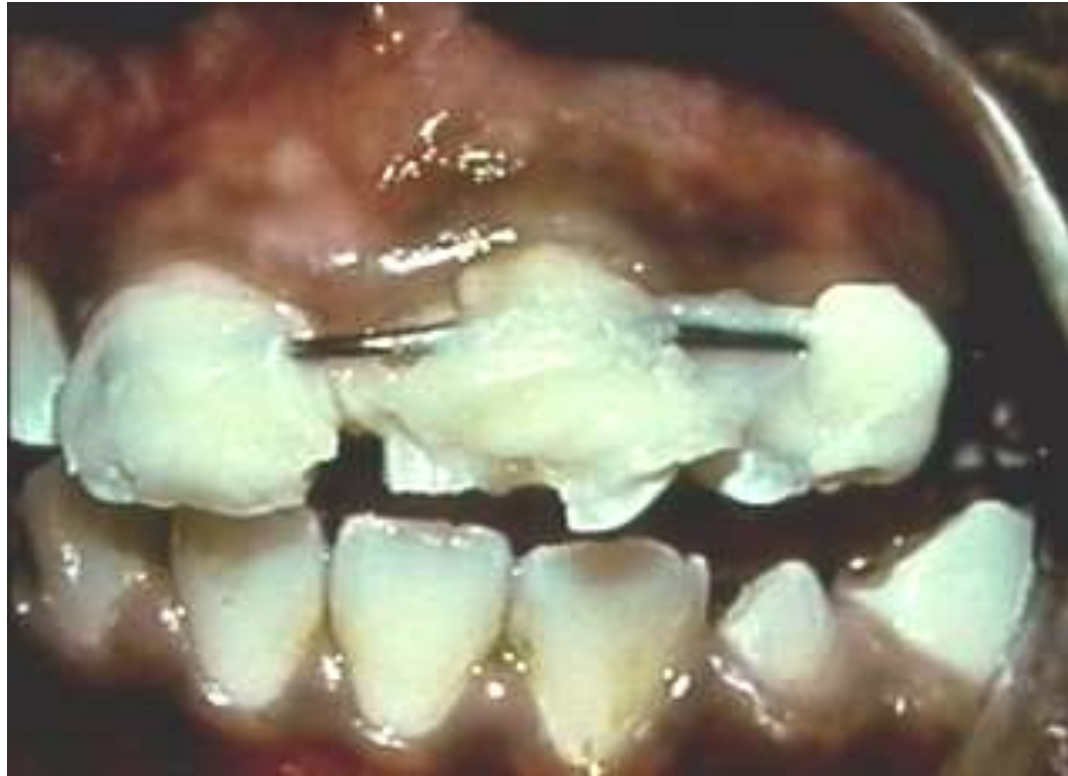
- "Periodontal Healing of Replanted Dog Teeth Stored in Viaspan, Milk, and Hank's Balanced Salt Solution" Trope, Endod Dent Traumatol, Jan-Feb, 1993.
- Viaspan (a storage media used in organ transplants) and HBSS proved superior to milk for long term storage (>6 hrs) of avulsed teeth.

Splinting

- .030 Stainless steel wire + Composite (old)
- .0175 Twist (Wildcat) + Composite
- Composite alone
- Avulsion: 7 days
- Root fractures: 1-3 months



Splinting (not good.)

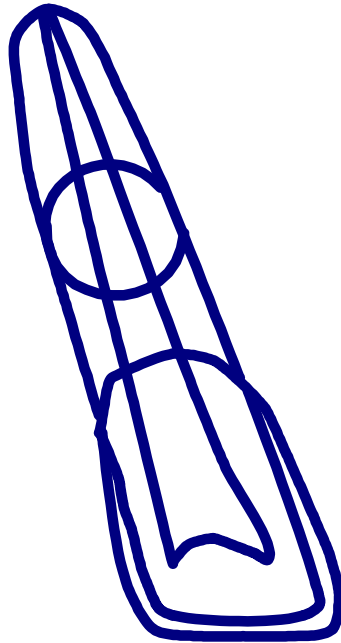


Splinting



Class VI Primary (root fracture)

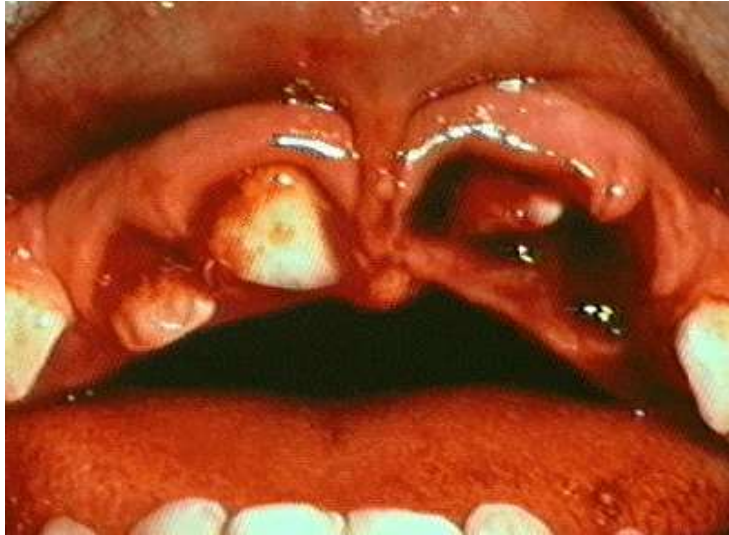
- Extraction is almost always the treatment of choice



Class VII Primary (displacement)

- Labial, lingual, extrusion - reposition tooth, compress alveolar bone, stabilize if necessary, check periodically
- Intruded primary tooth
 - allow 2-4 months for eruption
 - if ankylosis occurs, may luxate and check in 1 month, or remove

Intrusion, Primary Teeth



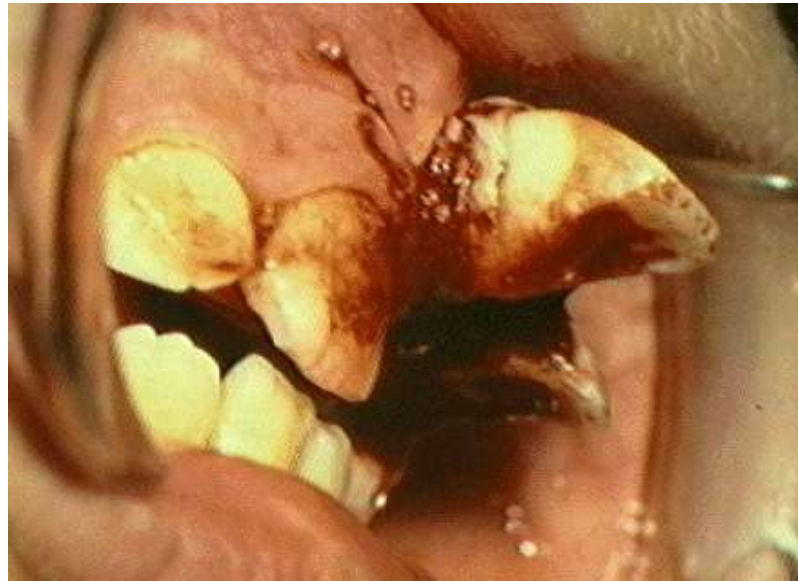
Intrusion of primary incisors

18 months later



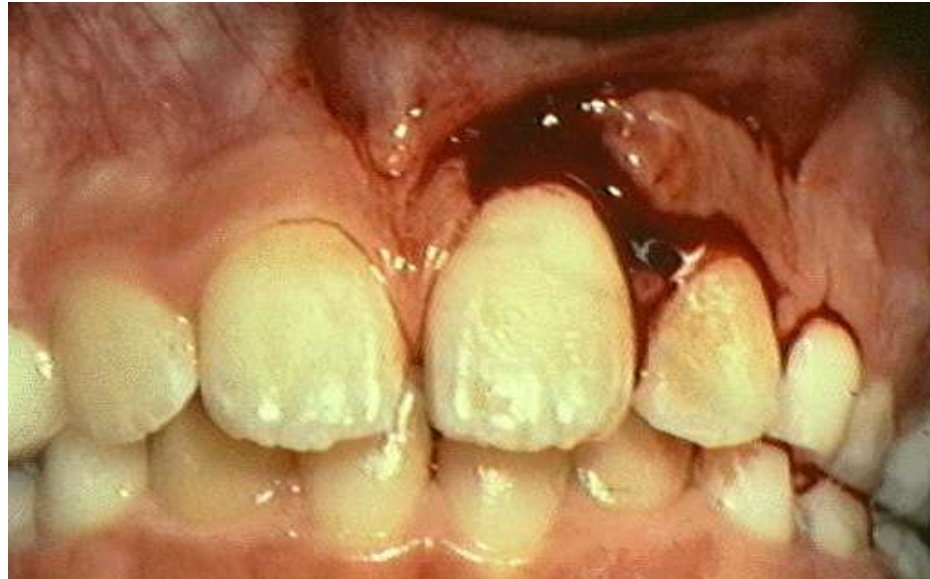
Photos by the Dental Trauma Server,
University of Geneva

Lateral Luxation



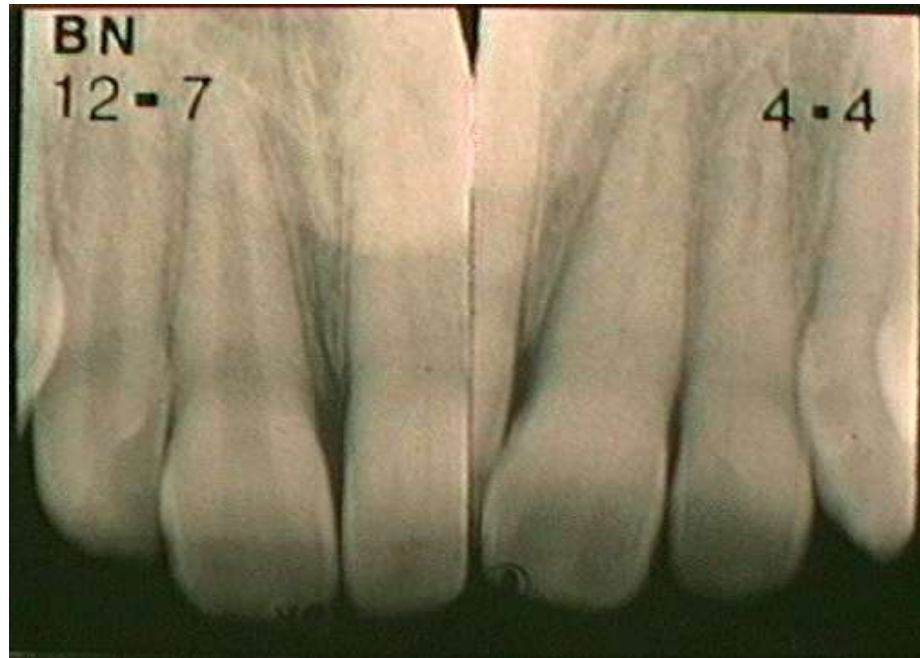
Photos by the Dental Trauma Server,
University of Geneva

Lateral Luxation



Photos by the Dental Trauma Server,
University of Geneva

Lateral Luxation



Photos by the Dental Trauma Server,
University of Geneva

Class VIII Primary - Coronal/Root Fracture

- Extraction is usually the only option



Class VIII Primary - Coronal/Root Fracture

- Radiograph day of trauma



Class VIII Primary - Coronal/Root Fracture



Class VIII Primary - Coronal/Root Fracture

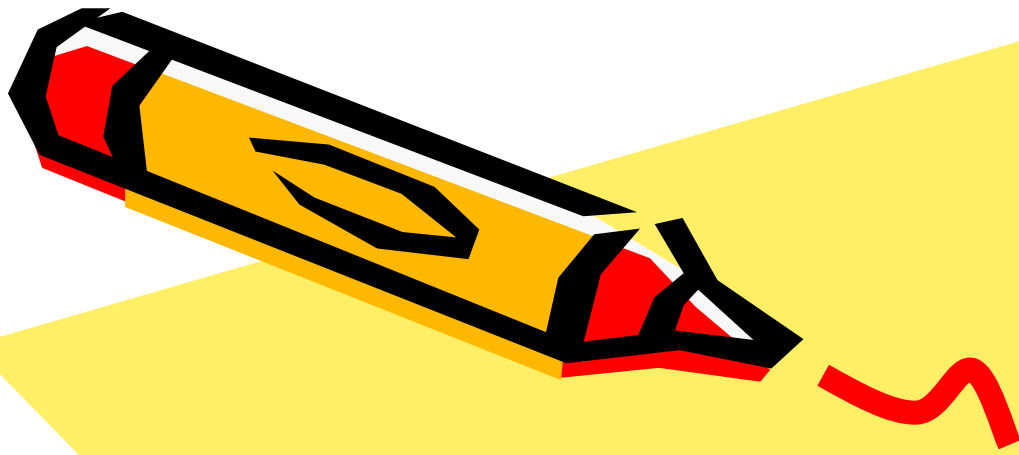
- Radiograph one month later



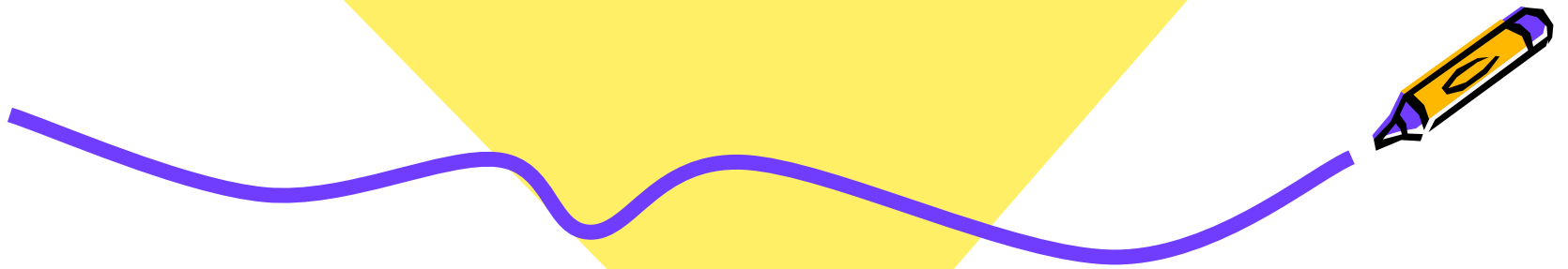
Class VIII Primary - Coronal/Root Fracture

- Tooth following extraction





Injuries to the permanent teeth



Crown fracture

Enamel infraction

- Incomplete fracture of the enamel without loss of tooth structure
- Microcracks in the thickness of enamel
- Rarely occurs alone and can be sign of attachment injury



Diagnosis

- observed during routine examination
- detected using indirect light or transillumination
- use of dyes

Differential diagnosis

- exclude enamel cracks due to thermal attacks

Treatment

- establish baseline pulp status with routine vitality tests
- in severe cases sealing of the cracks with adhesive system
(Love et al 1996)

Follow up

- at three, six, twelve months and annually thereafter

Prognosis

- pulpal complications are extremely rare (0.1%)

Enamel fractures

Diagnosis

- generally involves the anterior teeth (incisal edge or proximal angle)
- tooth is not sensitive to temperature, dehydration and pressure
- vitality testing may be negative initially
- concomitant luxation injury can result in discoloration of the tooth



Treatment

Extent and location of the fracture dictates the choice of treatment

- selective grinding of the incisal edge
- composite restoration

Prognosis

Prevalence of pulp survival ranges from 99 –100%



Preoperative view



After selective grinding

Enamel-dentin fracture

Diagnosis

- clinical examination of the fractured crown
- tooth is sensitive to variation in temperature, dehydration and pressure
- vitality test may be negative
- concomitant luxation injury can result in discoloration of the tooth

Incidence

- one-third of all dental injuries



Biological consequences

Bacteria can invade the sectioned dentinal tubule

Defense mechanism can combat this reaction

- passive mechanism- outward flow of dentinal fluid
- active mechanism- immediate inflammatory response

Factors that affect these protective mechanism

- concomitant luxation injury
- age of the tooth
- time of treatment
- distance of the fracture from the pulp

❖ **Affect the prognosis of the tooth**

Treatment

- Always require restoration in order to seal dentinal tubules or restore aesthetics
- Achieved by-
 - composite resin build-up
 - re-attachment of the crown fragment
 - porcelain veneers & crown

Prognosis

- Prevalence of pulp survival equals to 94-98%

Restoration by composite build-up



Preoperative view



After composite build-up

Restoration with re-attachment of coronal fragment

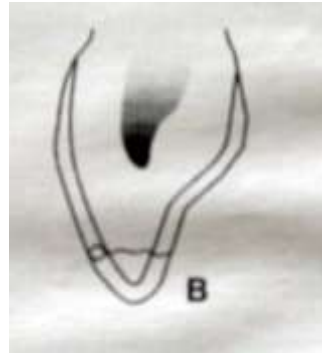
Advantages

- Improved aesthetics since enamel's original shape,color, brightness and surface texture are maintained
- Reduced chair-side time
- Use of tissue that abrades the same as the antagonist tooth and provides more predictable long term wear
- Psychological benefit to patient or parent
(Reis et al 2004)

Techniques



Use of circumferential bevel on enamel before re-attaching (Simonson 1979 ,Walker 1996)



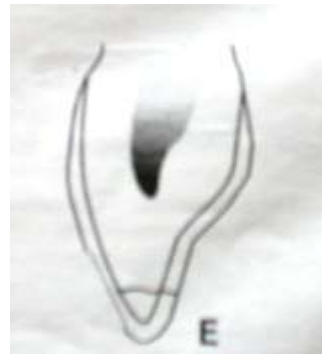
V shaped internal enamel groove (Simonson 1982)



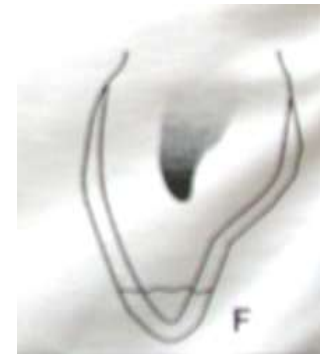
Internal dentin groove (Walker 1996, Reis 2001)



External chamfer (Franco 1985)



Overcontour (Reis 2001)



Simple re-attachment (Pagliarini 2000)

- Overcontour and Internal dentin groove technique provided highest fracture strength recovery. (Reis et al 2004)
- Presence of bevel increased the resistance to fracture in all restorative material used for re-attachment. Best fracture resistance was obtained with chemically cured composite in the beveled specimens and worst fracture resistance was in bonded specimens with adhesive specimen alone.(Flavio 2004)

Clinical steps in fracture reattachment





Enamel-dentin fracture with pulpal involvement (complicated crown fracture)

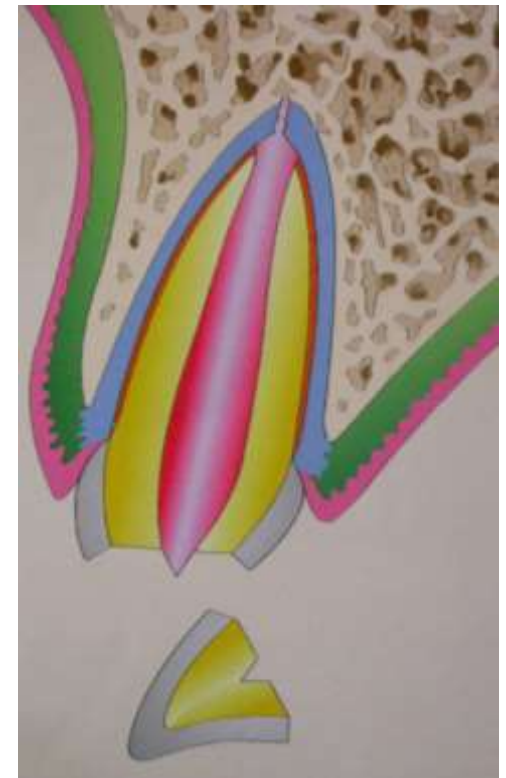
-Involves enamel, dentin & pulp

-Diagnosis

- clinical examination of the tooth
- pulp exposure
- tooth is sensitive to variation in temperature, dehydration and pressure
- vitality test is positive unless there is concomitant luxation injury

-Incidence

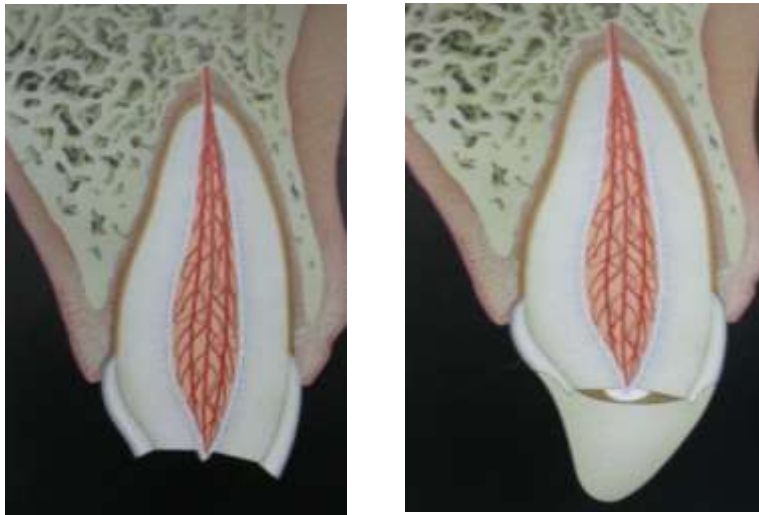
- 2-13% of all dental injury



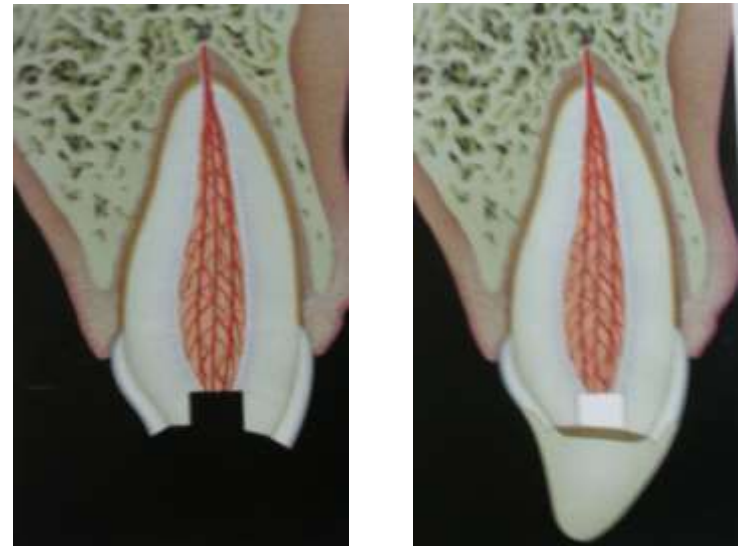
Treatment

Treatment of pulp exposure

- vital pulp therapy
 - pulp capping
 - partial pulpotomy
 - cervical pulpotomy
- pulpectomy



Pulp capping



Pulpotomy

Choice of treatment

- time spent with the exposed pulp
- health of the pulp before trauma
- diameter of the pulp exposure
- age of the tooth
- concomitant luxation injury
- stage of root development

Prognosis

- pulp capping- pulp survival varies from 63-88%
- partial pulpotomy- pulp survival varies from 94-100%

Treatment of the fractured tooth

- composite restoration
- fragment bonding

Crown and root fracture

- Involves enamel, dentin, and cementum
- Pulp may or may not be involved
- Fracture extends below the cemento-enamel junction

Diagnosis and clinical presentation

- chisel type of fracture with a fragment or fragments below the lingual gingiva
- fragment may be firm, loose and attached only to the periodontal ligament or may be lost
- periodontal injury causes pain on pressure or biting
- exposed dentin or pulp causes sensitivity to variation in temperature, dehydration and pressure

Incidence

- 5% of all dental injuries



Treatment

- Crown-root fracture have immediate implications for endodontic, restorative and periodontal prognosis due to its line of fracture which is subgingival

Objective

Exposing the fracture margins juxtragingivally so that all clinical procedures can be managed with strict moist and bleeding control.

Treatment is a multidisciplinary approach with an endodontist, an orthodontist, a periodontist and a prosthodontist.

Fragment removal and status quo followed by restoration

- More conservative treatment as long as the lesion extends superficially under the cemento-enamel junction
- It is followed by restoration at the juxtra gingival level
- Gingiva reattach to the exposed dentin by forming long junctional epithelium
- Prognosis of the pulp and of the restoration is poorer

Gingivectomy (osteotomy if needed)

Lower the level of gingiva so that fracture becomes supragingival

May be done in the region which is not 'aesthetic sensitive'



Forced orthodontic extrusion (with or without gingivoplasty)

Principle : To orthodontically move the fracture to a supragingival position

Indication : Where root portion is long enough to accommodate post retained crown



- Treatment** :
- after pulp capping ,pulpotomy or endodontic therapy
 - orthodontic traction is applied to the labial surface of the fragment or to a hook cemented into the root canal
 - root is extruded over a period of 2-3 weeks
 - gingiva follows the path of extruding root thus gingivectomy performed
 - prevention of re-intrusion by incising the circumferential PDL fibres and fixation of the tooth for 14 days
 - tooth is later restored with composite build up or post-retained crown



Malmgren et al 1991 report an average of five weeks of active treatment is needed for 2-3 mm of extrusion followed by retention period of 8-10 weeks

Bondemark et al 1997 described a new way for extruding teeth orthodontically with the use of magnets, total of 9-11 weeks were needed for 2-3 mm extrusion

Forced surgical extrusion

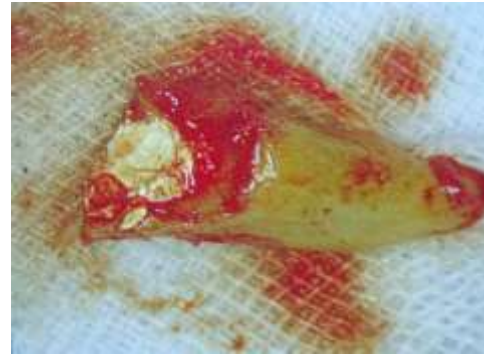
Principle : To surgically move the fracture to a supragingival position

Indication : Where the root portion is long enough to retain post retained crown

Treatment :

- removal of the coronal fragment
- followed by luxation and removal of the apical fragment
- root is moved into a more coronal position and secured in that position with sutures and / or splint
- in case of palatally inclined fractures , disarticulation of the radicular fragment followed by intentional replantation with 180° rotation





Vital root submergence

Johnson and Jensen (1997)

The root fragment is retained in situ and left vital. Gingival tissue is sutured over the exposed root stump to achieve primary closure. Later the root is replaced by an implant.

Type of treatment	Advantage	Disadvantage
1. Fragment removal and status quo	Very conservative Restoration soon after injury	Poor prognosis of pulp and restoration due to difficult moist control
2. Gingivectomy (osteotomy if needed)	Easy to perform. Restoration soon after injury	Not in an esthetic sensitive region
3. Forced orthodontic extrusion	Aesthetic sensitive region Bone and gingiva follow the tooth	Time consuming Restoration much later after injury

Type of treatment	Advantage	Disadvantage
4. Forced surgical extrusion	Esthetic sensitive region Rapid procedure Diagnosis of additional fractures / fissures	RCT must be performed More traumatising Restoration only after contention period Risk of external resorption
5. Vital root submergence	Preservation of bone support	Not in an esthetic sensitive region Cost of temporary tooth replacement
6. Extraction		Losses bone support for future implant Cost for temporary tooth replacement

Prognosis of the pulp for different levels of fracture

Level of fracture	Prognosis of pulp
Enamel infraction	Pulp survival 97-100%
Enamel fracture	Pulp survival 99-100%
Enamel-dentin fracture	Pulp survival 95-98%
Uncomplicated crown fracture	Pulp canal obliteration 0.2-0.5%
Complicated crown fracture	Pulp survival after direct pulp capping 72-81% Vital amputation 94-100%
All crown root fracture	Worse than crown fractures No reports available

Fracture re-attachment with Fibre based post



Fracture re-attachment with metal post

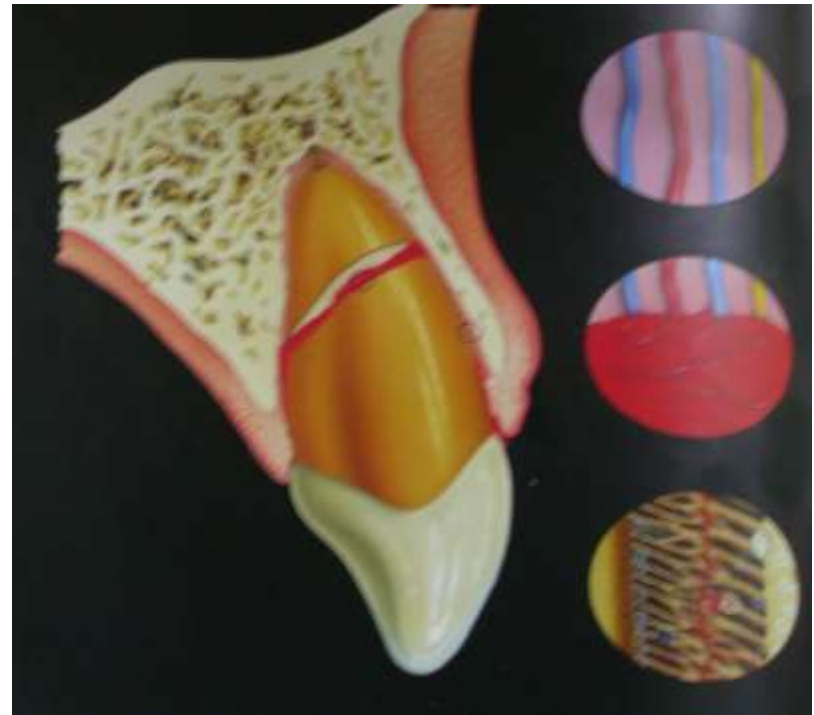
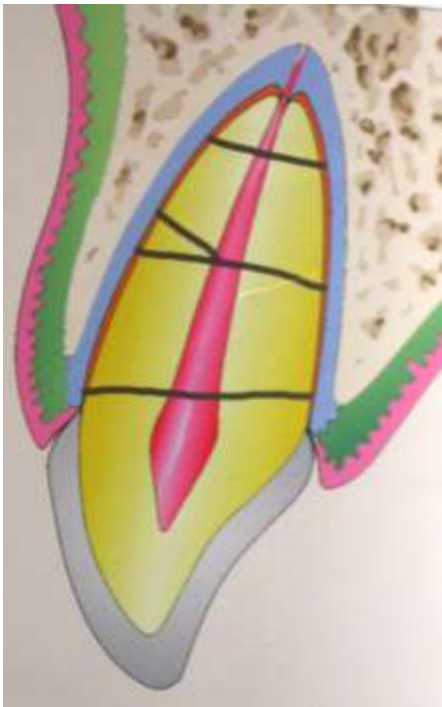






Root fracture

Fracture of cementum and dentin involving the pulp



Mechanism- Frontal impact creates a compression zones labially and lingually and the resulting shearing stress zone dictates the plane of fracture.

Incidence : relatively infrequent

occurs in less than 3% of all dental injuries

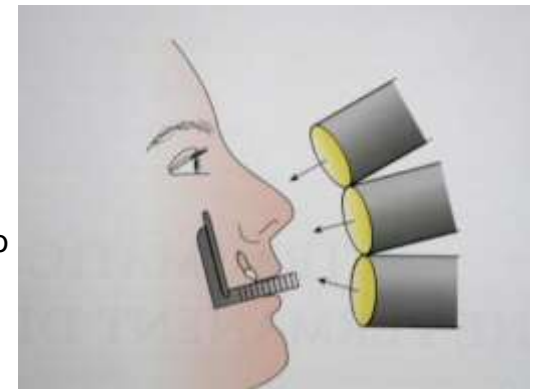
Diagnosis and clinical presentation

The extent of displacement of the coronal segment is usually indicative of the location of the fracture and can vary from simulating a concussion injury (apical fracture) to simulating an extrusive luxation (cervical fracture)

Radiographic examination

Imperative to take 3 angled radiographs

Central beam is directed with a maximum range of 15-20° of the fractured plane



Treatment

Emergency treatment involves repositioning of the segments in as close proximity as possible and rigidly splinting to adjacent teeth for 2-4 months

Causes

1. Traumatic

2. Iatrogenic

-screw type pins

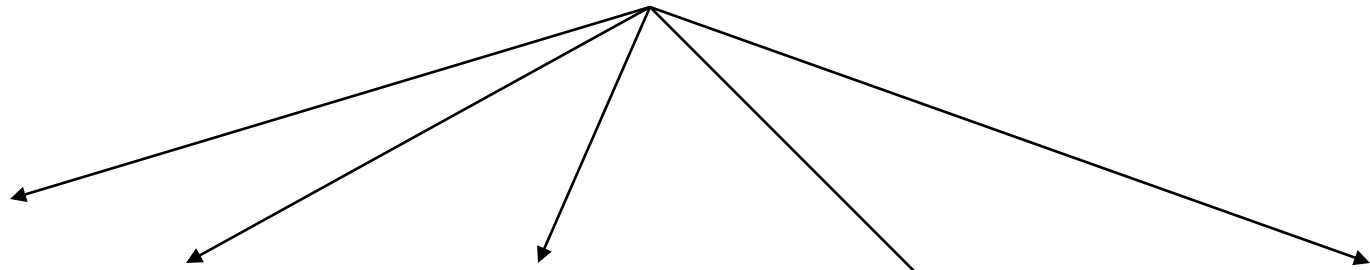
-inlays and posts

-post and core

-endodontic intraosseous implants

-obturation techniques

Classification



direction

horizontal

oblique

vertical

location

cervical third

middle third

apical third

number

simple

multiple

communited

extension

partial

total

position of root fragments

without displacement

with displacement

Horizontal fractures

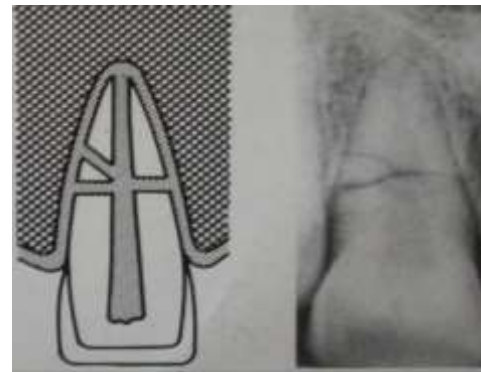
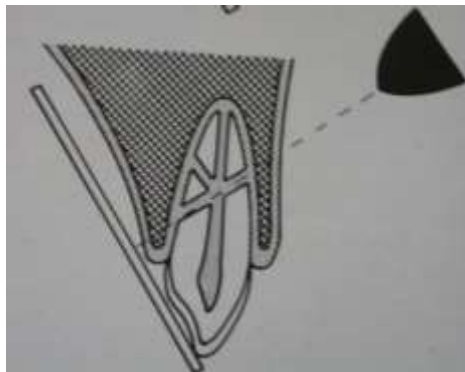
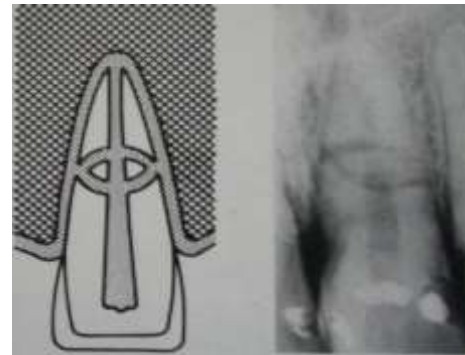
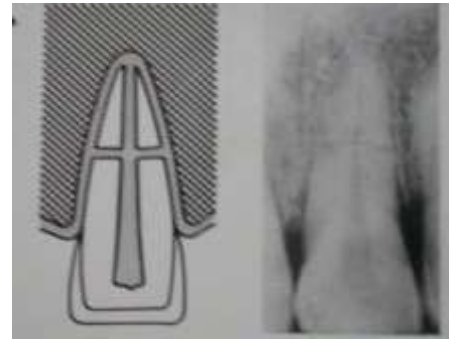
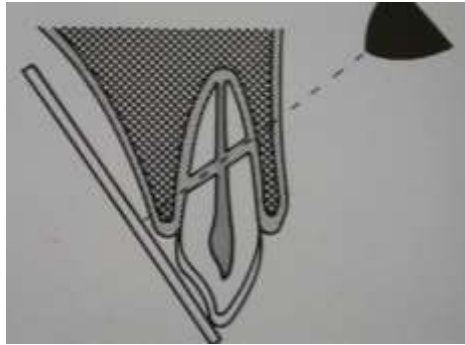
Case history and clinical examination

- patient feels discomfort on the buccal portion of the tooth
- sensitive to vertical and horizontal percussion
- slight or moderate mobility depending on the height of the line of fracture
- tooth may appear elongated due to separation of fragments
- tooth may or may not respond to vitality testing

Radiographic examination

- Radicular fracture follows an oblique direction and if they happen to coincide with the angulation of x-ray beam , the radiograph image will be sharper.
- If the x-ray beam do not coincide with the oblique line of fracture, it shows in the radiograph as an elliptical line giving the image of a multiple fracture.
- It is necessary to take several radiographs using different angulations to confirm the diagnosis.
- The lateral or anterior –posterior displacement of the segments of the fracture gives an image that has step like appearance on the radiograph.

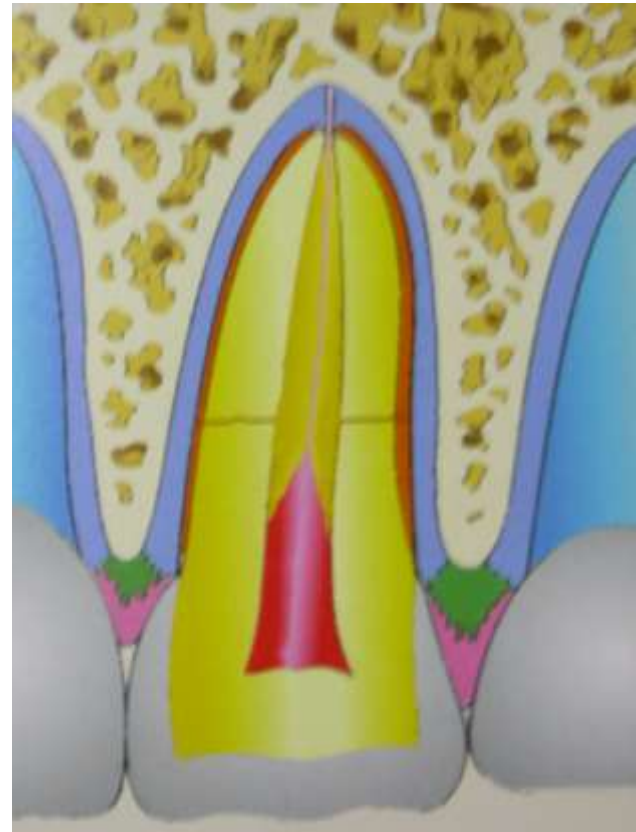
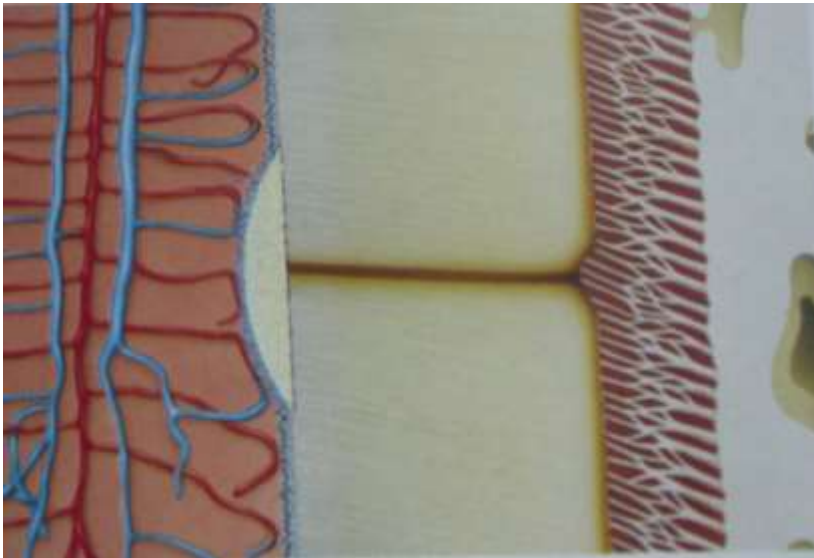
Radiographic demonstration of root fracture



Healing patterns

Andreasen and Hjorting-Hansen have described four types of healing of root fractures

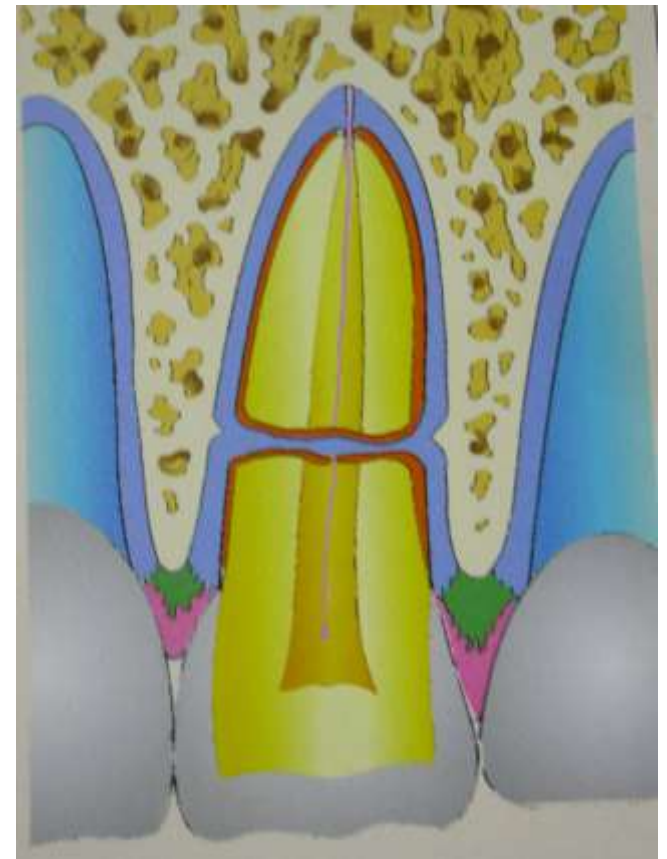
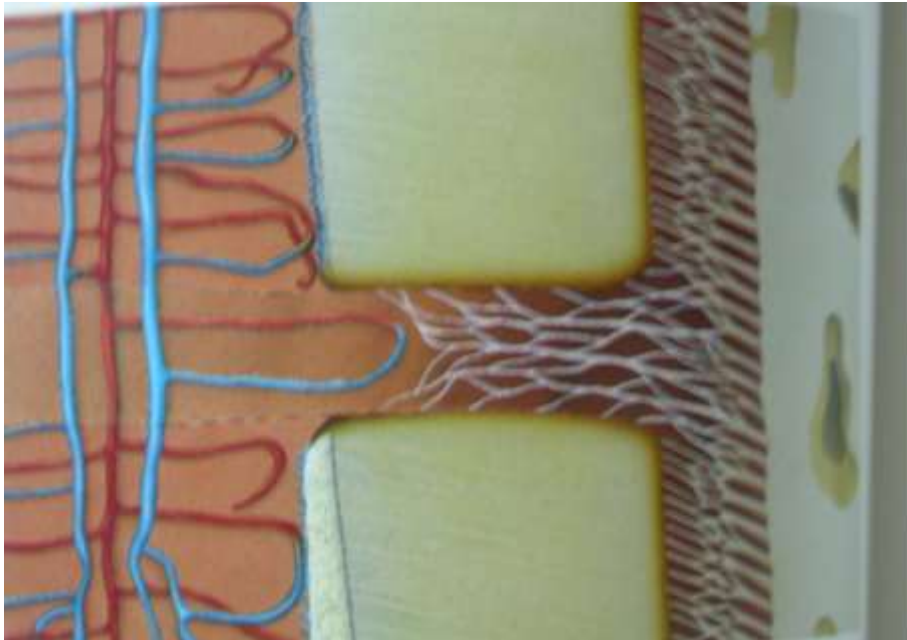
1. **Healing with calcified tissue** : Radiographically fracture line is discernible but the fragments are in close contact



2. Healing with interposition of connective tissue :

Radiographically:

fragments appear separated by narrow radiolucent line and the fractured edges appear rounded



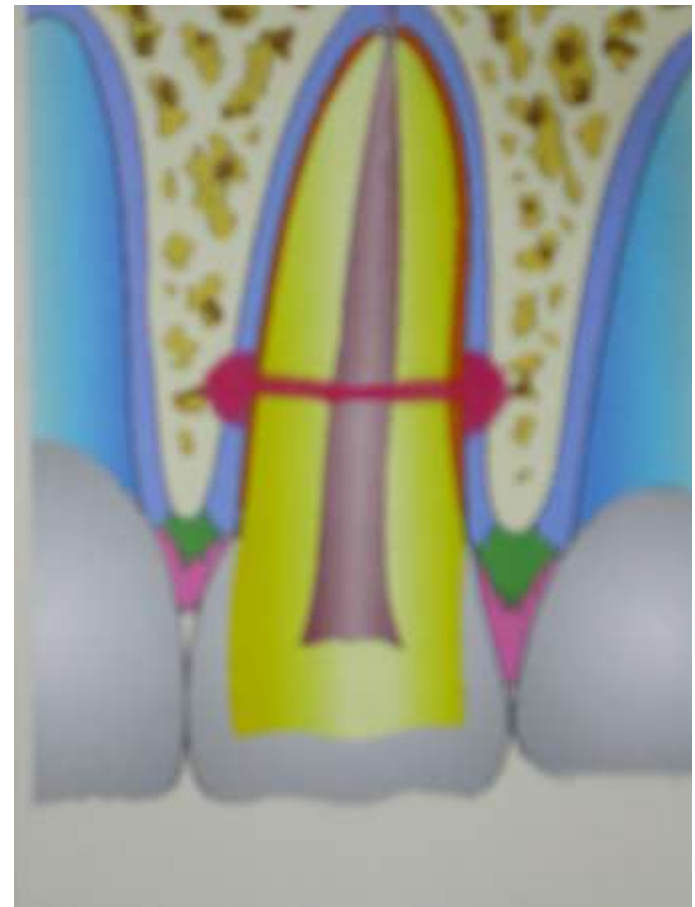
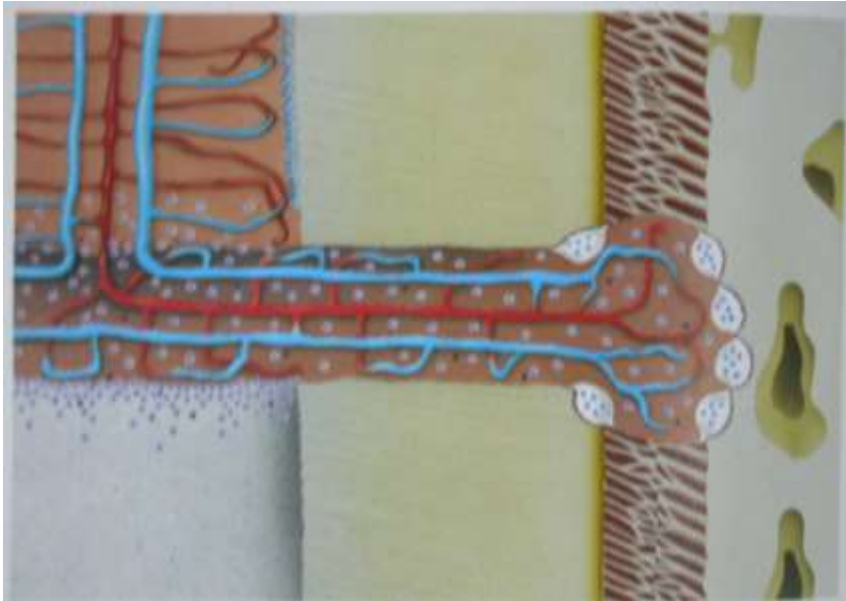
3. Healing with interposition of bone and connective tissue :

Radiographically a distinct bony ridge separates the fragments



4.Lack of healing with interposition of granulation tissue :

Radiographically a widening of the fractured line, a developing radiolucency corresponding to fracture line or both become apparent



Treatment of complications

Coronal root fractures:

- has poor prognosis
- if coronal segments are rigidly splinted(2-3months) , chances of healing are similar to mid-root fracture
- if the fracture occurs at the level of or coronal to the crest of alveolar bone, prognosis is extremely poor

Mid-root /apical root fractures :

- Pulp necrosis in 25% of the cases

Two types : 1. **Necrosis occurring in the coronal segment only**

Treatment : pulp space therapy in the coronal segment with calcium hydroxide dressing. Obturation done after the formation of apical barrier

2. Necrosis occurring in both apical and coronal segment

Treatment : - Pulp space therapy in both the segments with calcium hydroxide dressing. Obturation done following evidence of healing

- Surgical removal of the apical segment in case of failure of endodontic therapy in the apical segment

- If the remaining coronal segment has a compromised attachment ,endodontic intraosseous implants are used to provide additional support to the tooth

Follow up : After the splinting period is completed clinicians should schedule follow up examination at 3, 6 & 12 months and yearly thereafter

Prognosis :

3 factors influence repair process

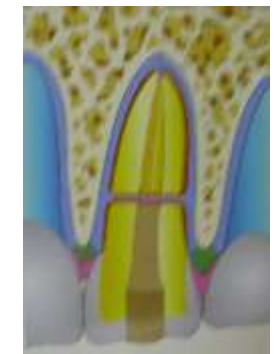
1. Degree of dislocation and mobility of the coronal fragment
 2. Immature teeth
 3. Timing of treatment
-
- In case of root fracture with necrotic pulp only in the coronal fragment ,pulp space therapy of only the coronal fragment can be a successful procedure
 - Pulp space therapy of both the fragments is not indicated
 - Pulp space therapy of the coronal fragment and surgical removal of the apical fragment is an arduous procedure but has reasonable prognosis provided the remaining coronal fragment can support the crown
 - Root canal therapy of the coronal fragment with calcium hydroxide followed by obturation with gutta percha appears to be the treatment of choice for non vital root fractured teeth

(J.O Andreasen et al 2004)

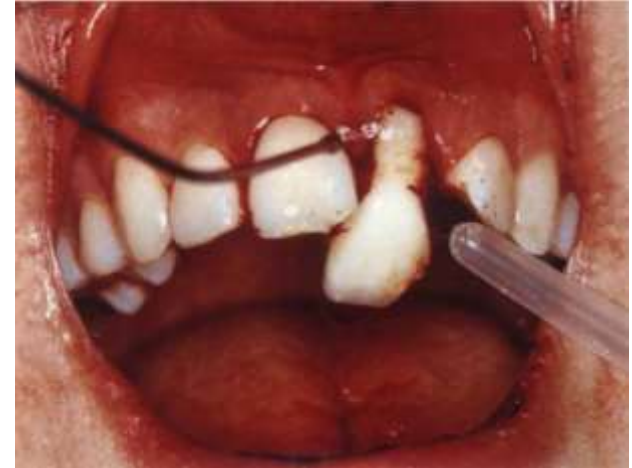
Treatment plan for deep root fracture without pulp necrosis



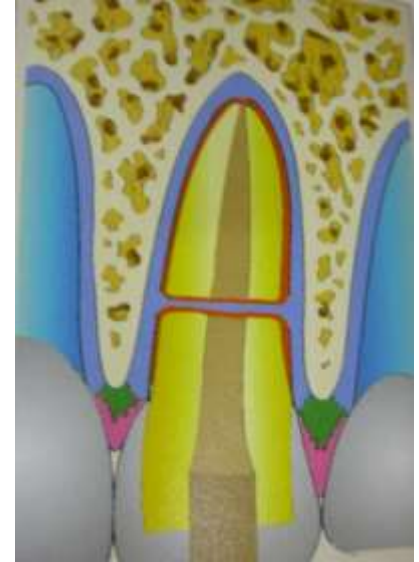
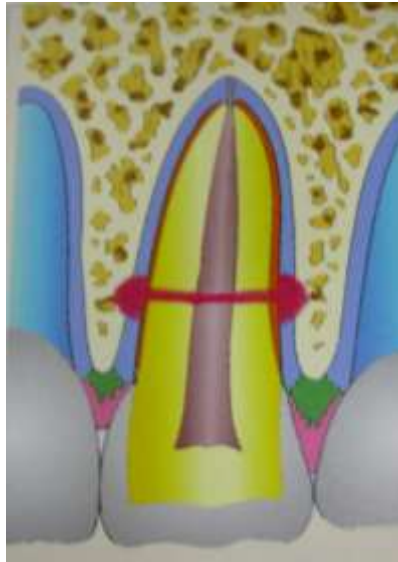
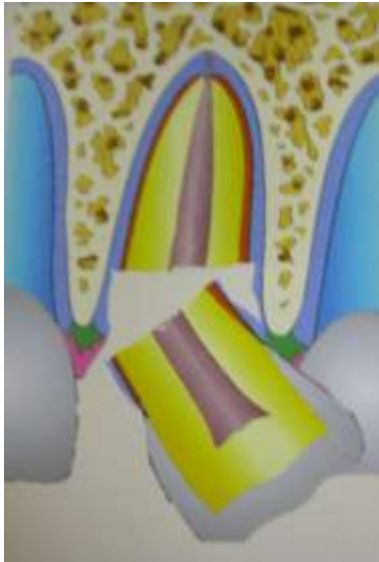
Treatment plan of deep root fracture with pulp necrosis



Treatment of severely extruded root fracture



Treatment plan for deep root fractures with pulp necrosis of the coronal and apical segments



Vertical fractures

- The line of fracture is parallel to the long axis of the tooth and can extend from the crown to the apex or is localized in the apical, middle or cervical third of the root
- May or may not involve the pulp chamber
- Seen most often in teeth that have had endodontic treatment

Case history and clinical examination

- Spontaneous pain or pain on mastication, swelling, presence of sinus tract
- Presence of deep, narrow periodontal pocket on the buccal or lingual root surface or on both surface.
- Use of fibre optic illumination
- Bite test, Staining, Vitality test
- Surgical exploration

•Radiographic examination

Fracture line perpendicular to the line of x-ray beam-
Presence of radio-opaque obturating material or posts- → Difficulty in diagnosing the fracture

Periapical radiolucency or a “halo” appearance on the proximal aspect of root surface, angular resorption of the crestal bone

•Computed tomography

Treatment of vertical fractures

-Single rooted tooth

- complete fracture- extraction

- coronal fracture—removal of fractured fragment- reposition the root coronally

- apical fracture- surgical removal

-Multi rooted tooth

- fracture involves one root-hemisection / radisectomy

Sealing of the fracture

- Glass ionomer, cyanoacrylates, composite resins

- Gortex membrane (polytetra fluoroethylene to establish new periodotal attatchmen

- CO₂ laser



Class I fracture

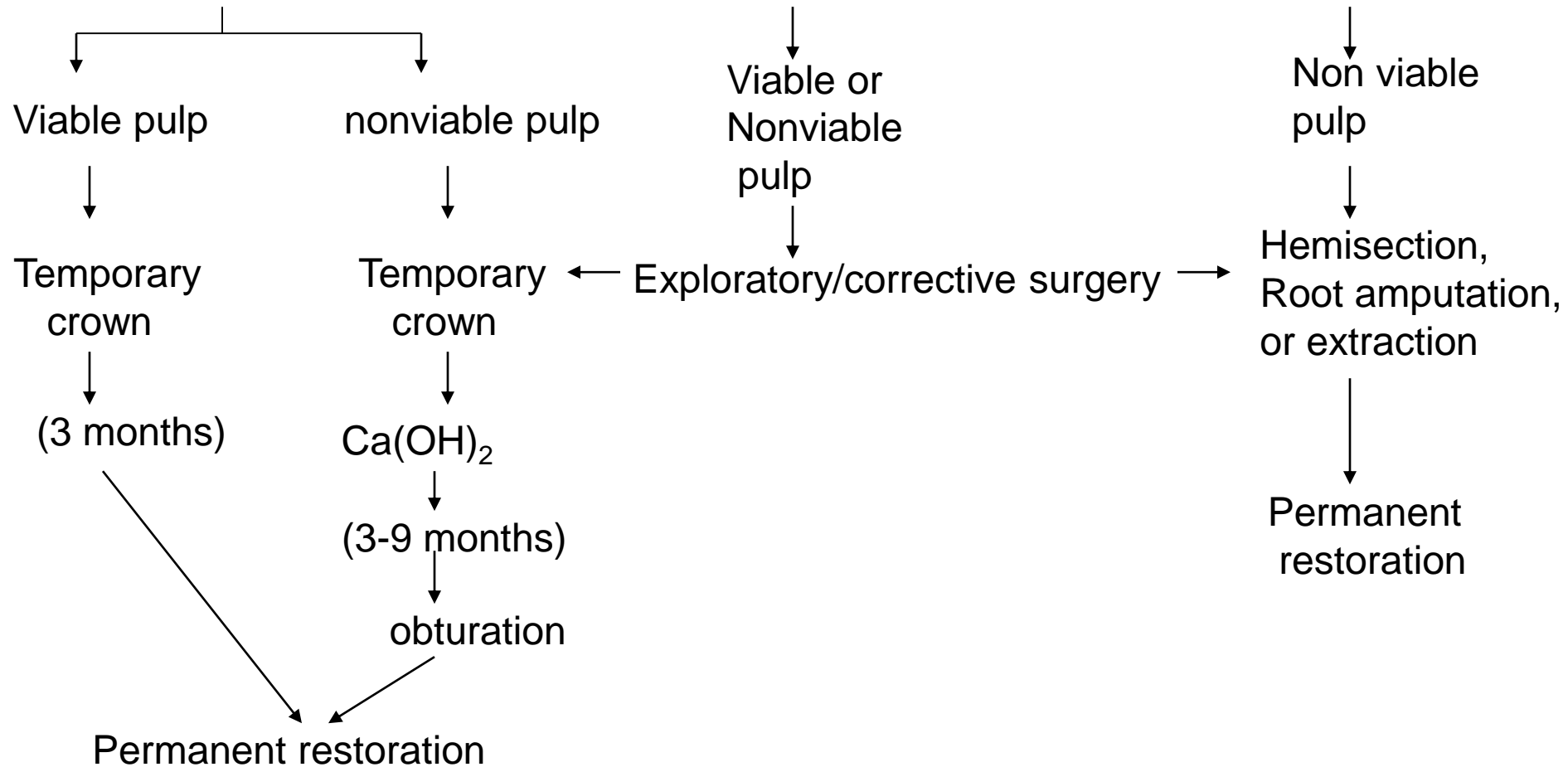
No periodontal defect

Class II fracture

Minor periodontal defect

Class III fracture

Major periodontal defect



Luxation Injuries

Involves trauma to the supporting tissues of the tooth

Incidence : 30 - 44% of all dental injuries
permanent dentition - 15-40%
primary dentition - 62-69%

Luxation injuries in the increasing order of severity are

Concussion

Subluxation

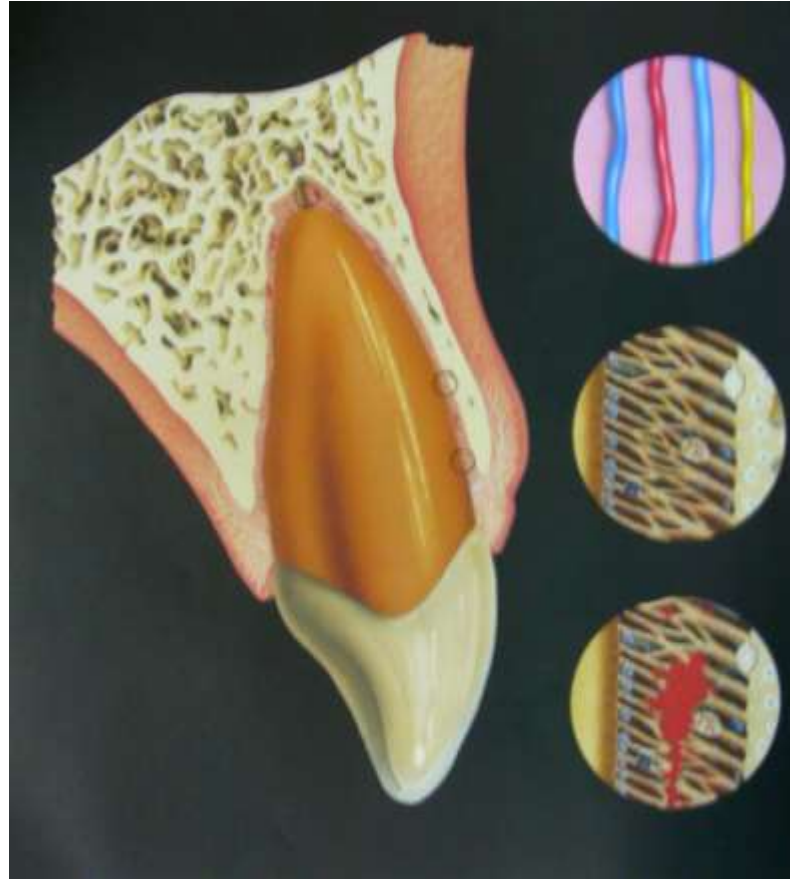
Extrusive luxation

Lateral luxation

Intrusive luxation

Concussion

A minor injury to the periodontal tissue without malposition or mobility of the teeth



Mechanism : a frontal impact leads to hemorrhage and edema in the periodontal ligament

Diagnosis and clinical presentation

- no displacement or mobility of the tooth
- pain to percussion (only feature)
- history of recent trauma
- no bleeding from the gingival sulcus
- radiographically no signs of pathology
- responds normally to vitality test in most of the cases

Treatment

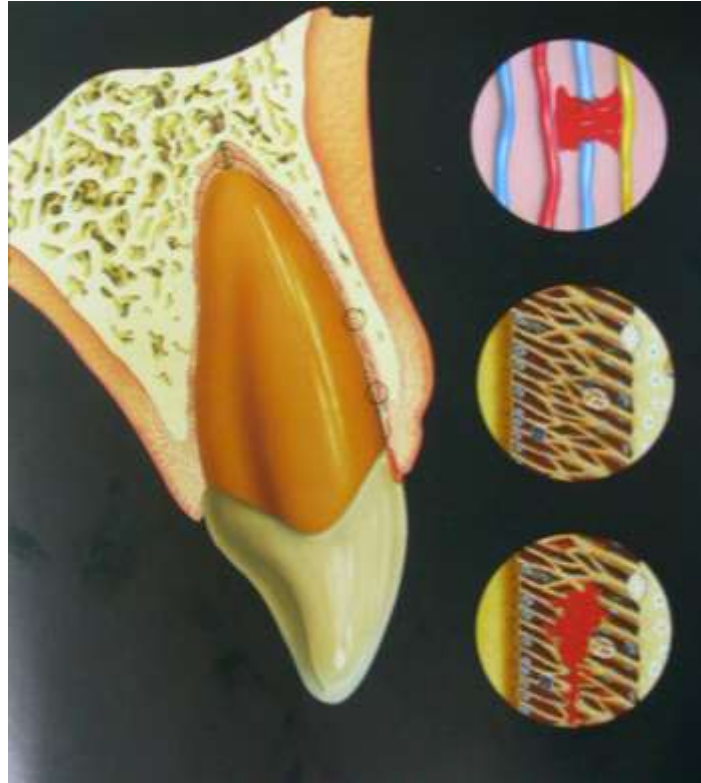
- relief of occlusal interferences
- ordination of soft diet for two weeks
- monitor pulp response periodically

Follow up

- schedule follow up at 3weeks,3,6,12 months & yearly thereafter

Subluxation

Results from slight injury to the periodontal tissue with a slight increase in mobility



Mechanism : if the impact has greater force the periodontal ligament fibres may be torn resulting in loosening of the injured teeth

Diagnosis and clinical presentation

- tooth is slightly mobile
- signs of sulcular bleeding
- sensitive to percussion

Treatment

- relief of occlusal interferences
- ordination of soft diet for two weeks
- monitor pulp response periodically
- immobilisation of 2 weeks for patient comfort

Follow up

- schedule follow up at 3weeks,3,6,12 months & yearly thereafter

Prognosis of concussion and subluxation

- minimal risk of pulp necrosis and even less risk of root resorption

Extrusive luxation

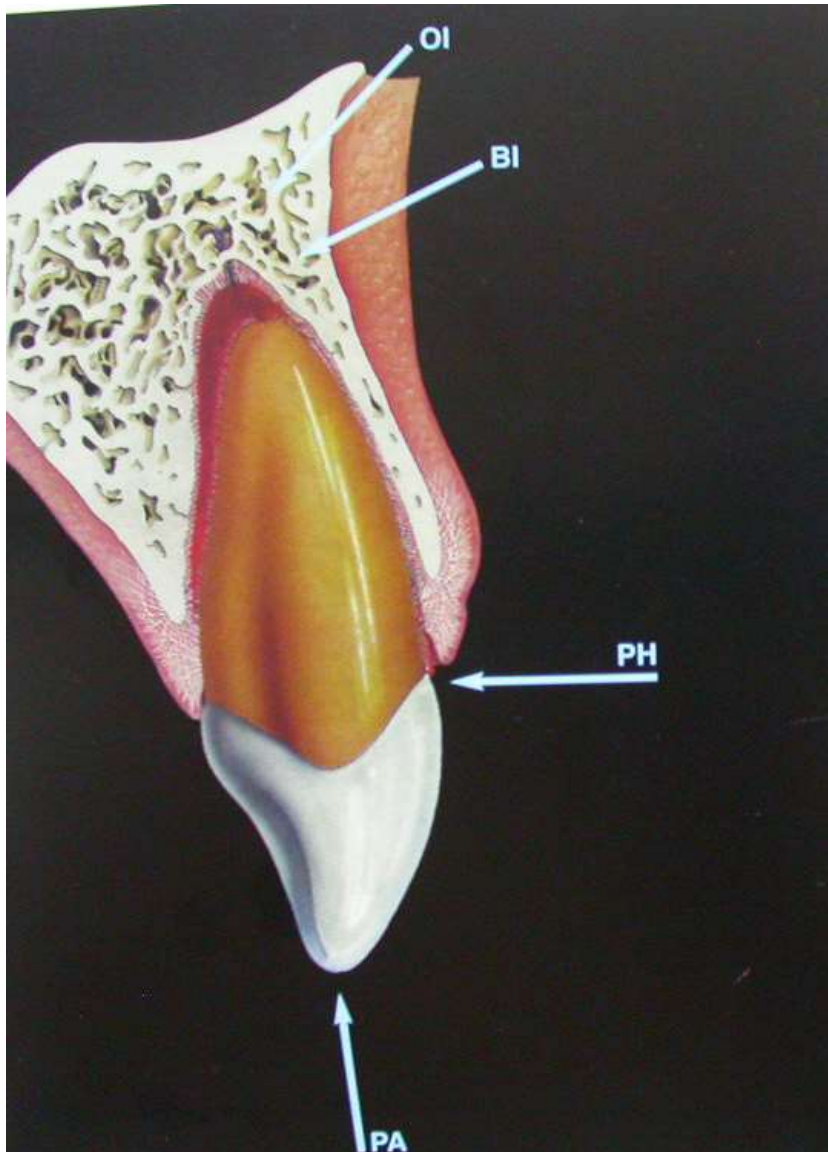
An injury involving displacement in the coronal direction

Pathogenesis :

- oblique forces displace the tooth out of its socket
- gingival fibres prevent the tooth from being avulsed
- periodontal ligament and the neurovascular supply of the pulp is severed



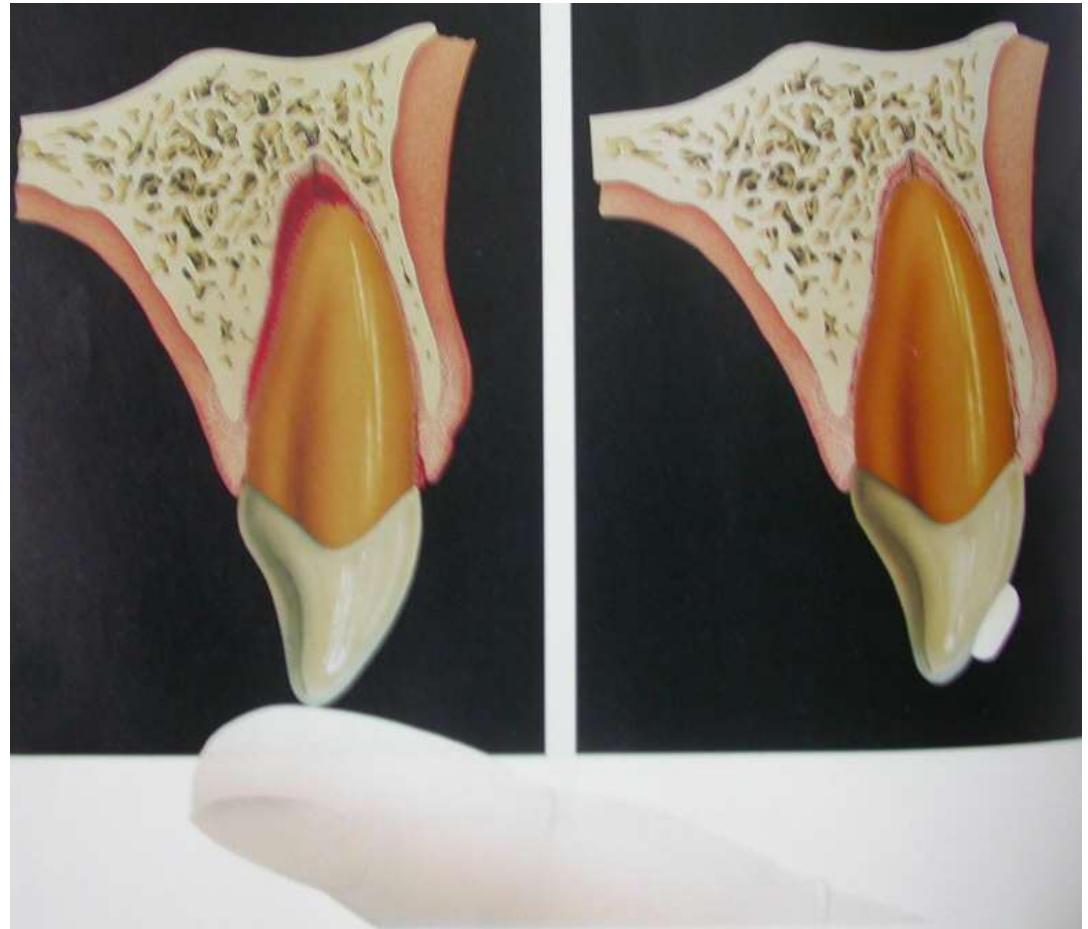
Clinical and radiographic features



Treatment

Consists of atraumatic repositioning and fixation(2-3weeks) which prevents excessive movement during healing period

Pulp space therapy



Lateral luxation

An injury involving displacement labially, lingually, distally, or mesially

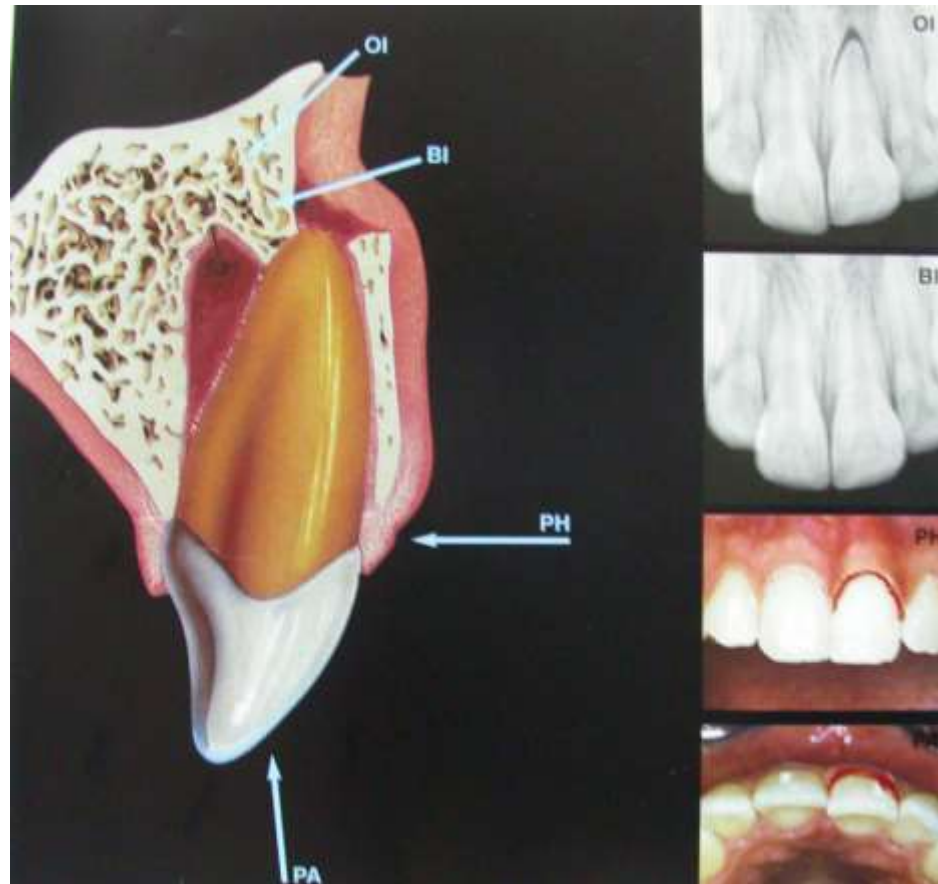
Represents rupture of the periodontal ligament, pulp as well as injury to the labial and/or palatal alveolar bone plate

Pathogenesis -

Horizontal forces displace the crown palatally and apex labially. Apart from severance of the periodontal ligament and neurovascular supply to the pulp, compression of the periodontal ligament is found on the palatal aspect of the root



Clinical and radiographic features



Clinical features- lateral displacement of tooth, sulcular bleeding, sensitivity to percussion, high metallic sound to percussion due to locking of the tooth in the new position.

Radiograph -Occlusal radiographic exposure or the eccentric bisecting angle exposure

Treatment



- ✓ Local anaesthetic administered
- ✓ Tooth repositioned by placing coronal and palatal pressure on the apical root with index finger and labial pressure on the palatal aspect of the crown with the thumb.
- ✓ Splinting with an acid etch technique for three weeks.

Follow up

-radiograph taken at the end of three weeks to ascertain healing

Splint removed

-in case of rarefaction of marginal periodontium (due to extent of trauma→ osteoclastic activity)

Splint is maintained for two months

Prognosis for extruded and laterally luxated teeth

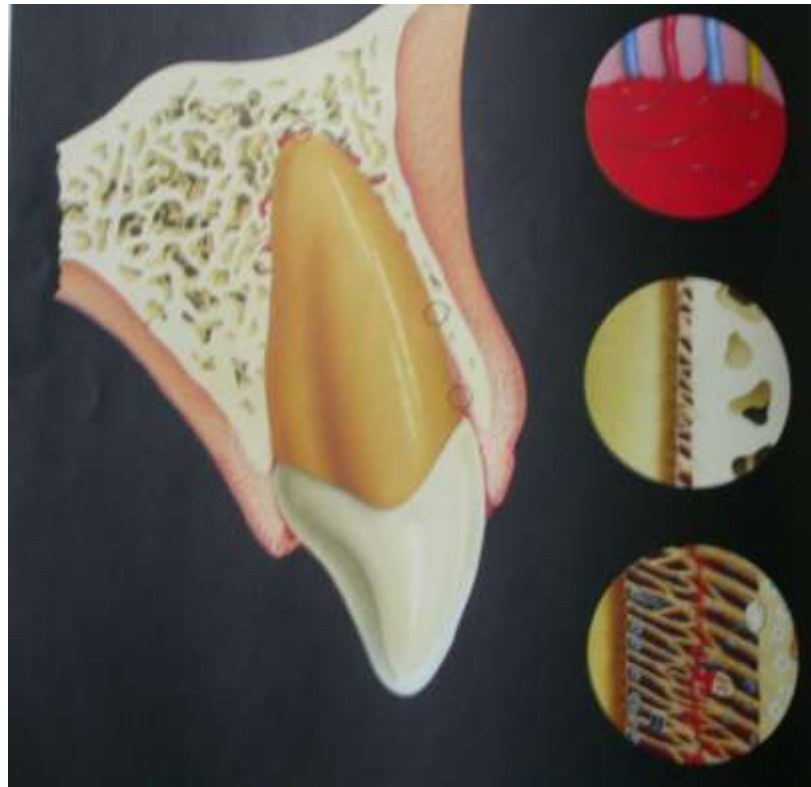
-pulpal and periodontal healing depends upon the stage of root development at the time of injury

-risk of pulp necrosis present in both luxation categories, especially in teeth with mature root formation

-Progressive root resorption is rare after extrusion but can occur after lateral luxation

Intrusive luxation

An injury involving displacement in an apical direction into the alveolus



An axial impact leads to extensive injury to the pulp and periodontium

Diagnosis and clinical presentation

- tooth pushed into the socket
- gives metallic sound to percussion test
- infra occlusion

Radiographic evaluation

essential to evaluate the extent and the position of the intruded tooth

Treatment

Depends entirely upon the stage of root development

Immature root formation

- spontaneous re eruption can be anticipated
- luxation of the tooth slightly with the forceps done if no signs of reeruption after 10 days
- pulpal healing is monitored during the period of reeruption at 3, 4, 6 weeks after injury
- in case of negative response of the pulp or periapical radiolucency endodontic therapy with calcium hydroxide dressing is done

Completed root development

- spontaneous reeruption is unpredictable
- orthodontic extrusion is indicated over a period of 2-3 weeks
- prophylactic endodontic therapy is indicated as frequency



of pulp necrosis is found in 100% of cases

Prognosis

- high risk of pulp necrosis and progressive root resorption especially in teeth with mature root formation

Avulsion

Avulsion or exarticulation implies complete displacement of the tooth from the alveolus

Incidence -0.5-16% in permanent dentition

-7-13% in primary dentition



Mechanism of avulsion

Frontal impact leads to avulsion with subsequent injury to both pulp and periodontal ligament

-Drying of the periodontal ligament has detrimental effect on healing

-Pulp necrosis occurs with avulsion

-Revascularization possible in immature apices

Healing pattern (ideal)

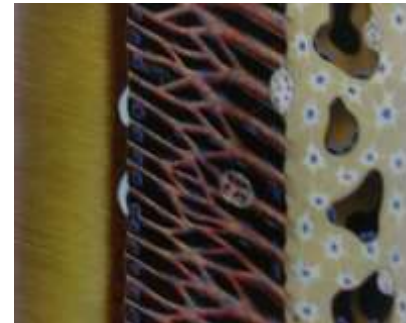
- ✓ revascularization of the severed periodontal ligament
- ✓ splicing of the ruptured Sharpey's fibres
- ✓ formation of new gingival attachment
- ✓ revascularization and reinnervation of the pulp

Healing events 2 weeks after replantation

- ✓ reestablishment of gingival attachment
- ✓ periodontal ligament regains 2/3rd of its original strength
- ✓ pulpal revascularization begins 4 days after injury (0.5mm per day)



Healing with minor injury to the periodontal ligament resulting in repair related resorption (surface resorption)



Healing with moderate injury to the periodontal ligament and associated infection in the pulp and/or dentinal tubules resulting in infection related resorption (inflammatory resorption)



Healing after extensive injury to the periodontal ligament resulting in ankylosis related resorption (replacement resorption)



Therapeutic protocols

(Diana Ram & Nester Cohenca 2004)

Pediatric dentistry

Two main stages

1) Emergency treatment

2) Definitive treatment

Therapeutic protocol for avulsed teeth with closed apex

Treatment at the place of accident

- Replant the avulsed tooth as soon as possible
- Best results with extra oral period less than 20 minutes
- If not replanted store the tooth in a storage medium

Storage medium

- Placing under patient's mouth

Avoided

- danger of swallowing the tooth
- saliva is septic medium , increase the possibility of infection

Hank's balanced salt solution (AAE recommendation)

Composition

Glucose

Sodium chloride

Potassium chloride

Calcium chloride

Magnesium chloride

Sodium bi- carbonate

Sodium phosphate

Magnesium sulfate

pH – 7, Osmolarity – 270 – 290 m Osm / litre appropriate for cell growth, non toxic and contain essential nutrients

Shelf life – 2 years



Milk



- Skimmed milk in ice
- Physiologic Osmolarity
- Very few bacteria
- Neutral pH
- Essential nutrients
- Maintains the vitality of periodontal ligament cells for 3 hours

Viaspan

(Dupont Pharmaceuticals, Wilmington, U.S.A.)

- Cold storage medium – Organ transplantation
- pH – 7.4, Osmolarity – 320 m Osm / Litre
- Superior long term storage medium
 - 37.6 % vitality of fibroblast after 168 hrs
 - 76.7% of PDL cells after 24 hrs
- Reduces the incidence of root resorption

Disadvantages

- Cost - 300 \$ / Litre
- Short shelf life

Contact Lens Solution (Huang et al)

Buffered isotonic solution with preservatives

- Sodium Chloride
- Copolymer of Polyoxyethylene and Polyoxypropylene
- Sodium phosphate monobasic
- Sodium phosphate dibasic
- Edetate disodium dihydrate (0.025%)
- Preserved with polyhexamide (0.0001%)
- Contains no Chlorhexidine and Thimerosal



Egg albumin (Rozenfarb 1997)

Propolis (Margaret &Roberta 2004)

Anti inflammatory, anti bacterial resinous bee-hive product.

Study concluded that Propolis may be able maintain periodontal ligament cell viability better than HBSS, milk or saline.

Teeth with 60 min or less extra oral dry time and stored in biologic medium

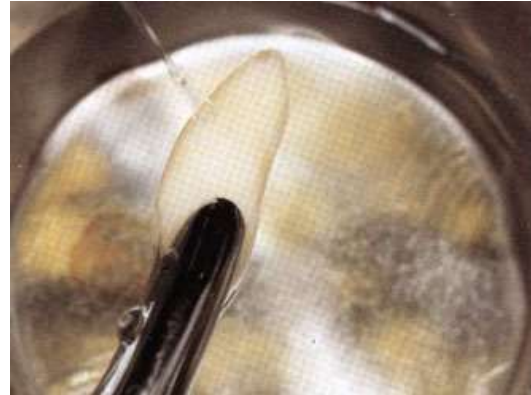
- Tooth should be held by the crown
- Irrigated with sterile saline
- Replanted with gentle digital pressure.

In case of tooth with partial development of root

- soaked in doxycycline 0.005% for 5 min before replantation
- Pulp revascularization enhanced by 40-60% of treated cases.

Closed Apex

(>30 min)



Teeth with more than 60 min extra oral dry time

Necrosis of periodontal ligament

Replacement root resorption

Treatment of root surface

-Eliminate the necrotic tissue from the root surface

mechanically- curettage

chemically- EDTA, citric acid, sodium hypochlorite

-Hold the tooth by the crown and irrigate the root surface with sterile saline.

-Soak the tooth in a sodium fluoride 2.4%, 5.5 ph solution for 20 minutes

Closed Apex :- Avital Peridontal Ligament

(Extra oral time > 60 min)



Treatment of dental socket

- Rinsed with sterile saline
- If alveolar bone has collapsed reposition gently
- A flap elevation indicated if bone interferes with replantation
- Fill the socket with emdogain

Emdogain

- Recommended by dental traumatology (IADT) for management of avulsed mature permanent tooth replanted after 60 minutes in dry extra oral condition
- Consists of hydrophobic enamel matrix proteins extracted from porcine developing embryonic enamel
- Used to treat avulsed teeth prior to replantation to prevent or delay replacement root resorption by regenerating healthy periodontium

Mechanism of action

- Based on the ability to produce new periodontal ligament from the socket side cell population

Bio active substances

Treating avulsed teeth



Emdogain® treatment technology and its application of *enamel matrix proteins* in periodontal therapy has resulted in successful outcomes for hundreds of thousands of patients worldwide. Now this proven treatment for moderate to severe periodontal defects is providing possibilities to the trauma patient.



Emdogain® Gel is a *premixed and prefilled* formulation that requires no preparation. With a single gel application onto the root surface of the avulsed tooth and directly into the alveolar socket, the prognosis of replanted teeth has been shown to improve through *prevention or retardation of resorption and ankylosis*.



ORA

Filippi, Van Aru, JPMH

EMDOGAIN



Repositioning of the tooth

- Repositioned very gently with light digital pressure

Treatment of supporting tissue

- In case of soft tissue laceration suturing done

Tooth immobilization

- Semi-rigid splint for 7-10 days
- Splint should not interfere with maintaining hygiene or physiologic movement of the tooth
- Splinting done for a longer period in case of bone fractures (1-2 months)

Pharmacologic treatment

- Prescribe antibiotic therapy to avoid infection during the first week after replantation

Amoxicillin 500mg x3/day for 7 days

children-50mg/kg in divided

doses every 8 hrs

Doxycycline 100mgx 1/day for 7 days

- Chlorhexidine rinses & strict hygiene instructions during entire splinting period
- Analgesics prescribed in case of pain
- Soft diet recommended
- Tetanus prophylaxis if necessary

Endodontic treatment

Timing directly related to the stage of root development

Tooth with completely developed root

- If the extra oral dry time was less than 60 min :
 - pulp extirpation done 10-14 days after replantation
 - calcium hydroxide dressing for a period ranging from 2 weeks to 6 months

- If the tooth was out of socket and dry for more than 60 min
 - calcium hydroxide dressing placed for a longer period to evaluate the rate of replacement resorption before obturation.

Tooth with incompletely developed root

- If the extra oral dry time was less than 60 min or tooth stored in biologic medium

- replant immediately to allow revascularization

- endodontic treatment is contraindicated as first treatment of choice

- if pulp necrosis is diagnosed , long term or short term apexification with calciumhydroxide followed by apical seal with mineral trioxide aggregate is performed

- If extra oral dry time was greater than 60 min

- do not replant the tooth

Restoration

- crown restoration or sealing of endodontic access cavity performed at the earliest

Follow up period

- clinical follow up at the end of 1 week, 2-3 weeks, 3-4 weeks, 6-8weeks and then every 6 months over a period of 5 years

Potential Complications

Surface Resorption



Replacement Resorption



Inflammatory Resorption



Canal Obliteration



Infra Occlusion



Success rate → as low as 4% and as high as 50%

Depends upon:

- a) Dry extra oral time
- b) Elimination of pulp space infection
- c) Maintaining pulpal vascularity
- d) Effective Endodontic treatment

Splints

Dental splint is a rigid or a flexible device or compound used to support, protect or immobilize teeth that have been loosened, replanted, fractured or subjected to certain endodontic surgical procedure. (AAE)

Semi-rigid splints

- Indicated in traumatized teeth without alveolar fracture whereby the physiologic movement of tooth is allowed
- Acid etch composite resin technique with materials such as waxed dental floss, suture, flexible braided orthodontic wire, monofilament nylon line used
- Other fixation materials are Kevlar and Fibresplint (allows horizontal movement), Protemp and Flexible wire composite splints (allows lateral support and vertical flexibility)

Rigid splints (unacceptable)

- Self cure splints
- Circumferential splints
- Arch bar splint
- Intracoronal splint
- Orthodontic splint

Root fracture – 2 - 4 months immobilization

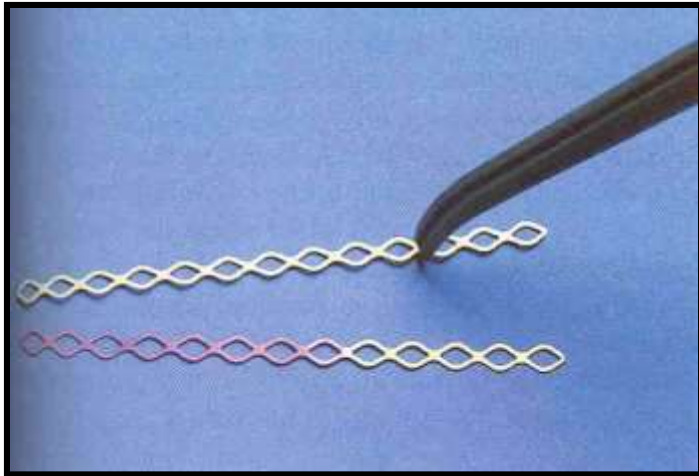
Alveolar bone fracture - 6 weeks

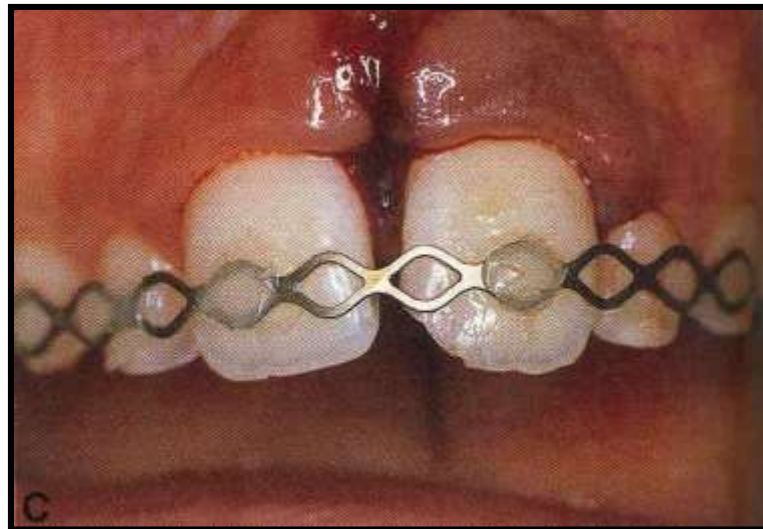
Effect of rigid splints

- Root resorption
- Pulp necrosis
- Canal obliteration

Splinting

Titanium Trauma Splint





Soft tissue injuries



Tissues involved are : gingiva, alveolar mucosa & lips

Types of soft tissue injuries



Abrasion



Contusion



Laceration

Treatment principles

- Cleansing the wound
- Repositioning of displaced tissue
- Immobilisation of the tissue with sutures

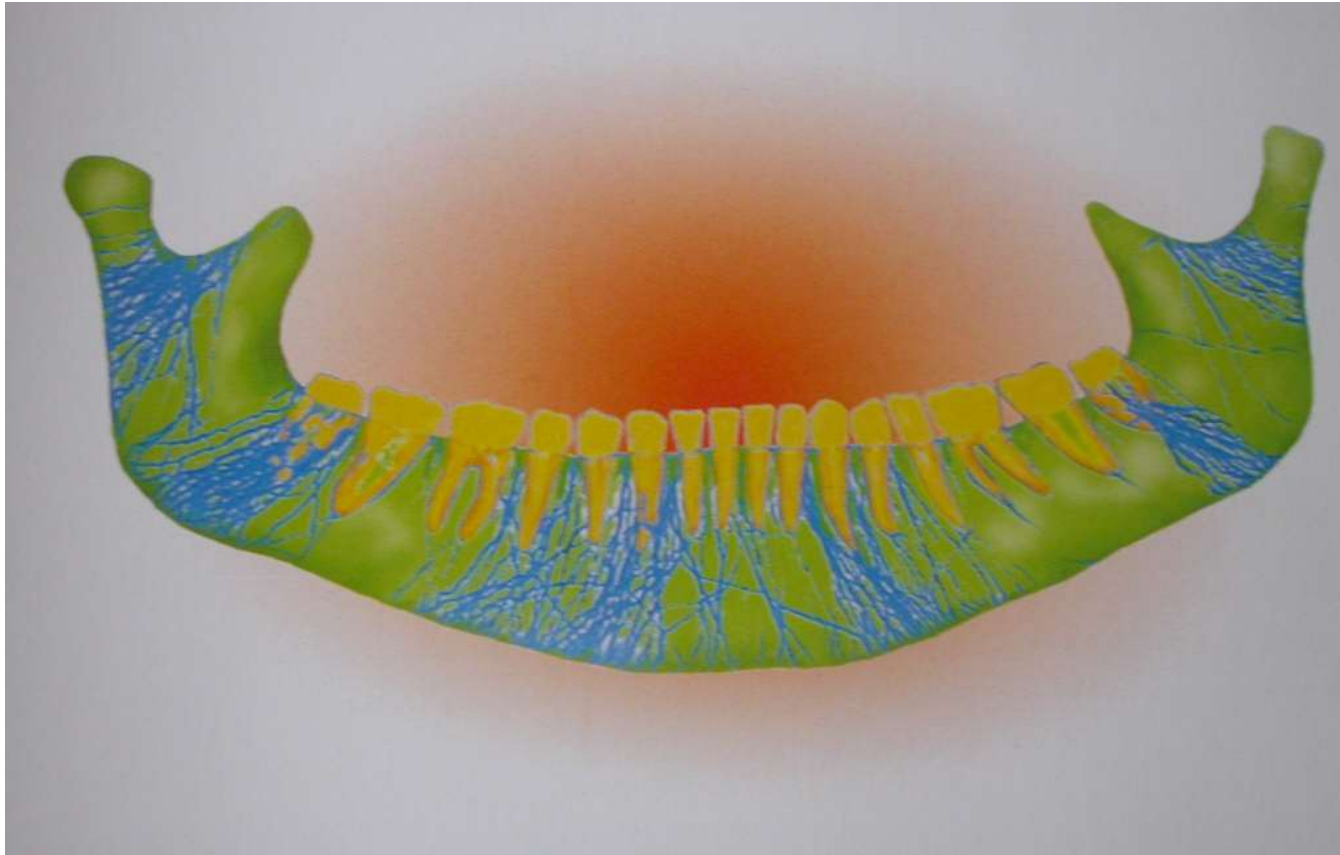
Gingival Wounds

- Rinse
- Reposition
- Suture
- Oral hygiene instructions
- Removal of suture after 4-5 days

Lip laceration

- Split or penetrating lesions
- Protruding incisors act as bayonet result in sagittal split
- Treatment :-Administer antibiotics if indicated
 - Take a radiograph of the lip
 - Use regional anaesthesia
 - Rinse
 - Remove foreign bodies, contused muscle and salivary gland tissue
 - Suture labial mucosa first
 - Rinse the wound again
 - Suture the cutaneous wound with fine sutures
 - Suture removal after 4-5 days

Injuries to the supporting bone

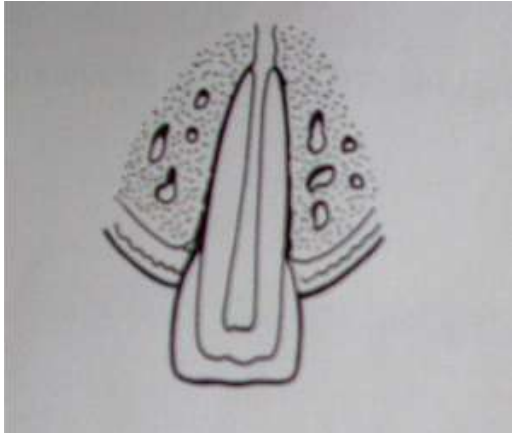


Injuries to teeth may be combined with fractures of the alveolar bone, mandible, maxilla, soft tissue trauma to gingiva and oral mucosa

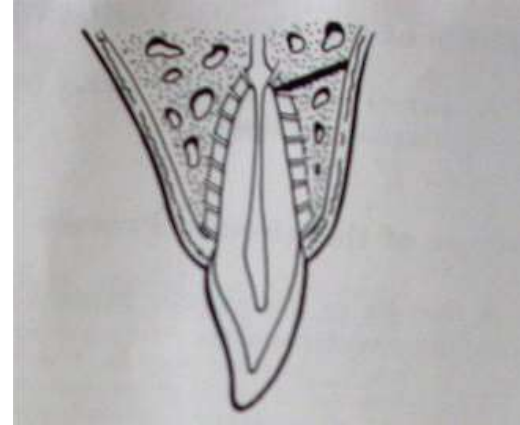
Types

- Communion of the alveolar socket : can occur along or together with intrusive or lateral luxation
- Fracture of the alveolar socket wall : confined to facial or lingual socket wall
- Fracture of the alveolar process : may or may not involve alveolar socket
- Fracture of the mandible or maxilla : may or may not involve alveolar socket

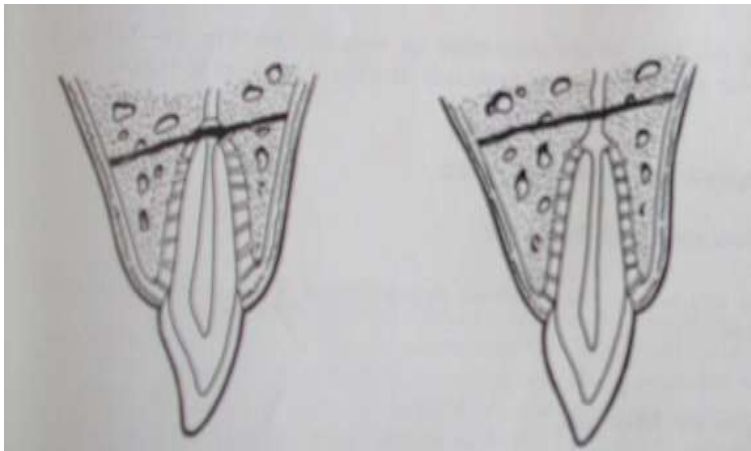
Classification



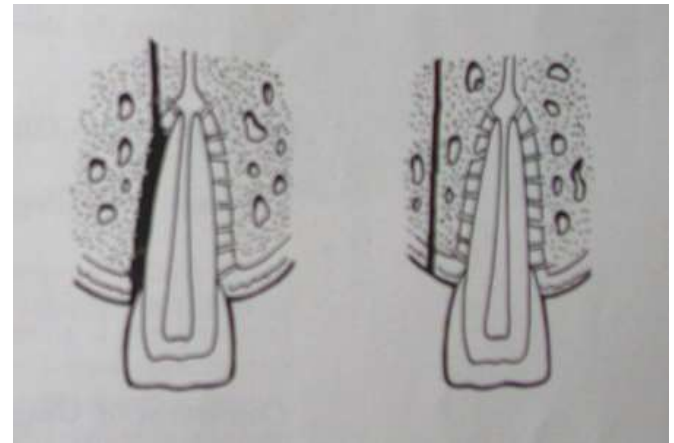
Comminution of the alveolar socket



Fracture of the alveolar socket wall



Fracture of the alveolar process



Fracture of the mandible or maxilla

Examination and diagnosis

Alveolar process fracture

- Associated with intrusive or lateral luxation
- Involves two or more teeth
- Haematoma in the adjacent attached gingiva or mucosa

Fracture of the mandible or maxilla

- Post trauma malocclusion

Radiographic interpretation

Alveolar process fracture

- Multiple radiograph with varying vertical angulation
- Level of fracture line moves along with the angulation

Treatment of fracture of maxillary alveolar process



Treatment of fracture of mandibular alveolar process



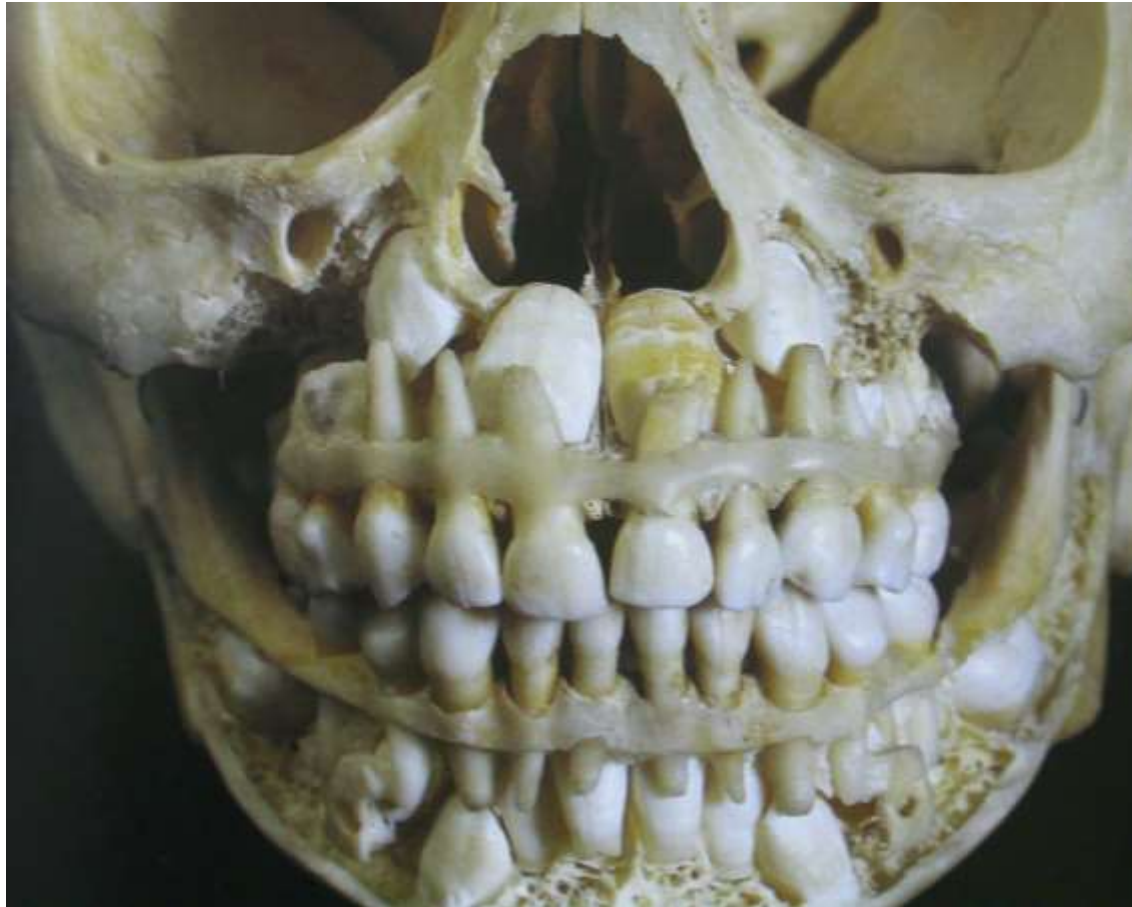
Follow up

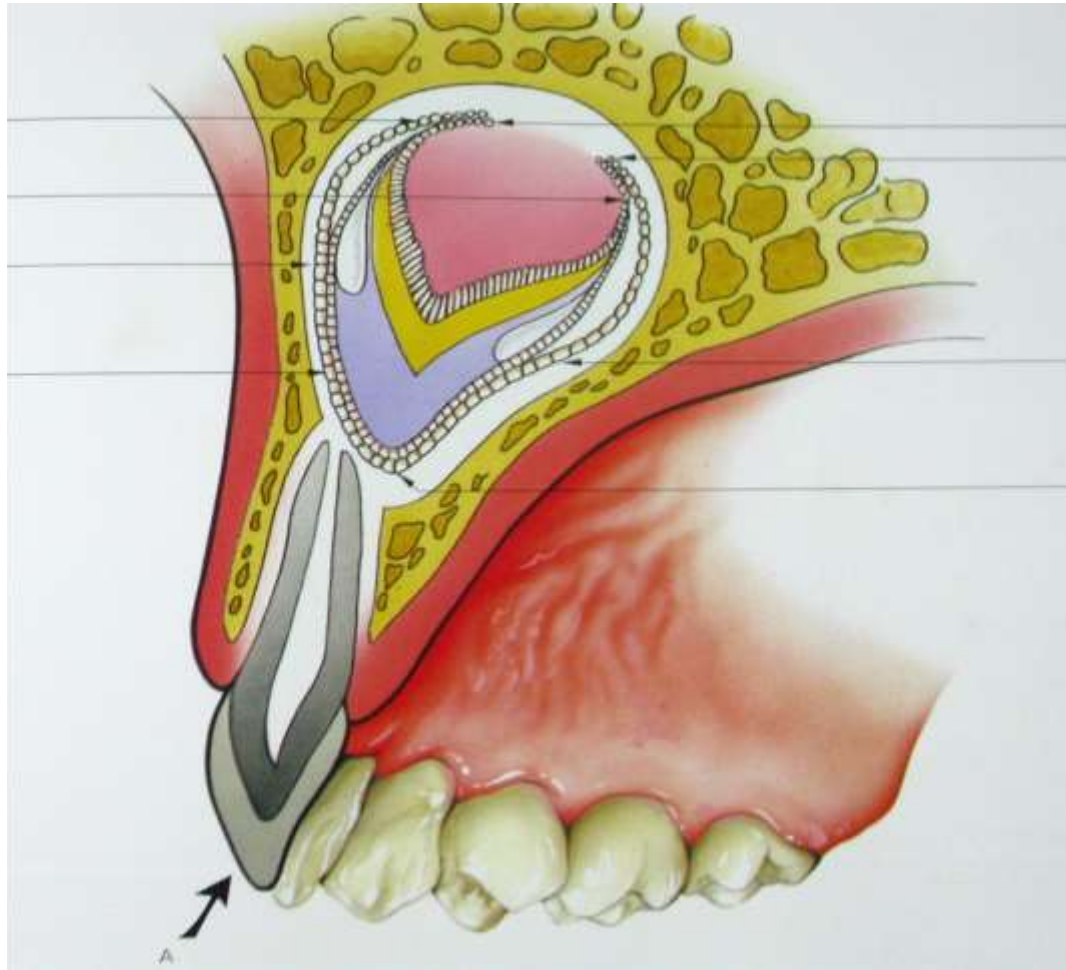
- Splint removed in 3-4 weeks
- Careful follow up of pulpal and periodontal situation

Prognosis

- Early repositioning of the fracture relates to better pulpal healing
- Periodontal healing uneventful

Traumatic injuries of the primary dentition





The treatment decision made not so much in terms of primary tooth but on long term health of permanent successors

Epidemiology

- Ranges from 4-33% in children (1990)
- Maxillary central incisors – 70%

Etiology

- Automobile accidents, sports play, child abuse and iatrogenic injuries

Treatment

Initial evaluation and diagnostic tests performed as described for permanent dentition

Goals

- To protect patients health
- To protect developing tooth bud
- To maintain integrity of injured tooth

Treatment options

Crown infraction and crown fractures that do not involve pulp

- No treatment
- Smoothing the sharp edges
- Composite resin restorations

Crown fractures involving the pulp

- pulpotomy
- pulp space therapy
- resin restorations or full coverage crowns

Crown and root fractures

extraction

pulp space therapy and full coverage crown (optional)

Root fracture

- No treatment
- Splinting mobile teeth
- Extraction

Concussion and subluxation

- Occlusal evaluation and alignment

Lateral luxation and extrusion

- Crown displaced lingually and apex labially away from the tooth germ - no treatment advised
- Crown displaced labially and apex forced into follicle - extraction

Intrusion

- No treatment
- Wait for the eruption
- Extraction

Avulsion

- Reimplantation contraindicated
 - pulp necrosis
 - injury to the permanent tooth

Damage to the developing permanent tooth bud

Classification according to anatomical and histological deviation of developing tooth (Andreasen)



1. White or yellow brown discoloration of enamel



2. White or yellow brown discoloration of enamel with circular hypoplasia

3. Odontoma like malformation



4. Crown dilaceration



5. Partial or complete arrest of root formation



6. Root dilaceration



7. Sequestration of permanent tooth germ

8. Disturbance in eruption

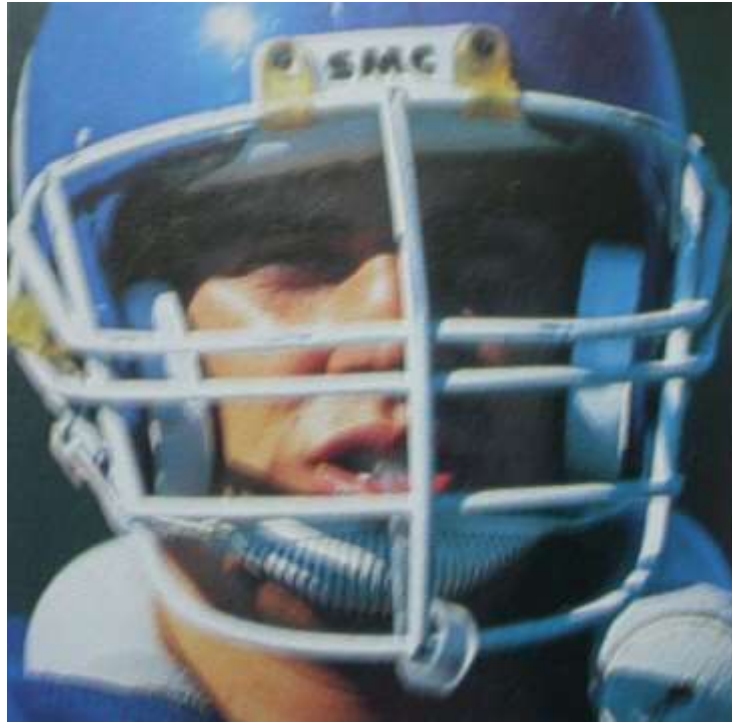
Follow up procedure

- At 1 and 2 months – to ascertain spontaneous re –eruption
early pulpal complication
- At the end of 1 year – to diagnose late pulpal complication
or malformation of permanent incisors

Prevention of dental injuries



Face guards



Cage type guards that are attached to helmet or helmet straps

Prefabricated or custom made - clear polycarbonate plastic

Disadvantage :not applicable to all sporting activities

gives no protection if hit under the chin

Mouth guards

- **Soft and comfortable**
- **Firm enough to cushion traumatic impact**
- **Adaptable to the hard and soft tissues**
- **Minimal time for fabrication**
- **Retains form after prolonged removal from the mouth**
- **Not interfere with speech and breathing**
- **not have offensive odour**
- **Non toxic**
- **Should provide proper occlusion (Shimada 2004)**



Advantages

- Effective in reducing severity and number of dental injuries
- Reduce the likelihood of brain concussion ,cerebral hemorrhage and brain stem damage

Disadvantages

- Uncomfortable because of bulk
- Tissue reaction
- Maintenance

Types of mouth guard

- Stock mouth guard
- Mouth formed or boil and bite mouth guard
- Custom made mouth guard

Stock mouth guard

- Preformed rubber or polyvinyl type polymer
- Inexpensive and ready to use without modifications
- Also used during mixed dentition period and patients wearing ortho brackets
- Least protective due to poor fit
- Less comfort to wear



Mouth formed or boil and bite mouth guard

Two types :

1. Preformed shell of semi-rigid polyvinyl with an inner lining of silicon or plasticised acrylic gel



Disadvantage

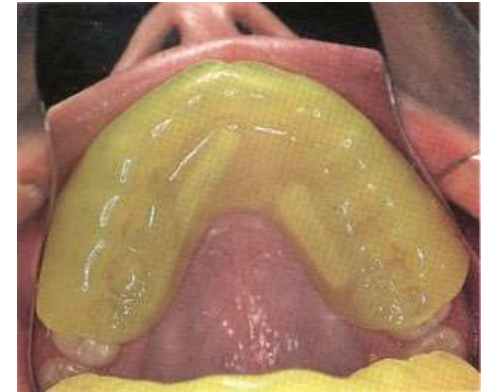
- Inner lining may creep over time causing decreased retention
- Bulky

2. Preformed thermoplastic copolymer of polyvinyl acetate

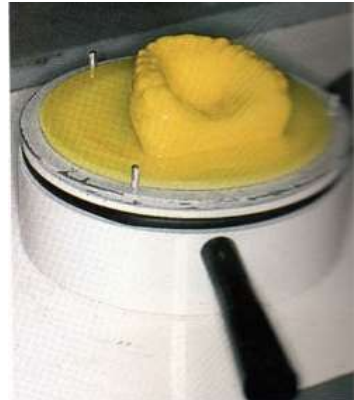
- Prefabricated by softening for a few seconds in hot or boiling water and adapted in the mouth
- Bulky



Custom made mouth guard



- Fabricated on a cast
- Made of polyvinyl acetate or polyethylene
- Heated and vacuumed pressed on the cast
- Best available protection and most comfortable to the wearer
- Expensive
- Modification – multi laminated stock sheets that have harder inserts to further support palatal side of the incisors

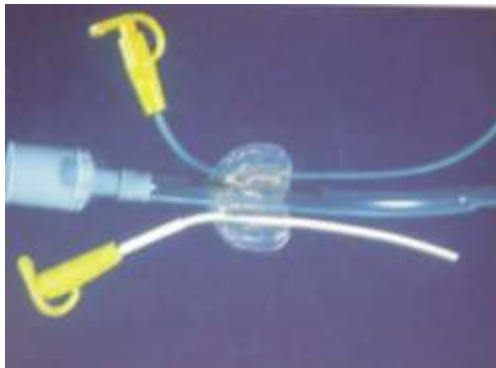




Mouth protector
during laryngoscopy



Stock mouth guard for individuals
with orthodontic appliances



Neonatal protective plate supporting
an endotracheal tube

Summary and conclusion

Trauma to teeth is a common occurrence that every dental surgeon must be prepared to assess, evaluate and treat when necessary.

Coupled with the dynamic panorama of sporting activity and the significant increase in violence all over the world, tooth trauma and its management has posed a major problem to the dental professionals.

Tooth trauma leaves not only physical permanent scars but also psychological impact on its victims.

Understanding the basic principles and therapeutic protocols can help to provide the appropriate treatment and prevent the complication.

A simple enamel fracture to an avulsed tooth can be restored or put back in its socket now with excellent post operative results.

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