Management of Non-Vital Immature Permanent teeth Secondary to Trauma

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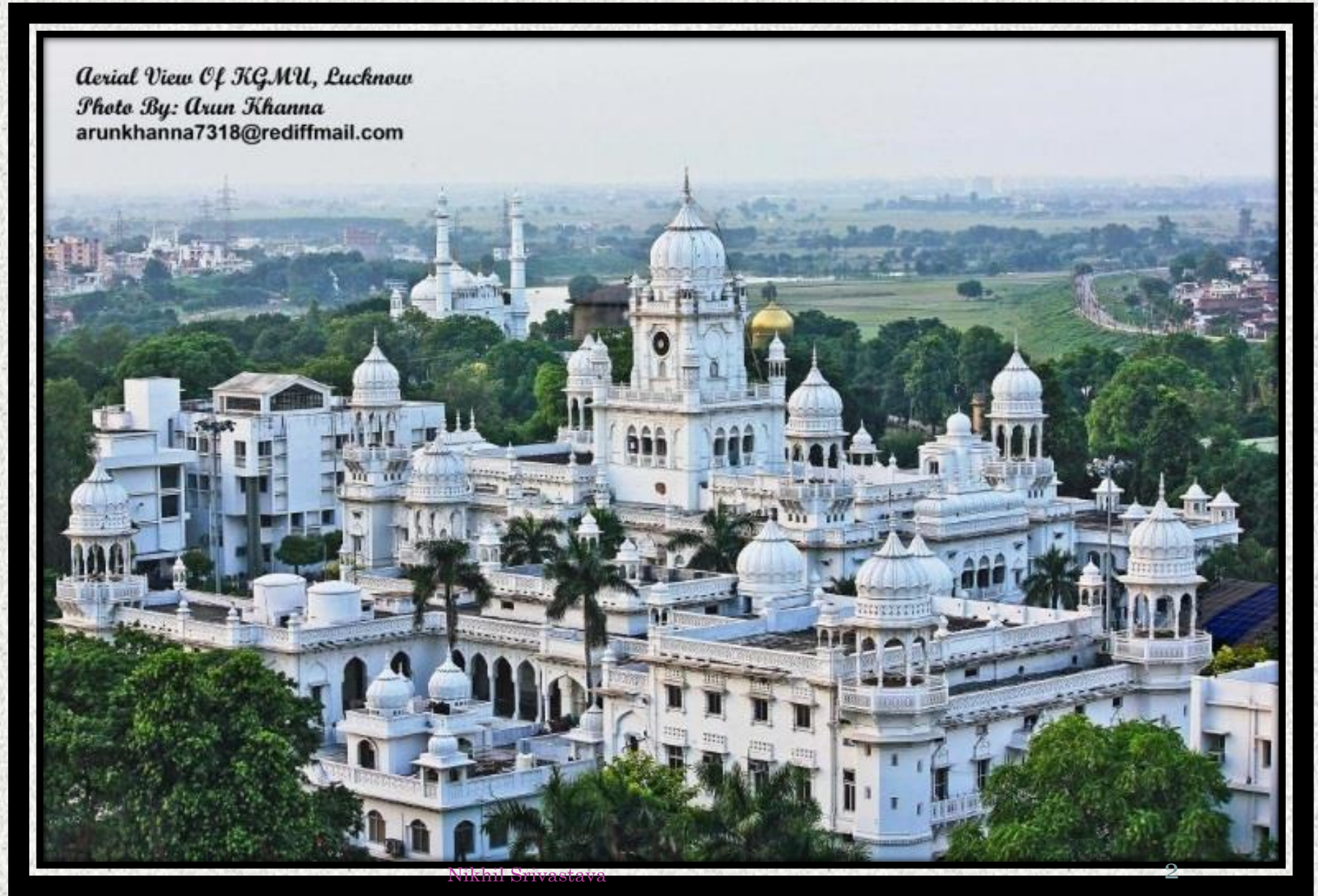

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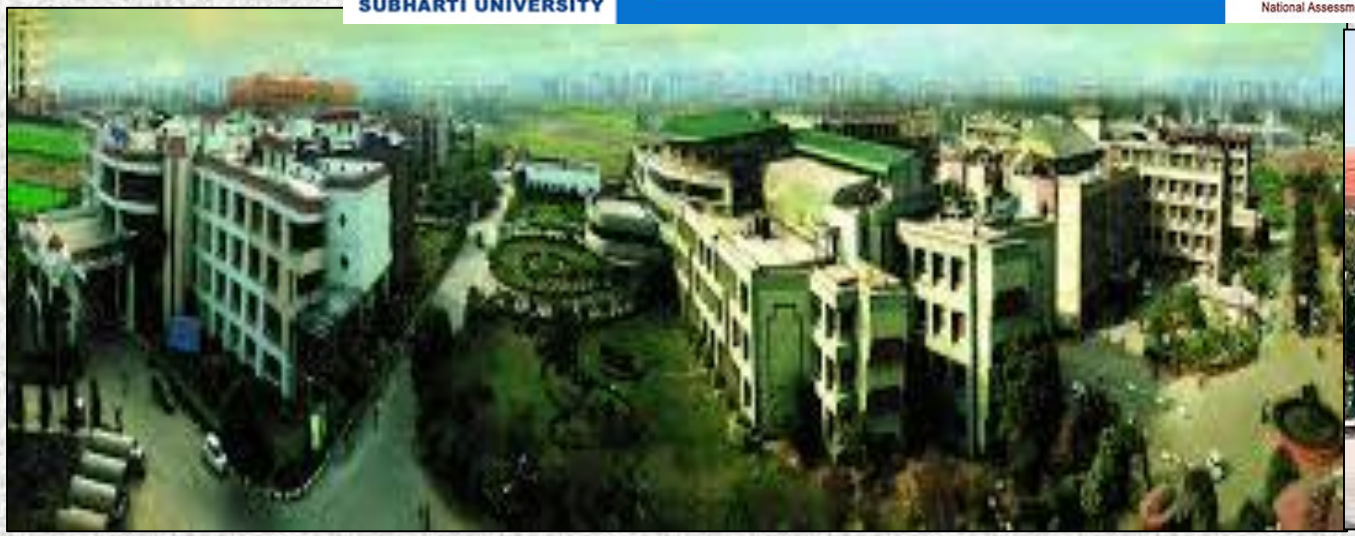

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Long Essays-

Classify ATT. Discuss the management of Ellis Class IV fracture wrt tooth no 21 in a 9 year old boy with the h/o trauma last year.

OR

A 10 year old boy reports with a chief complaint of fractured & discoloured tooth no. 11. History reveals fall from the cycle approx. 2 years back. Classify the trauma & discuss the management options with their merits & demerits.

OR

Essay on- critically evaluate the management options of non-vital immature permanent teeth

Short Essays-

CH Vs MTA apexification

Histology of the bridge formed following CH apexification

Trauma- Any physical injury of sudden onset and severity which requires immediate medical attention.

Classification by Ellis and Davey (1970)

- Based on numeric system.
- One of the most widely accepted classification.

Class I - Simple fracture of the crown involving little (or) no dentin.

Class II - Extensive fracture of the crown involving considerable dentin, but not the dental pulp.

Class III - Extensive fracture of the crown involving considerable dentin and exposing the dental pulp.

Class IV - The traumatized teeth that become non-vital with (or) without loss of crown structure.

Class V - Teeth lost as a result of trauma.

Class VI - Fracture of the root with or without a loss of crown structure

.

Class VII - Displacement of a tooth without fracture of crown (or) root.

Class VIII - Fracture of crown en masse and its replacement.

Class IX - Injuries to primary dentition

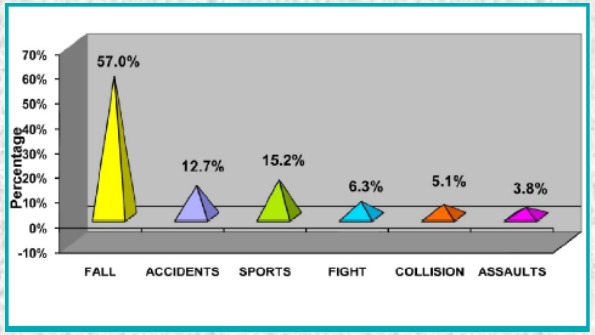
Modified Ellis & Davey Classification

Type	Criterion
0	No trauma
I	Simple fracture of crown, involving little or no dentin
II	Extensive fracture of crown, involving considerable dentin, not the pulp
III	Extensive fracture of crown, involving considerable dentin, exposing pulp
IV	**Non-vital tooth with out the loss of crown structure**
V	Total tooth loss
VI	Displacement of tooth, without fracture of crown or root
VII	Fracture of the entire crown and its replacement

Naidoo S, Sheiham A, Tsakos G. Traumatic dental injuries of permanent incisors in 11- to 13-year-old South African schoolchildren. Dent Traumatol 2009;25:224–228.

FACTS & FIGURES…..

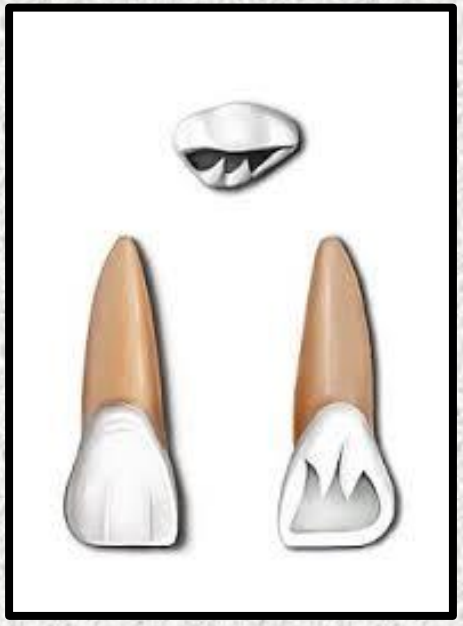
1. Area of the oral region – 1% of the body
2. Injury to the oral region – 5% of the body
3. Boy : girls – 1.4:1
4. ‘Fall’- the most common cause of injury
5. Single tooth trauma- most common
6. Most common age group for injury- 11 years
7. Central incisors- most commonly affected



Andersson et al.Epidemiology of traumatic dental injuries. JOE 2013

Permanent Maxillary Central Incisor

Event	Time	Structure	Dimension
1st evidence of calcification	3-4 months	Crown length	10.5 mm
Enamel completion	4-5 years	Root length	13.0 mm
Eruption time	7-8 years	Mesio-distal width	8.5 mm
Root completion	10 years	Labio-lingual width	7.0 mm



Wheeler's dental anatomy, physiology & occlusion. 9th Ed.

Young (Immature) Permanent tooth ?

A tooth which is not fully formed, particularly the root apex. A vital pulp is necessary for the development and maturation of the tooth root.

-British Society of Pediatric dentistry

- After eruption, a tooth takes three more years for the root development to complete (Fouad 2009).
- At the time of eruption, enamel calcification is also incomplete & takes 2-3 years to complete.

trauma before root completion ⇒ chances of pulp necrosis

non-vital tooth

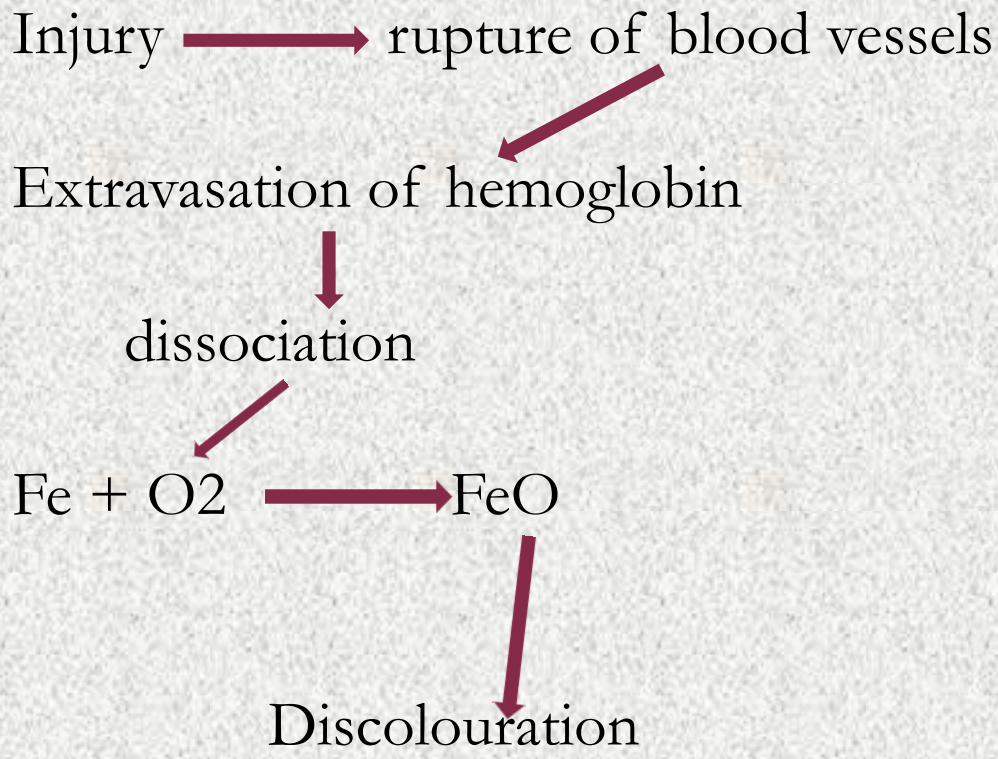
Diagnosis-

1. **History-** time of injury, interventions, medication, how injury occurred

2. **C/F-** fracture, discolouration, no bleeding/ pus discharge, sinus +/-

3. **Tests-** IOPA, pulp tests

Why a non-vital tooth gets discoloured ?



V Gopikrishna et al IJPD 2008

False Positive response in non-vital tooth ?

An anxious patient → anticipating unpleasant sensation

Necrotic pulp may conduct electric current to the viable adjacent areas.

Improper placement of probe- touching gingiva

Failure to isolate/ dry the tooth

R Gopakumar. IJCPD 2011

Why a tooth becomes non-vital ?? pulp necrosis

The aetiology of pulp necrosis in immature permanent teeth include caries, trauma or the presence of the dental anomalies, dens invaginatus and dens evaginatus.

Australian Endodontic Journal
The Journal of the Australian Society of Endodontology Inc., the Australian and New Zealand Academy of Endodontists and the Asian Pacific Endodontic Confederation

Aust Endod J 2014; 40: 95–100

LITERATURE REVIEW

What can cause the pulps of immature, permanent teeth with open apices to become necrotic and what treatment options are available for these teeth

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Keywords
apexification, calcium hydroxide, mineral trioxide aggregate, necrotic immature permanent teeth, regenerative endodontics.

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doi:10.1111/aej.12087

Abstract

Pulp necrosis of immature permanent teeth represents a significant challenge for clinical management as root development ceases and open apices remain. The aetiology of pulp necrosis in immature permanent teeth can include caries, trauma or the presence of the dental anomalies, dens invaginatus and dens evaginatus. Endodontic treatment is complicated by the resultant thin dentinal root walls and the lack of apical closure. The long-term prognosis is compromised by increased risk of cervical root fracture and reduced crown to root ratio. Currently there is a paradigm shift in the management of such cases from traditional apexification procedures towards regenerative endodontic procedures. Regenerative endodontics can promote continued root development and apical closure, which does not occur with calcium hydroxide or mineral trioxide aggregate apexification. As supporting evidence grows and clear treatment guidelines are developed for regenerative endodontics, it is likely to become the gold standard for management of such teeth.

Introduction

The management of necrotic immature, permanent teeth presents a clinical challenge because of incomplete root

Causes of pulp necrosis

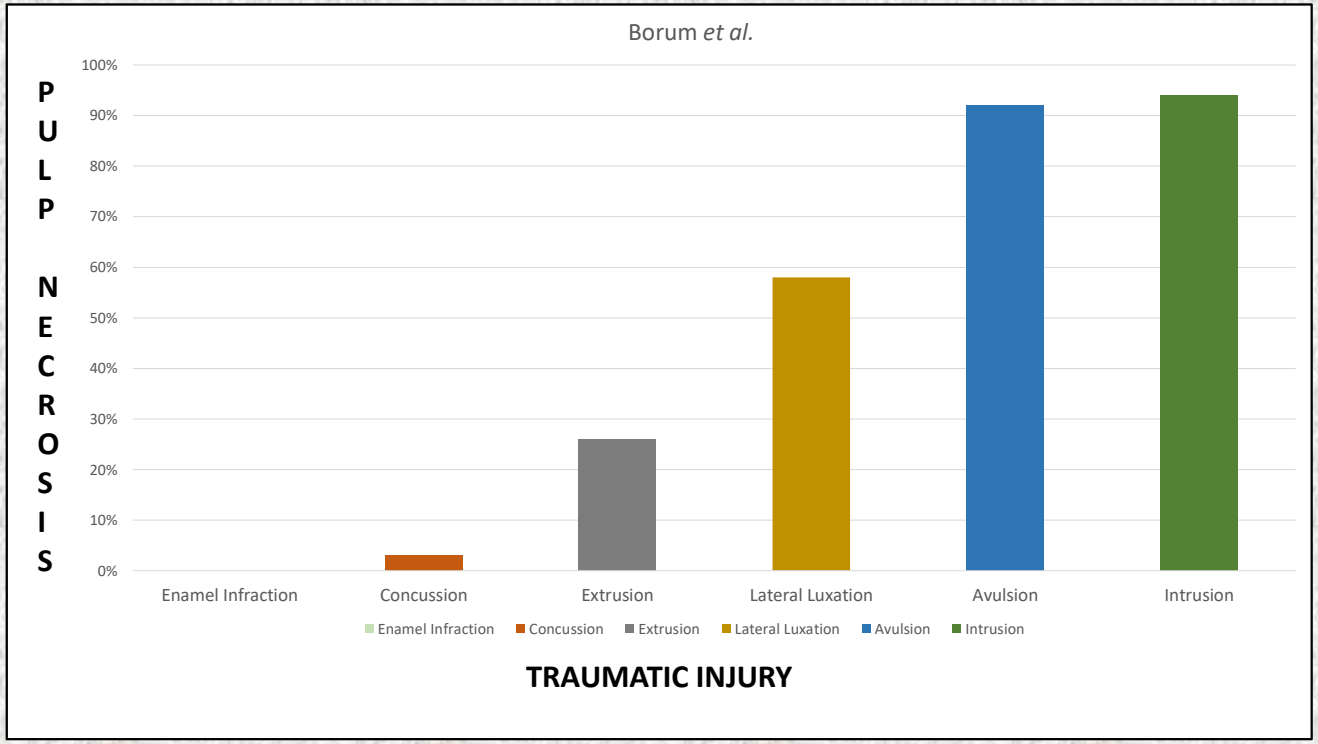
It is well established that pulp necrosis of immature, permanent teeth can halt continued root development, pro

Flanagan TA. What can cause the pulps of immature, permanent teeth with open apices to become necrotic and what treatment options are available for these teeth. Australian Endodontic Journal. 2014 Dec;40(3):95-100.

Dental Trauma….

- Trauma (TDI)
- Crushing/displacement injury to apical area
- Complete/partial obstruction in blood supply
- If not restored
- **Necrosis**

Which type of trauma causes pulp necrosis ?



Concussion – 3%,

Enamel–dentin fracture – 12%,

Extrusion – 26%,

Lateral luxation – 58%,

Avulsion – 92%,

Intrusion – 94%

Borum MK, Andreasen JO, Therapeutic and economic implications of traumatic dental injuries in Denmark; an estimate based on 7549 patients treated as a major trauma centre. Int J Paediat Dent 2001, 11;249-58

Surprisingly……..

30% - injuries in permanent teeth

Occur……..

before the completion of roots ???

Treatment Options

Non-vital immature permanent teeth

- Creating apical stop (Apexification)
  - Gradual — Traditional
  - immediate — Apical Barrier Technique
- Creating root end closure (Regenerative Endodontics)
  - revascularization (Cell Homing)
  - tissue engineering technology (Cell Transplantation)

Apexification-method of inducing apical closure by the formation of osteo-cementum or a similar hard tissue or continued apical development of the root of an incompletely formed tooth in which the pulp is no longer vital.

- AAE

Materials used-

- Calcium Hydroxide
- Mineral Trioxide Aggregate (tricalcium silicate, tricalcium aluminate, tricalcium oxide & silicate oxide)
- Bioceramics (zirconium oxide, calcium silicates, calcium phosphate monobasic, calcium hydroxide, filler, and thickening agents)
- Biodentine (tricalcium silicate,dicalcium silicate,calcium carbonate,calcium oxide, calcium hydroxide & zirconium oxide)

Mechanism of action-

CH or MTA in the apical III

↓

Stimulation

↓

release of growth factors & bioactive molecules form alveolar bone matrix

↓

signal

↓

stem cells in PDL & alveolar bone marrow

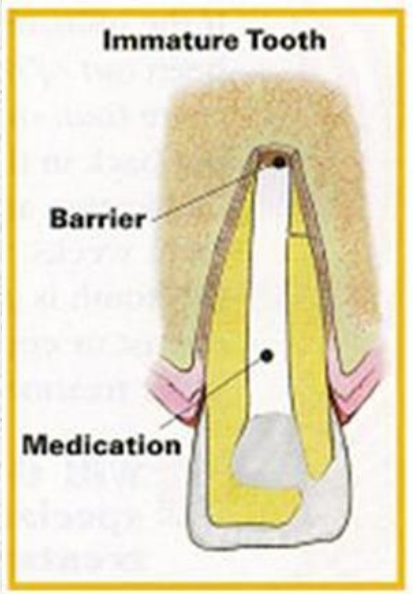
↓

differentiation into odontoblast like cells

↓

hard tissue barrier (cementoid or osteoid)

Kareem A M K, Rasha M A. Managements of Immature Apex: a Review. Mod Res Dent. 1(1). MRD.000503. 2017



Traditional Apexification

- Calcium Hydroxide powder/ paste
- Use of $Ca(OH)_2$ in apexification was first reported by Kaiser
  - multi-appointment procedure
  - Fastest bridge formation- CH+Iodoform

Kaiser JH. Management of wide-open canals with calcium hydroxide. 1968

Ghosh S, Mazumdar D, Ray PK, Bhattacharya B. Comparative evaluation of different forms of calcium hydroxide in apexification. Contemp Clin Dent 2014;5:6-12

First Appointment

i. **Isolation**

ii. **Access – Straight line**

iii. **Instrumentation – Working length – 2-3 mm short**

- **Circumferential filing**
- **120-140 number Files**

90, 100,110, 120, 130, 140

iv. **Irrigation – NaOCl + Saline**

v. **Seal the access**

Second Appointment

vi. **Dry the canal – Blunt end of paper point**

vii. **Material placement – Metapex / Pulpdent or**

thick paste of $Ca(OH)_2$ + $BaSO_4$ + CMCP

(with amalgam carrier or Syringe)

viii. **Fill till CEJ**

ix. **A layer of $Ca(OH)_2$ powder**

x. **Access sealed**

Case 1 CH Apexification

Pre-op

Canal cleaned, shaped & filled with calcium hydroxide .

Post-op
Apical 1/2 obturated with GP & rest with composite
(1.6 years follow up)

Case 2 CH Apexification

Pre-op

Canal cleaned & filled with CH .

6 months Post-op GP obturation

Case 3 CH Apexification

Pre-Op

Canal cleaned & filled with Metapex

Post-Operative

Case 4 CH Apexification

Pre-Operative

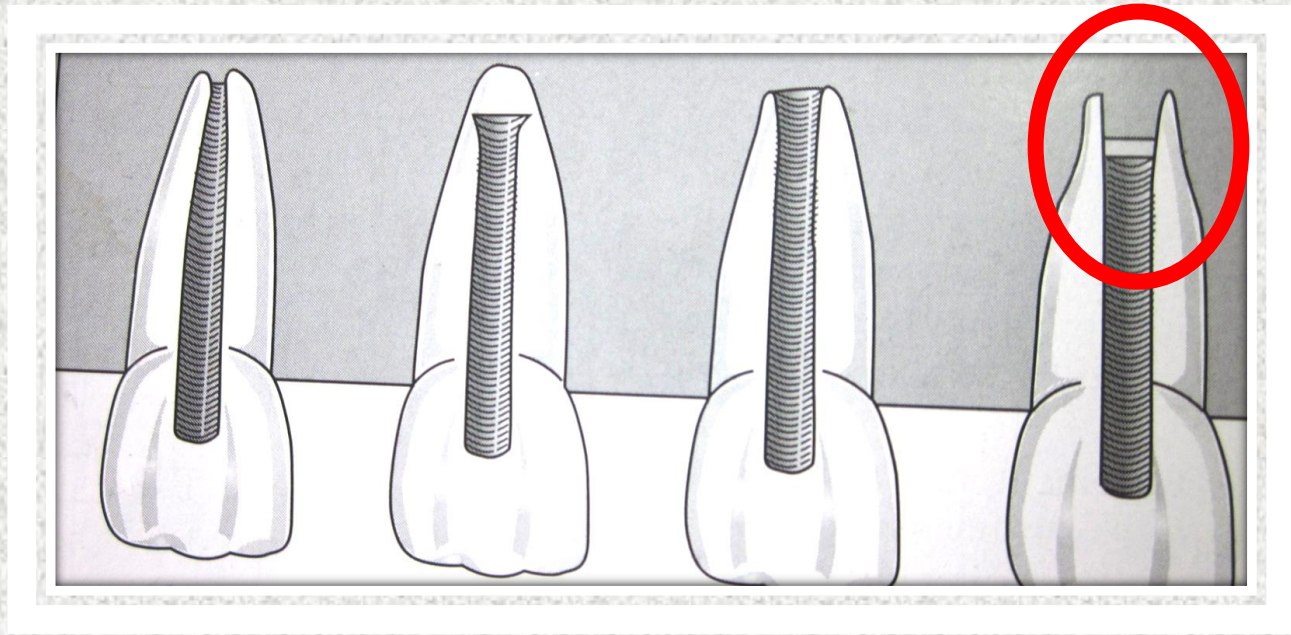
Metapex filling after canal cleaning

Obturation

Types of Apical Closure

Periodic recall-

- **Normal time 6-24 months**
- **3 months recall… see evidence**



FRANK'S CRITERIA

Apical Barrier Technique

k/a One/two Step apexification
Material used-

MTA (Grey & White) …… FeO & MgO in Grey

- **Powder: Liquid = 3: 1, Mixed with water**
- **Setting time – 2.6 hrs**
- **pH 10.2 during mixing & 12.5 when set**

Material is packed in apical III

Quick … apical barrier technique allows Immediate obturation

Witherspoon DE, Ham K 2001

Technique:

1. Canal cleaned & medicated with CH
2. After 1 week – Irrigate with 1 - 1.5 % NaOCl
3. Dry the canal, pack 3 – 4 mm of MTA at apical third
4. Wait for 3 hours…..allow to set
5. Obturate

Fast Setting MTA

Sets in 4 minutes

Good sealing capabilities

Strong antibacterial properties

Minimal discoloration & calcification

Other uses – Retrograde fillings, DPC,

Perforation repair

Case 5 MTA Apexification

Pre-Op

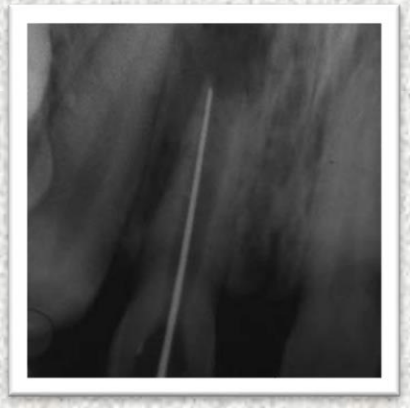
Working length

MTA placement

Post obturation

Case 6 MTA Apexification

Pre Op



Working length

MTA plug

Post Obturation

Outcome-

In either of the approaches…..

- Tooth remains non-vital
- Short roots & prone for fracture
- Thin dentinal walls
- Apical barrier is weak & porous (CH Apexification)
- Altered Crown Root ratio
- Need for full coverage restoration

CH Vs MTA Apexification

Calcium Hydroxide

1. Multi visit procedure
2. Apical stop – 6-24 months
3. Bridge formation-
   irregular
   Cheesy consistency
   minute communication
   (vascular inclusions)
4. Need for refilling
5. Cost effective
6. Weaken dentin- if placed for more than 5 months

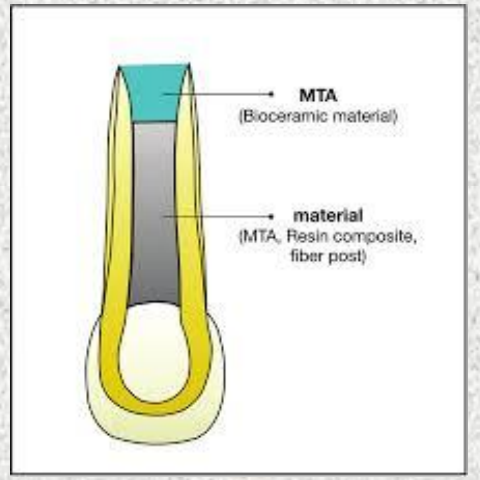
Mineral Trioxide Aggregate

1. One or two visit procedure
2. Apical stop – immediate
3. Apical stop-
   thicker
   harder
   non-porous
4. No need
5. Not cost effective
6. No effect on dentin

Reinforcement of Thin Dentinal Walls Following Apexification

- Apical III- GP obturation (CH) or MTA
- Cervical & middle III reinforced
- 4 approaches-

a. Use of adhesive sealers
b. GIC
c. Intra canal composite with clear posts
d. Glass fiber posts (biomechanical properties & modulus of elasticity similar to dentin)



Kareem A M K, Rasha M A. Managements of Immature Apex: a Review. Mod Res Dent. 1(1). MRD.000503. 2017

Suggested Reading

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Thank You

Any Questions ?

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