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Treatment of Immature Permanent Teeth with Pulpal Necrosis

Immature permanent teeth (young permanent teeth)

- Immature permanent teeth are those teeth which their root development and apical closure have not been completed.
- They are found among children aged six-years- (when centrals and sixes erupted) until 2 -3 years after the eruption of third molar. After apical closure, those teeth are classified as mature teeth.
- Root completion requires 3 years or more after eruption
- When the permanent tooth erupt only two thirds (2\3) of its roots is formed and the dentine formation will continue as long as the dentine-pulp complex is vital and it does not stop after complete root formation.

Note

Young immature permanent teeth are highly cellular so they have a better healing potential than the adult mature teeth. Therefore, this point can be used to preserve the vitality of the pulp tissue. The degree of root development affects the type of the treatment.

Apexification

It is a method used to induce root end closure in an incompletely (immature) formed non-vital permanent tooth in which root growth and development had been stopped due to pulpal necrosis.

The conventional treatment of pulpless anterior teeth usually requires apical surgery. There is a less traumatic endodontic therapy called apexification, which had been found to be effective in the management of immature, necrotic permanent teeth. The apexification procedure should precede root canal therapy in the management of teeth with irreversibly diseased pulps and open apices. The procedure had been demonstrated to be successful in repeated clinical trials stimulating the process of root end development, which

was interrupted by pulpal necrosis, so that it continues to the point of apical closure. Often a calcific bridge develops just coronal to the apex. When the closure occurs, or when the calcific "plug" is observed in the apical portion, routine endodontic procedures may be completed; the possibility of recurrent periapical pathosis is thus prevented.

Apexification technique:

1) Proper isolation ideally done with rubber dam.
2) Coronal access should be wide enough to include the pulp horns so that the removal of all the necrotic pulpal tissue can be done to prevent future contamination and discoloration.
3) Gentle debridement of the root canal.
4) Irrigation should be done with disinfecting solutions e.g. 0.5% - 2.5% NaOCl or 0.2% chlorhexidine solution. The irrigation should be done without pressure because there is a wide open apex and it might spread apically affecting the stem cells that are needed for the closure. The needle should be loose inside the root canal.
5) Working length should be estimated. Length of the root canal should be determined radio-graphically because the electronic apex locators are not reliable in teeth with open apices.
6) Minimal instrumentation should be done to prevent the damage of the thin dentinal walls.
7) After ensuring the canal is sterile with no symptoms of infection, apexification can be done using either non-setting Calcium Hydroxide or MTA (or biodentine). The traditional way was the use of calcium hydroxide (it is highly successful but it takes long time for the follow up and to get the closure). So now, MTA plug is used as a substitution.

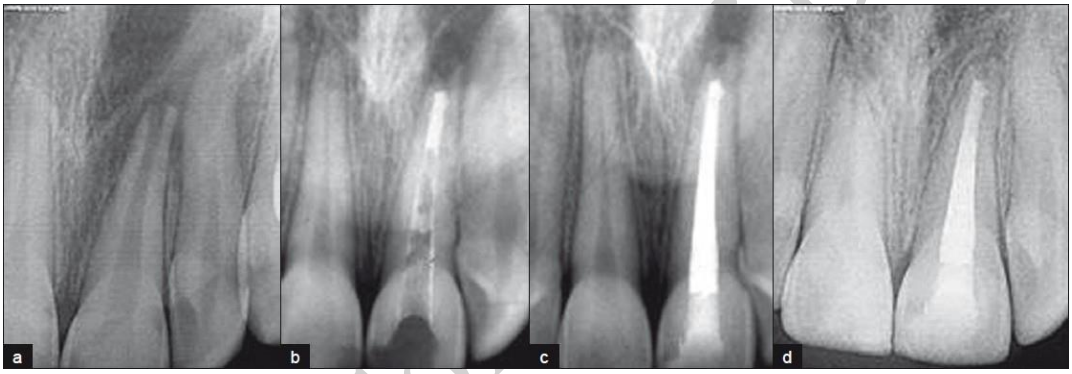
Notes

- Apexification with calcium hydroxide requires multiple visits and may take a year or more to achieve complete barrier in order to complete the treatment using Gutta Percha (Patient compliance is needed and the patient has to report every 3 months to check the apical closure). That is why MTA is better to be used, as its setting is faster and the re-call visits needed will be shorter.
- Complications: The most common complication associated with the use Ca $(OH)_2$ apexification is the cervical crown or root fracture because the cervical portion of the tooth is very thin and may fracture easily. Using Ca $(OH)_2$ for long time had some concerns because it makes the dentine more brittle and prone to fracture. It had been reported that Ca $(OH)_2$ may significantly increase the risk of root fracture after long-term application. That is why MTA is the new material to be used.

MTA apical seal has a number of advantages:

- Less patient compliance is required, the number of visits are reduced.
- The dentin will not loss its physical properties.
- The material allows for earlier restoration of the tooth, thus minimizing the likelihood of root fracture.

While advances with MTA go some way towards a better outcome, ultimately no apexification method can produce the outcome that apexogenesis can achieve (apical maturation with increased thickness of the root). Because even with successful apexification, the tooth is still weak and susceptible to fracture due to thin walls of the root canal. The problem in apexification that even if an apical seal is achieved there will be stress on the walls and might end-up with fracture through the cervical area.



a) A preoperative radiograph of maxillary left central incisor with an open apex (b) Radiographic evaluation of Mineral trioxide aggregate level (c) Follow-up after 6 months (d) Follow-up at 18 months

Regenerative Endodontic Procedures (REPs)

It is defined as biologically based procedures designed to replace damaged structures, which include dentin, root structures and cells of the pulp–dentin complex. These procedures provide a biological alternative to induce continuous root development and reduce the risk of fracture associated with traditional treatments of immature teeth with necrotic pulps, such as calcium hydroxide or MTA or biodentin apexification, where the root remains thin and weak. Therefore, it has much better results than that got with apexification. This new protocol of treatment coincides with the recent concept of regenerative medicine, which promotes the research and practice of tissue regeneration.

The idea behind the revascularization is that induce bleeding at the wide-open apex, which contains the active stem cells. These stem cells have the ability to give

rise to new odontoblasts influenced by Hertwig's Epithelial Root Sheath, allowing new root dentine to form and root maturation to proceed and complete.