Lec. 5 **Restorative dentistry**

Restorative Dentistry and Pulpal Health

Pulp: is loose specialized connective tissues of mesodermal origin, it located in the center of the tooth, consist of collagen fibers and ground substance supporting the vital cellular, vascular, and nerve structures of the tooth.

It is a unique connective tissue in that its vascularization is essentially through one opening (the apical foramen at the root apex), and it is completely encased within relatively rigid dentinal walls. Therefore, it is without unlimited collateral blood supply or an expansion space for the swelling that accompanies the typical inflammatory response of tissue to injury.

Effect of Operative Procedures on the Pulp:

Pulp can get irritated by various restorative materials and dental procedures:

1. **Effect of tooth preparation on pulp**

The immediate reaction of the pulp when cutting dentine is the disturbance of the odontoblasts cells beneath the cut tubules of the cavity. This disturbance leading to complete degeneration and disintegration of those cells, followed by the establishment of acute inflammatory reaction. Usually, it will resolve into a repair process with subsequent reparative dentine formation.

This will depend on many factors:

a. The depth of the cavity, the deeper the cavity the more the damage to the pulp.
b. Speed of Rotation: Ultra high-speed should be used for removal of enamel and superficial dentin. A speed of 3,000 to 30,000 rpm without coolant can cause pulpal damage.
c. Heat Production: the production of heat within the pulp is the most severe stress that restorative procedures impart on the pulp. Amount of heat produced depends on ***speed of rotation***, ***size and shape of the cutting instrument***, ***length of time in contact with dentin***, ***amount of pressure exerted on hand piece***, ***if water coolant is or not used***. For the water to be effective, it must have sufficient pressure to penetrate the area of turbulence and should be delivered directly at the point of contact between the bur and the tooth.
d. Vibration: Vibrations are an indication of eccentricity in rotary instruments. Higher the amplitude, more destructive is the pulp response.
e. Nature of Cutting Instrument: Use of worn off and dull instruments can cause vibration and reduced cutting efficiency. Their use encourages the clinician to

apply excessive operating pressure, which results in increased temperature .This can result in thermal injury to pulp.

2. **Effect of restorative materials on pulp:** Properties of a material that could cause pulpal injury are its cytotoxic nature, acidity, heat evolved during setting and marginal leakage.

Physiological changes of the dental pulp with age:

- With age, the pulp becomes more fibrous less cellular. The number of cells in the dental pulp decreases as cell death occurs with age.
- The volume of the pulp chamber with continued deposition of dentine. In older teeth, the pulp chamber decreases in size, in some cases the pulp chamber can be obliterated.
- An increase in calcification in the pulp occurs with age. It may contain pulp stones that may be attached to the pulp cavity wall or free in the mass of pulp tissue.

Treatment of Deep Seated Caries and Pulp Protection:

- In a moderate carious lesion, all caries removed, to protect the pulp after tooth preparation, liner is applied to cover the axial and/or pulpal floor. Then, base material is placed over the liner. After the base material hardens, permanent restoration is done.
- In deep carious lesion, caries can reach very near or up to the pulp, so treatment of deep carious lesion requires precautions because of postoperative pulpal response

Depending upon the condition, following methods for pulpal protection are employed.

Pulp Capping: defined as treatment designed to maintain the vitality of the pulp. Several favorable conditions must be present before considering direct or indirect pulp capping:

1. The tooth must have a vital pulp and no history of spontaneous pain.

2. Pain elicited during pulp testing with a hot or cold stimulus should not linger after stimulus removal.

3. A periapical radiograph should show no evidence of a periradicular lesion of endodontic origin.

4. Bacteria must be excluded from the site by the permanent restoration.

Indirect Pulp Capping

Indirect pulp capping is a procedure performed in a tooth with deep carious lesion adjacent to the pulp. In this procedure, all infected carious dentin and demineralized dentin is removed in the periphery of the preparation, but a small amount of demineralized dentin is left immediately over the area of the pulp. A sealing liner is placed to cover the remaining demineralized dentin. Then covered with a biocompatible material to seal out bacteria and their by-products.

Clinical technique

1. Isolation: After administering anesthetic, isolate the tooth with a rubber dam to minimize bacterial contamination of the treatment.

2. Preparation: Prepare the tooth for the final restoration, leaving demineralized dentin only in the area immediately adjacent to the pulp. Use a caries-disclosing dye if necessary to ensure complete carious dentin removal. After this is accomplished, use a spoon excavator or a large round bur in a low-speed handpiece at very low speed. Use very gentle, featherweight strokes over the area of the demineralized dentin to remove only the wet (soft, amorphous) carious dentin. Leave the dry, fibrous, demineralized dentin that gives some moderate resistance to gentle scraping with a spoon excavator.

3. Lining: Place a calcium hydroxide liner over the remaining demineralized dentin. If additional sealing is indicated, use a glass-ionomer liner.

4. Restoration: Place the final restoration (amalgam, composite, glass ionomer). If time does not allow for placement of a final restoration at the first appointment, a glass ionomer or reinforced zinc oxide–eugenol provisional restoration should be placed and the patient reappointed for the final restoration as soon as possible. The indirect pulp capping liner should not be disturbed during the subsequent restoration process.

Direct Pulp Capping

Direct pulp capping procedure involves the placement of biocompatible material over the site of pulp exposure to maintain vitality and promote healing.

Indications

· Small mechanical exposure of pulp during tooth preparation or traumatic injury.

· No or minimal bleeding at the exposure site.

Contraindications

· Wide pulp exposure

· History of spontaneous pain

Clinical procedure

1. Administer local anesthesia /Isolate the tooth with rubber dam.
2. When vital and healthy pulp is exposed, check the fresh bleeding (bright red) at exposure site.
3. Clean the area with distilled water or saline solution and then dry it with a cotton pellet.
4. Apply calcium hydroxide over the exposed area.
5. Give interim restoration such as zinc oxide eugenol for 6 to 8 weeks.
6. After 2 to 3 months, evaluate the tooth. If secondary dentin formation takes place over the exposed site, restore the tooth permanently. If favorable prognosis is not there, then it indicated for root canal treatment.

Factors affecting success of direct pulp capping:

1. **Age of the patient:** Due to vascularity of the pulp, young patients have greater potential for success than older ones.
2. **Type of exposure:** Mechanically done pulpal exposure has better prognosis than exposure caused by caries, due to less pulpal inflammation and deleterious effect of bacterial toxins on the pulp.
3. **Size of the exposure:** In large exposures, it is difficult to control the hemorrhage. Small pinpoint exposures are easy to manage and have a greater potential for success.
4. **History of pain:** If previously pain has not occurred in the tooth, the potential for success is more.

Calcium hydroxide:

It has been considered the "gold standard" of direct pulp capping material for several decades. Calcium hydroxide has excellent antibacterial properties, high pH about 12.5, stimulate the formation of calcified barrier. Its application to an exposed pulp is followed rapidly by the formation of a necrotic zone next to the calcium hydroxide, within two weeks, a layer of coarse fibrous tissue develops and beneath this, a layer of odontoblast like cells appears. After further two weeks a calcified barrier or dentin bridge is formed.