Operative Dentistry

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***Pulp Irritants***

**Lecture (8)**

Like other soft tissues, the pulp reacts to irritants with an inflammatory response. The pulp irritants can be classified according to the cause of irritant:

 I-bacterial

II-Physical

III-Irradiation

IV-Chemical

**I-Bacterial irritant**

**1-Caries**

Carious dentin and enamel contain numerous bacteria such as Streptococcus mutans, Lactobacilli, and Actinomyces. The population of microorganisms decreases to few or none in the deepest layers of carious dentin. Microorganisms in caries produce toxins that penetrate to the pulp through the dentinal tubules. As a result of microorganisms and their by-products in dentin, pulp is infiltrated locally primarily by chronic inflammatory cells. As the lesion progresses deeper into the tooth, pulpal reaction increases and the intension and character of infiltrate change. The outward flow of fluid through dentinal tubules does not prevent bacteria or their toxins from reaching the pulp and initiating pulpal inflammation. The extent of pulpal inflammation beneath a carious lesion depends on the depth of bacterial invasion as well as the degree to which dentin permeability has been reduced by dentinal sclerosis and reparative dentin formation and the time of irritant.

**2-Contamination of an exposed pulp by microorganisms**

When actual pulpal invasions by bacteria and/or their toxins occur, severe inflammation occurs and is infiltrated locally by PMN leukocytes to form an area of liquefaction necrosis at the site of exposure. Pulpal tissue may stay inflamed for long periods and may undergo necrosis eventually or become necrotic quickly.

**3-Periodental disease**

Periodental disease may be extend to the pulp through the accessory canals, the apical foramen, and open dentinal tubules. The inflammatory changes of the pulp occur when teeth have many accessory canals or when periodental defect has progressed to the apex.

Many studies concluded that the accumulative effect of P.D.D. has a damaging effect on the pulp, as indicated by the presence of pulp calcification, inflammation, or resorption, but total pulp disintegration is certainty only when the apical foramen is infected.

Some studies found that p.d.d does not have a direct inflammatory effect on the pulp; the initial effect of periodontal inflammation may be degenerative.

-Root curettage can result in pulp devitalization. During curettage of a periodontal lesion that extends around the apex of a root, the pulp vessels may be severed and the pulp devitalized.

**II-Physical irritant**

**1- Mechanical Irritation**

**A- Tooth preparation (caries removal or crown preparation)**

Pulp trauma results when the pulp is closely approached or the dentin is extensively removed. Over cutting during cavity preparation, whether a pulp is exposed or not is one of the greatest damages to the pulp. Not only the depth of cavity effect the pulp, but also the width of the cavity has the same important. Pulpal damage is roughly proportional to the amount of tooth structure removed as well as to the depth of removal. Also operative procedures without water coolant cause more irritation than those performed under water spray.

 **B- Orthodontic movement**

The force of movement during orthodontic treatment creates disturbance in the circulation of the pulp that is similar to those found in periodontally involved teeth.

If the force beyond the limitation of physiologic tolerance, blood vessels in the periodontal ligaments may rupture with resultant hemorrhage which lead to loss of the nutritional supply to some pulp cells. If hemorrhage occur from larger vessels of the pulp the entire pulp become necrotic. In addition, orthodontic movement may initiate resorption of the apex, usually without a change in vitality.

**C- Tooth fracture (acute trauma)**

Which occurs by either direct trauma to the tooth or indirect trauma to the jaw, in addition severe occlusal pressure to tooth with large filling can cause fracture. Fracture is related to the bacterial invasion that follows the accident. Untreated bacterial invasions will decrease any possibility of sustained vitality. If fracture occurs through the root, this will lead to disrupt the vascular supply that the injured coronal pulp often loses its vitality.

**D- Attrition**

Is a mechanical wear of the incisal or occlusal tooth structure as a result of functional or para- functional movements of the mandible (tooth grinding, or bruxism usually due to stress). Pulp inflammation or necrosis related to the incisal wear is seldom, pulp has ability to lay down dentin, but when a severely worn tooth occur (but when attrition exceed the rate of deposition of reparative dentin, pulp exposure with an observable incisal opening could be seen).The pulp may be devitalized at an earlier time and finally reached the chamber and some time the tooth required to be crowned.

**E- Abrasion (chronic trauma)**

Is defined as loss of tooth structure by mechanical or frictional forces, these lesions are commonly caused by excessive tooth brushing, but repeated and excessive forces by other materials and appliance, such as dental floss, tooth picks, or removable appliances, may also produce defects. These lesions can progress rapidly if they occur at the cemento enamel junction because, the enamel is thin and the mechanical forces can wear the dentin and cementum away quickly and may also be so severe as to invade the pulp space. The lesions commonly caused by horizontal brushing and appear as V- shaped notches on the labial surface.

**F- Abfraction**

Abfraction is a type of noncarious cervical lesion characterized by loss of tooth tissues with different clinical appearances.

The theory of abfraction sustains that tooth flexure in the cervical area is caused due to occlusal compressive forces and tensile stresses, resulting in microfractures of the hydroxyapatite crystals of the enamel and dentin with further fatique and deformation of the tooth structure. Abfraction lesions are also said to be facilitated by the thin structure of the enamel and the low packing density of the Hunter-Shreger band at the cervical area.

It is important to determine and eliminate the cause (attrition, abrasion, or abfraction). If the tooth is hypersensitive, it could be relieved by desensitizing agents, topical fluoride, fluoride rinse, dentinal bonding agents, or restoration.

**2- Thermal Irritation**

It is commonly believed that various dental procedures, such as tooth preparation, composite resin polymerization, finishing and polishing procedures can cause rise in intrapulpal temperature.

It was reported that an intrapulpal temperature increase of 5.5oC for 10 seconds can cause histological damage in the pulp tissues (irreversible pulpitis or even pulp necrosis).

**Two new methods for tooth preparation are available**

-Laser

-Kinetic cavity preparation (air abrasion)

**Laser device**: is a device which produces beams of very high intensity light. There are several types available based on the wavelengths. Laser used for soft and hard tissues, for soft tissue they can produce completely blood free incision followed by rapid healing. The use of a variety of lasers, including CO2, Er:YAG, and free electron lasers (FEL) on tooth structure has demonstrated minimal pulpal response, comparable to that of high-speed rotary instrumentation.

The effect of laser depend on 1- power of beam 2- extent to which beam absorbed. When we used laser for cutting of enamel and dentin the process would generate heat, which might affect the pulp so it should be used in pulsating manner (not continuously).

**-Air abrasion:** this generates heat, difficult for operator to determine the cutting progress within the cavity preparation.

Air abrasive equipment is being used for stain removal and cleansing pit and fissure before sealing. Animal studies have shown that air abrasion cavity preparation is no more traumatic to the pulp than rotary instrumentation.

**III-Irradiation irritant**

The pulp of teeth is affected in-patient who is exposed to deep radiation therapy for malignant growth in head and neck region. In time odontoblasts cell and other cells will necrotic, the salivary gland will affected resulting in decreasing of salivary flow

IV- **Chemical irritant**

**1-Erosion**

Erosion is been defined as loss of tooth structure due to chemical action. Thus erosion of facial or lingual cervical tooth structure may create lesions. This can be a prominent in patient with oral habits such as constant citrus ingestion, continues exposure to airborne acids, or gastrointestinal problems that produce repeated exposure of teeth to gastric acids. In these cases, the oral lesions generally present a rounded, cupped-out defect initially confined to the enamel, if left untreated, the loss of tooth structure due to the chemical attack will accelerate once dentin has been reached, and deeper pattern of destruction will be seen

**2-Chemical irritation of various restorative materials.**