Restorative Dentistry

Lec.2

Cariology

Cariology: A science that deals with the study of etiology, histopathology, epidemiology, diagnosis, prevention and treatment of dental caries.

Dental caries: defined as multifactorial, transmissible, infectious oral disease caused primarily by complex interaction of cariogenic oral flora with fermentable dietary carbohydrates on the tooth surface over time.

ETIOLOGY OF DENTAL CARIES:

Many factors involved in the caries process such as the tooth, dental plaque, diet, time, saliva, social & demographic factors: fig (1).

Tooth: it consists of calcium phosphate minerals that demineralizes when the pH lowers. As the environmental pH recovers, dissolved calcium & phosphate can re-precipitate, the process called (remineralization). Susceptible areas on tooth for caries are deep and narrow pits and fissures and exposed root surfaces. Abnormal tooth position also affects the initiation of dental caries, it becomes difficult to clean, and hence retain more food and debris.

Dental plaque: Dental caries do not occur if the oral cavity is free of bacteria. *Streptococci mutans* are considered the main causative factor for caries because of their ability to adhere to tooth surfaces, produce abundant amounts of acid and lower pH level.

Diet: dietary carbohydrates are necessary for the bacteria to produce energy; the acids formed as a by-product, so that initiate demineralization.

Time: affects the caries process, as dietary carbohydrates must be present for a sufficient length of time to cause demineralization, in fact, caries lesions do not develop so fast but it takes time, it may take years for cavitation to occur. This gives the dentist & the patient time for preventive treatment strategies.

Saliva: (How does saliva help to prevent tooth decay?)

Saliva plays a very important role in process of fighting tooth decay. Here is a list of some of the benefits that saliva provides:

- Bacterial cleanser: saliva lubricates oral tissues and bathes teeth and the biofilm.
- Saliva contains buffering agents that can neutralize the acid created by the bacteria, which inhabit dental plaque and cause tooth demineralization (tooth decay).

- Saliva contains the minerals that must be present for the tooth remineralization process to occur.
- Saliva contains antibacterial agents that can inhibit the proliferation of oral bacteria.

Social & demographic factors: many studies have shown that dental caries is more prevalent in the lower socioeconomic categories.

Figure 1: Diagram showing local factors involved in etiology of dental caries

Rate of Caries Progression and caries risk assessment:

During the dental examination: the presence of open cavities and fillings represents the ***prevalence*** of the disease - which is the most important indicator of the balance between resistance factors and caries inducing agents. The ***incidence*** of the disease must also be evaluated. Caries incidence may be determined by observing the speed at which existing lesion enlarge, or by observing the development of new carious lesions between two clinical examinations.

NOTE: The placement of new restorations within a short period of time indicates a high caries risk. The number of cavities, and their active or inactive status should be noted, the presence of lesions on smooth dental surfaces indicates a high caries risk situation. Patient's caries risk status will affect the treatment (materials and procedures, treatment vs no treatment) you are going to prescribe. Patient's caries risk will determine recall intervals; failure to address the underlying cause of the disease will allow the disease to continue, restoration alone will not treat the disease.

CLASSIFICATION:

Carious lesions can be classified in different ways:

According to their Anatomical Site

- ***Pit and Fissure Caries***: This caries is usually seen in pit and fissures on occlusal surfaces of posterior teeth and buccal and lingual surfaces of molars and on lingual surface of maxillary anteriors.
- ***Smooth Surface Caries***: This is usually seen on all smooth surface of teeth, gingival third of buccal and lingual surfaces and proximal surfaces.
- ***Root Caries***: Root caries occurs on exposed root surface.

According to Speed of Caries Progression

- ***Active Carious Lesion***: Rapidly invading caries involving several teeth. If untreated, acute caries can result in pulp exposure. It is soft in consistency and light colored.
- ***Inactive/Arrested Carious Lesion***: Stopped progressing, long-standing caries characterized by a large open cavity or intact surfaces, which no longer retains food and becomes self-cleansing. It is hard in consistency and dark-colored.
- ***Rampant Caries****:* is the name given to multiple active carious lesions occurring in the same patient, frequently involving surfaces of teeth that are usually caries free. Typically occur in (bottle feeding baby) fig.2 and (patient undergo radiation therapy).

Figure 2: Photograph showing rampant caries involving maxillary incisors

Based on Extent of Caries

- ***Incipient Caries***: It consists of demineralized enamel, which has not extended to DEJ. This lesion can be remineralized by proper preventive procedures, hence called as reversible caries.

- ***Cavitated Caries***: In this stage, caries extend beyond enamel into the dentin. This lesion result in breaking the integrity of the tooth. So also termed as irreversible caries.

Diagnosis:

Dental caries is diagnosed by the following:

- ✓ Visual changes in tooth surface.
- ✓ Tactile sensation while using explorer.
- ✓ Radiography: definite radiolucency indicating a break in the continuity of tooth structure.
- ✓ Transillumination: producing a characteristic shadow on the proximal surface indicates presence of caries.

New Detection Devices:

1. Direct digital radiographs for caries detection: This systems use a wire- based sensor that contains a computer chip inside a protective casing, the sensor is connected to a PC by wire. The sensor is placed in the patient's mouth, when this sensor hit by x-ray the information is transmitted directly to the computer & displayed as an x-ray image on the computer screen.
2. Intraoral camera: for caries detection & for patient motivation.
3. Caries detector dyes.
4. Laser: Argon laser, Diode lasers.
5. Electrical conductance measurement: are based on the principle that porous carious lesions have higher conductive values than intact tooth structure.

Prevention and management of the dental caries:

Main objectives of caries prevention are to reduce number of cariogenic bacteria and to create an environment favorable for remineralization of the tooth. These objectives can be met by:

· Increasing resistance of tooth surface to demineralization

· Increasing pH of biofilms

· Inhibiting microbial growth and metabolism.

MANAGEMENT

Restoration of a decayed tooth involves the use of a drill with low or high-speed rotary instruments for tooth preparation, but now-adays other procedures have also been used for removal of caries like:

- **Chemomechanical caries removal**: involves the selective removal of carious dentin by using reagent such as (Caridex and Carisolv), that is applied to the carious lesion by means of applicator until the sound dentin comes. *No need for local anesthesia and Suited for treatment of anxious and pediatric patients*.
- **Air abrasion:** it removes tooth structure using a steam of aluminum oxide particles generated from compressed air. The abrasive particles strike the tooth with high-velocity & remove little amount of tooth structure.

Clinical application of air abrasion includes: Detection of pit & fissure caries, removal of superficial enamel defects, cleaning fissures & surface preparation for sealant preventive resin restoration and for small class I & V preparation.

- **Ozone Treatment of Dental Caries**: Ozone occurs naturally when molecular oxygen (O_2) is photodissociated into activated ions (O^-) which further combines with other oxygen molecules (O_2) to form transient radical anions (O_3). Ozone ultimately decomposes to a hydroxyl radical which is a powerful oxidant. It oxidizes biomolecules resulting in cell death. The ozone delivery system is a device that takes in air and produces ozone gas. The ozone is then delivered via a hose into a disposable sterile cup, the cup forms a seal around the lesion being treated so that ozone cannot leak into the oral cavity(fig.3). Around 20- 40 seconds of ozone application have been shown to penetrate through carious dentin to eliminate any live bacteria, fungi, and viral contamination. Because of this change in microenvironment, the remineralization of enamel and dentin can be accomplished.

Fig. 3 Ozone treatment of dental caries

- **Laser devices:** laser devices that are capable of cutting dental hard tissues effectively & can be used for operative procedures.