Pediatric Dentistry

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د.زينب جمعة

DENTAL CARIES DEFINITION, CLASSIFICATION AND ETIOLOGY

DEFINITION:

The term dental caries is used to describe thesigns and symptoms of a localized demineralization of the mineral portion of these tissues followed by the disintegration of their organic material, caused by metabolic events taking place in the biofilm (dental plaque) caused by the action of microorganisms on fermentable carbohydrates covering the affected area. The destruction can affect enamel, dentin and cementum. The disease can result in bacterial invasion and death of the pulp and the spread of infection into the periapical tissues, causing pain. In its early stages, however, the disease can be arrested since it is possible for remineralization to occur.

•Sequence of caries in primary dentition:

–First to be attacked are the mandibular molars followed by maxillary molars, then the maxillary anterior teeth.

Only rarely are mandibular anterior teeth affected or the lingual/buccal surfaces of the primary teeth generally, except in cases of rampant caries.

–First primary molars in both the mandibular and maxillary arches are less susceptible to caries than the second primary molars, though the first primary molars erupt earlier than the second. Difference is thought to be due to differences in morphology of occlusal surfaces as the pits and fissures in second primary molars are deeper, and less completely coalesced.

–Proximal caries progress more rapidly than occlusal caries and cause higher percentage of pulp exposure. Therefore, regular bitewing radiographs are essential for children once there are no spaces between the teeth or after proximal contact is established.

•Sequence of caries in permanent dentition:

Once the first permanent molars erupt, one should expect frequent occurrence of caries in the occlusal pits and fissures.

The maxillary and mandibular permanent incisors are not highly susceptible to caries attack except in children with rampant caries (RC).

The mandibular second permanent molars are more susceptible to caries than the maxillary second permanent molars.

The Caries Diagnosis

1. ***Visual examination:*** The clinical visual examination consisting of five stages form the basis of caries diagnosis.
   - ✓ ***Systematic:*** Always start at the same place in the mouth – there is logic in making this the most distal surface in the upper right quadrant and working clockwise to the lower right, as these ties in with the FDI tooth notation. For every tooth, work round its surfaces in a systematic manner.

- ✓ ***Clean:*** Dental plaque is not translucent, so to diagnose even quite advanced lesions it must be removed. Polish the patient's teeth prior to attempting to diagnose caries.
- ✓ ***Illumination:*** The dentist requires a light source to make diagnosis possible. In addition to good illumination provided by a suitably positioned operating light, the use of a light source will facilitate transillumination.
- ✓ ***Dry:*** The detection of caries in its early stages relies on the differences in the porosity and therefore refractive index of caries versus sound dental hard tissue. When we dry the teeth we will have the ability to detect disease at its earliest visible stage (the white spot lesion).

Drying the teeth helps with caries activity assessment:

- A white spot enamel lesion has a matt enamel (acid-etched appearance) surface; this frequently indicates an active lesion.
- A lesion with a glossy surface is often arrested.

- ✓ ***Put the sharp probe away:*** For many years a visual-tactile examination rather than a purely visual examination was the mainstay of caries diagnosis. This should no longer be the case for a number of reasons:

- The use of a probe does not improve the accuracy of caries diagnosis.
- Probing of a demineralized site (which has the potential to remineralize) will further destroy the enamel structure creating an iatrogenic cavity and preventing any possibility of remineralization.
- There is the possibility of inoculating other sites with cariogenic bacteria.

However, a blunt probe, such as a periodontal probe, can be used to remove plaque from fissures using a dredging motion. As it can be problematic determining if a brown spot lesion is cavitated or not, the side of a blunt probe may also be used to confirm if a surface has broken down.

2. ***Radiographs***: The views that are of value for caries diagnosis are:

- ❖ ***Bitewing:*** is the 1st choice of caries diagnosis, provide information on both occlusal dentine caries and proximal enamel and dentine caries.
- ❖ ***Orthopantomogram (OPG):*** can detect the presence of an occlusal dentine carious lesion with a high degree of accuracy. Proximal surface lesions can also be seen on OPG but with much lower accuracy than with bitewings.
- ❖ ***Bimolar view*****:** Bimolars are not as useful a view as bitewings because there is often overlap of structures. However, they are of use in the pre-cooperative child who will not cope with bitewings or an OPG.
- ❖ ***Periapical view:*** are as accurate as bitewings for caries diagnosis, but obviously less information is available on any one film. The key role of the periapical view is in the diagnosis of periodontal disease, periapical disease and the diagnosis and monitoring of dental traumatic injuries.

3. Adjuncts and Novel Aids to Caries Diagnosis

- ***Magnification:*** During restorative treatment, dentists are increasingly using magnification to assist with the preparation of teeth. Magnification can also help with the detection and diagnosis of caries.
- ***Fibre-Optic Transillumination (FOTI):*** FOTI helps with the detection of proximal enamel and dentinal lesions, and occlusal dentinal caries. Clinically, FOTI can be used in a number ways – for example, the dentist can use it routinely at every examination helping to decide if radiographs are indicated. It can also be used to provide further information when, despite a thorough clinical visual examination and radiographs, the clinician still remains unsure. One particular use of FOTI is to help differentiate between staining and caries on the occlusal surface.
- ***Temporary Tooth Separation (TTS):*** The placement of an orthodontic separator for about three to four days to move the teeth apart allows direct visual access to a surface for diagnosis. The tooth returns to its original position following removal of the separator within hours. This approach has two significant advantages over bitewing radiography:
  - The avoidance of exposure to ionizing radiation.
  - The ability to detect whether the surface is cavitated.

  The drawbacks of TTS: the patient may experience some discomfort while the separator is in place, and this discomfort is likely to be greater if all contacts are separated.
- ***Laser Fluorescence:*** The currently available commercial device (Diagnodent, KaVo Germany) measures the fluorescence of the porphyrins made by bacteria in the caries. This device is designed for the diagnosis of occlusal caries but it can be used on accessible smooth surfaces. It is not designed to be a screening tool, where it is likely to generate a number of false positive diagnoses, but to aid the dentist with equivocal lesions. In use, the dentist applies the probe tip to the tooth surface under investigation and a digital reading indicates the status of the surface through sound to deep dentine caries.
- ***Electric Caries Meter (ECM):*** Enamel is a very poor conductor of electricity. However, following carious attack the enamel becomes more porous and the ions present in the pores in the lesion will conduct electricity with much less resistance than sound enamel. This is the principle behind the working of the ECM (ECM Lode Netherlands). Like the laser fluorescence devices, the ECM is principally of use on occlusal surfaces. ECM is technique-sensitive. Of particular relevance to pediatric dentistry is that the ECM is not reliable on immature teeth.

All of the above methods have both advantages and disadvantages, but they should be considered a toolkit from which the dentist selects to improve the accuracy of caries detection and diagnosis.

CLASSIFICATION:

- Carious lesions can be classified according to their *anatomical site*. There is nothing chemically special about these sites.
  1. Lesions may commonly befound in *pits* and *fissures* or on *smooth surfaces.* Smooth surface lesions may start on enamel (*enamel caries*) or on the exposed root cementum and dentin (*root caries*).
  2. *Primary caries* is used to differentiate lesions on natural, intact tooth surfaces from those that develop adjacent to afilling, which are commonly referred to as *recurrent* or *secondary caries*. As such, the etiology of both is similar
  3. *Residual caries*, as the term implies, is demineralized tissue that has been left behind before a filling is placed.
- An important classification is whether a lesion is *cavitated* or *non-cavitated*, as it impinges directly on the management of the lesion.
  Caries lesions may also be classified according to their activity. This is a very important concept and one that impinges directly on management, although it will be evident from the text that the clinical distinction between *active* and *inactive* (*arrested*) lesions is sometimes difficult. Clinically, if in doubt the dentist should always react as though he or she is dealing with an active lesion.
  A lesion considered to be progressing (the lesion would have developed further at a subsequent examination if not interfered with) would be described as an *active carious lesion*. In contrast to this is a lesion that may have formed years previously and then stopped further progression. Such lesions are referred to as *arrested carious lesions* or *inactive carious lesions*.
- The first sign of a carious lesion on enamel that can be detected with the naked eye is often called a *white-spot lesion*. This appearance has also been described as an *early*, *initial* or *incipient lesion*, but not all white-spot lesions are incipient! These terms are meant to say something about the stage of lesion development.
- *Rampant caries* is the name given to multiple active carious lesions occurring in the same patient. This frequently involves surfaces of teeth that do not usually experience dental caries. These patients with rampant caries can be classified according to the assumed causality, e.g. *bottle* or *nursing caries*, *early childhood caries*, *radiation caries* or *drug-induced caries*.
- *Hidden caries* is a term used to describe lesions in dentin that are missed on a visual examination but are large enough and demineralized enough to be detected radiographically. It should be noted that whether a lesion is actually hidden from vision depends on how carefully the area has been cleaned and dried and whether an appropriate clinical examination has been performed.

ETIOLOGY

•Dental caries is a multifactorial disease

–The primary factors are:

- ✓ The tooth
- ✓ The microorganisms
- ✓ Fermentable Carbohydrates
- ✓ Time

–The secondary factors are:

A. Local factors:

- ✓ Anatomy of the teeth in early eruption
- ✓ Crowding or irregular teeth (makes cleaning difficult)
- ✓ Presence of dental appliances, e.g. partial denture , space maintainer, orthodontic appliances

B. Systemic factors: such as

1. ***Childhood Fever and Caries Susceptibility***: Common childhood illnesses such as:(chickenpox, measles, middle ear infections, fevers caused by respiratory or urinary tract infections, and other fevers that cause skin rashes because enamel and skin share a common ectodermal origin) all can affect the coincidental dental hard-tissue formation. This can result in hypomineralization and discoloration, due to:
   - Altered tooth morphology
   - enamel porosity
   - Difficulties in maintaining good oral hygiene due to sensitivity.

An example of this is molar incisor hypomineralization (MIH), in which the permanent incisors and first permanent molars are affected (and possibly also the tips of the canines). The affected teeth appear to be prone to post-eruptive enamel loss.

2. ***Inherited defects*:** Children with congenital enamel defects such as amelogenesis imperfecta or disease of the other dental hard tissues (e.g. dentinogenesis imperfecta) may be more susceptible to caries, but these conditions are rare.
3. ***"Family" caries***: Families DO tend to pass on their dietary habits through generations. Therefore, granny losing her teeth early could be an indication of a "sweet tooth" being a family phenomenon. Furthermore; *Streptococcus mutans,* the main pathogen responsible for caries, IS transmissible and there is very good evidence to show that it is passed from mother to baby.
4. ***Medicines*:** in particular, elixirs, *CAN* cause caries *BUT* only if they contain sugar. Some medicines are sucrose-free, but may contain other sugars such as glucose syrup. "Sugars-free" means no sugar at all.

Dentists and their teams should advise parents and medical and pharmacy colleagues to add the letters 'SF' for sugars-free to written prescriptions – this is particularly important in cases in which repeated prescriptions are required.