Carious and Non Carious Lesions

Lesions involved in tooth destruction are mainly categorized into carious and non carious lesions. These lesions result in loss of tooth structure that requires operative intervention. It is essential to have thorough knowledge and understanding for the etiology and symptoms of these lesions to establish a comprehensive operative treatment for each case. Failure to identify and treat the underlying cause will allow the lesion to continue causing inevitable failure of the restorative treatment.

Dental Caries

It is an *infectious microbiological disease of the teeth that results in localized demineralization and destruction of the calcified tissues*. Caries is caused by *acid producing bacteria*. These acids will decalcify the inorganic portion of the teeth, and then the organic portion is disintegrated. Caries is characterized by episodes of alternating phases of demineralization and remineralization. In addition, partially demineralized tooth structure can be remineralized by calcium and phosphate ions present in the high concentrations in saliva or by remineralizing solutions. Understanding the balance between demineralization and remineralization is the key to enlightened caries management.

Caries can be described according to type, location, extent and rate. The main *types* of caries are *primary caries* which is the original carious lesion affecting the sound tooth and *secondary caries*, also termed *recurrent caries*, which occurs at the junction of a restoration and the tooth and may progress under the restoration if margins of restoration is not properly sealed.
**Location of primary caries:**

There are three distinctly different clinical sites for caries initiation:

- **Pits and fissures:** which is the most susceptible site.

- **Smooth enamel surfaces** that shelter plaque; which includes the *area under buccal and lingual height of contour* and *proximally under the contact area*.

- **Root surface**

**Pit and fissure caries:**

A *fissure* results from the incomplete union of two enamel lobes during the formative period of enamel. If complete union occurs between two enamel lobes, the result will be a *groove*. Similarly, a *pit* results from the incomplete union of three enamel lobes during its formation, if complete union happens, the result will be a *fossa*. Thus, a fissure or a pit is a fault or defect in enamel whereas a groove or a fossa results in a smooth union. The shape of pits and fissures contributes to their high susceptibility to caries. They are shelter areas for plaque retention and colonization of bacteria. As the caries *initiates*, it forms a small area of penetration which *progresses* following the direction of enamel rods until it reaches the dentino-enamel junction (DEJ). **DEJ** has the least resistance to caries attack and thus allows *lateral spreading* of caries. Caries then *penetrates* dentin towards the pulp via the dentinal tubules causing *cavitation* in dentin. Thus, caries is described to form two cone-shaped patterns in enamel and dentin; with the base of each cone at the DEJ.

**Smooth surface caries:**
It does not begin in an enamel defect but rather in smooth enamel areas that is neglected by poor oral hygiene measures and becomes covered with plaque. When smooth surface lesion is initiated, it follows the direction of enamel rods forming a cone, but with its base at the enamel surface and its apex towards the DEJ. Lateral spread of decay also occurs at the DEJ leading to a cone-shape in dentin with its apex pulpally. Caries progression will lead to dentinal cavitation.

**Root caries**

Root surface is rougher than enamel and readily allows plaque formation in the absence of good oral hygiene. Root caries is more rapid than other sites of caries because cementum is extremely thin and provides little resistance to caries attack. It is more prevalent in old age due to gingival recession.

**Extent of primary caries:**

The first evidence of caries activity in enamel is termed incipient caries. This lesion is reversible, i.e. it can be remineralized. However, in cavitated caries, the enamel surface is broken (not intact), and usually the lesion is advanced into dentin. In this case, remineralization is not possible and the caries in nonreversible. Treatment by tooth preparation and restoration is usually indicated. If the carious process is reversed, the caries becomes remineralized and is termed arrested caries.

**Rate (speed) of caries:**

Acute caries is when the disease is rapidly progressing causing rapid destruction of tooth structure. It this case, the periods of demineralization exceeds the periods of remineralization and the lesion is very soft. It is also lighter in color because there is less time for extrinsic pigmentation from the oral environment. In contrast, Chronic
caries is characterized by slow progression and there is time for remineralization. Thus, it is harder and darker in color.

**Non carious lesions**

These are lesions with *non-microbial* origin that cause defects in tooth structures. Abrasion, erosion and abfraction are common causes for non carious *cervical* lesions. A brief understanding of terminology, causes and clinical picture of non carious lesions of relevance to operative dentistry will be discussed.

**Abrasion**

It is the *pathologic surface loss of tooth structure resulting from direct frictional forces between the teeth and external objects, or from frictional forces between contacting teeth components in the presence of an abrasive medium*. Toothbrush abrasion is the most common example, where improper brushing techniques causes localized cervical lesions on the labial surface of teeth especially at the starting point of brushing. Toothbrush abrasion lesions are characterized by being linear in outline, following the path of brush bristles. The surface is extremely smooth and polished, and the patient has very good oral hygiene. Another form of abrasion lesion is *pipe-smoking depression abrasion* occurring at the latero-anterior portion of the arch coinciding with the location of the pipe-stem (Fig. 2-8, A). Vigorous use of toothpicks between adjacent teeth can cause *proximal abrasion*. Certain *occupational habits* such as cutting sewing thread or holding nails with incisor teeth can create specific localized form of abrasion.

**Abfraction**

*Abfraction is cervical defect that results from abnormally heavy forces as a result of unbalanced faulty occlusion*. Normally, during
mastication and function, the cervical part of the tooth is subjected to *tooth flexure* which induces compressive stresses during centric occlusion and tensile stresses during eccentric occlusion. It is hypothesized that in faulty occlusion, excessive compressive and tensile forces created during tooth flexure produces *microfractures (abfractions)* in the thin enamel at the cervical area. This leads to the characteristic wedge-shape of such lesions. Once enamel is lost, dentin becomes subjected to various wear-causing factors. Abfraction could involve one tooth, e.g. rotated or mal-aligned tooth or many teeth with parafunctional occlusion. Such lesions are usually associated with wear facets.

*N.B.:* Cervical tooth wear could occur due to multi-factorial causes.

For example, *erosion* could be associated with *abrasion* if the patient brushed his teeth following an acidic intake. Similarly, *abrasion, erosion or both* could occur in association with *abfraction* following enamel microfracturing. Microfractures of enamel at cervical area *iatrogenic abrasion* is that which is caused by faulty dentistry such as abrasion of opposing natural teeth with porcelain. An example is given in which faulty upper partial denture with porcelain teeth caused abrasion of the lower natural teeth.

**Erosion**

*It is the pathological loss of tooth structure resulting from chemico-mechanical action, mainly due to acids.* It could result from either *exogenous* acidic agents, such as lemon juice (by lemon sucking), excessive consumption of acidic drinks or acid fumes due to environmental pollution. It causes a smooth lesion on the labial surfaces of exposed teeth. Erosion could also result from *endogenous acids*, such as gastric acids from frequent regurgitation, such as in bulimia. This
causes generalized erosion of the palatal and occlusal surfaces of upper teeth. The mandibular teeth show less loss of enamel since it is partially protected by the tongue.

**Attrition**

It is the *mechanical wear of the incisal or occlusal tooth structure resulting from direct frictional forces between contacting teeth*. It is a *physiological*, continuous, age-dependant process. However, it could be accelerated by *pathological* parafunctional mandibular movements, e.g. in bruxism (stressful tooth grinding). Attrition affects occluding surfaces resulting in flattening of their inclined planes and in facet formation. In severe cases, enamel of the cusp tips (or incisal edges) is worn off and dentin is exposed. It could also lead to loss of vertical dimensions of teeth. Attrition also affects *proximal contact areas*, leading to flat proximal contours and decreased mesiodistal dimensions of teeth.

**Enamel hypoplasia**

It is a *defect in enamel due to improper enamel matrix formation due to injury of ameloblasts during enamel formation*. This leads to defective areas in enamel. It is usually seen on anterior teeth and first molars in the form of opaque white or brownish areas or pitted and grooved enamel which is usually hard and discolored. In severe cases, depressions or loss of a segment of enamel may occur.

**Enamel hypocalcification**

It is a *defect in enamel due to improper mineralization of the enamel due to injury to ameloblasts*, i.e. the injury of ameloblasts occurs during mineralization of the formed matrix not during formation of the matrix as in hypoplasia. Thus, the affected areas will not be defective in
any way, but they will appear chalky white. The defect could vary from isolated pits to widespread linear defects or patches.

**Discoloration**

It is a deviation from the normal tooth shade and color of an individual. Although it is not destructive, yet it has a far-reaching effect on the affected individual, both socially and psychologically. According to its etiology, discoloration can be either extrinsic due to surface staining, calculus or surface deposits that can be removed by proper cleaning and polishing of teeth or Intrinsic which is created from pathological changes in one or more of the tooth tissues, for example, discoloration as a result of hypoplasia or hypocalcification. Discoloring changes of dentin may also result from medicaments administered by pregnant females during the stages of tooth formation of the infant, for example Tetracycline staining. The resulting discoloration ranges from grayish-yellow to gray-brown or dark-brown. Intrinsic discoloration can also result from pigmentation of non-vital tooth following pulpal necrosis. This will cause grayish to dark black discoloration.

**Malformation**

It is a deviation from normal shape or size of the tooth. These are usually of hereditary origin (dental anomalies). Deviation in the size is manifested in the form of microdontia or macrodontia. The most common type of malformation in shape is peg shaped lateral incisor tooth.

**Fracture**

It is separation and/or loss of tooth structure as a result of trauma from a fall, a blow or sudden biting on a hard unyielding substance. Traumatic injuries to natural teeth crowns range from simple fractures of
enamel (chipping), to fracture of enamel and dentin with or without pulp involvement, to total loss of crown structures. Trauma can also lead to total avulsion of the tooth, fracture of tooth root or displacement of affected tooth. In addition, weakened teeth may split under normal masticatory forces when biting on a hard object.
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Dental caries

- Infectious microbiological disease of the teeth that results in localized demineralization and destruction of the calcified tissues

- Characterized by episodes of alternating phases of demineralization and remineralization

- Caries can be described according to type, location, extent and rate
Dental caries

Types

Primary (pits and fissures-smooth enamel surface-root surface)

Recurrent (at the junction of restoration and the tooth)
Pit and fissure caries

A

B

C

D
Smooth surface caries
Root caries:
Dental caries

According to extent

- Incipient caries--------reversible( arrested)
- Cavitated caries---------- non reversible
Dental caries

- According to speed
  Acute (rapid destruction)
  Chronic (slow progression)
Non carious lesion

Abrasion:
- Pathological Loss of tooth structure by direct frictional force between teeth and external object or between contacting teeth in presence of abrasive medium

Types:
Tooth brush abrasion
abrasiōn

– Pipe smoking depression abrasion
At latero–anterior portion
– Proximal abrasion
– Occupational habits
– Iatrogenic abrasion
erossion

- Pathological loss of tooth structure resulting from chemical action, mainly due to acids.
- Causes
  Exogenous acid (lemon juice, acidic drinks or acid fumes)
  Endogenous acids (gastric acid from chronic vomiting)
abfraction

Cervical defect result from abnormally heavy force as result of unbalanced faulty occlusion.
attrition

– Loss of tooth structure from direct frictional force between contacting teeth
– Characteristics
  Physiologic
  Age dependent
  Accelerated by bruxism
attrition

Affect occlusal and proximal surface
Enamel hypoplasia

Defect in enamel due to improper enamel matrix formation due to injury of ameloblast during enamel formation

Seen on anterior teeth and first molars

In the form opaque white area or brownish area or pitted and grooved enamel
Enamel hypocalcification

Defect in enamel due to improper mineralization of enamel due to injury to ameloblast
Affected areas appear chalky white
Deviation from normal tooth shade and color according to etiology it may be
Extrinsic eg calculus
Intrinsic eg tetracyclin staining and pulp necrosis
malformation

Deviation from normal shape or size of the tooth

The most common type of malformation is peg shaped lateral incisor
Fracture

- Separation or loss of tooth structure as result of trauma
- My include
  Enamel
  Enamel and dentin with or without pulp involvement
  Total loss of crown