Caries Pathophysiology and Tissue Reaction to Cavity Preparation
Study Objectives

• To discuss the pathophysiology of caries and its impact on enamel, dentine and pulp.
• To discuss about the reaction of dentine and the pulp to cavity preparation.
Introduction

• Caries is a multifactorial infectious disease with significant morbidity and in extreme cases, mortality for the child.

• Understanding the irreversible though arrestable destruction process of caries helps the dentist plan better for its management.
When the caries progresses from the enamel into the dentin, sclerotic dentin is formed by the deposition of minerals into and between the tubules (intratubular and intertubular dentin).

Reparative and tertiary dentine is also secreted by other mesenchymal type cell of the pulp that differentiate into new odontoblasts.
The quality and amount of tertiary dentine depends on the depth and rate of progression of the carious lesion. The faster the lesion progresses, the poorer and more irregular is the reparative dentine.

If the noxious stimulus is too intense, the cytoplasmic processes of the odontoblasts degenerate and “dead tracts “are formed.
When the caries process advances more rapidly than the elaboration of reparative dentine, the blood vessels of the pulp dilate, and scattered inflammatory cells become evident, particularly subadjacent to the areas of the involved dentinal tubules (transition stage).
If the carious lesion remains untreated, a frank exposure eventually occurs. The pulp reacts with an infiltration of acute inflammatory cells, and the chronic pulpitis becomes acute.
• A small abscess may develop under the region of the exposure, and the chronic inflammatory cells may be formed further away from the central area of the irritation.
• The remainder of the pulp may be uninflammed (chronic partial pulpitis with acute exacerbation).
• As the exposure progresses, the pulp may undergo partial necrosis, followed in some instance by total necrosis.
Drainage is the factor determining whether or not partial or total necrosis will occur.
If the pulp is open and drainage can occur, the apical tissue may remain uninflammed or chronically inflamed.
If the drainage is impeded by food impaction or restoration, the entire pulp may become necrotic more rapidly.
The factors affecting the dentine pulp complex during operative procedures (cavity or crown preparation) are mainly the cutting of dentin per se, the generation of heat, and the desiccation the tissues.
When uninvolved dentine undergoes operation, as in extension for prevention, tubules that are not protected by reparative dentine are cut. The tissue reaction that occurs is similar to that occurring with caries: intratubular and intertubular mineralization takes place resulting in sclerotic dentine formed by the formation of tertiary dentin.
The amount and regularity of tertiary dentin are related to the depth of the cavity preparation. As the depth is increased, production of reparative dentine is enhanced but its regularity and quality is compromised. Also, dead tracts may result in damage done to odontoblastic processes.
Pulp reaction to operative procedure can be mild or severe, depending on the technique used. When the technique is gentle, the reaction is mild, and minor alterations in the odontoblastic layers can be observed as a result of fluid accumulation.

A gentle technique implies using appropriate cooling and minimal pressure.
• In a severe reaction, the nuclei of the odontoblasts may be aspirated into the dentinal tubules, hemorrhage may be present, and inflammation is extensive, sometimes resulting in cell necrosis.
• Cutting a cavity without using water cooling might lead to irreversible changes in the pulp owing to the heat generated at the tip of the bur.
• The application of pressure increases the damage.
• Prolonged air blasts also deleterious to the pulp.
A blast of air on dentine for 10 seconds is enough to produce displacement of odontoblastic nuclei.

In order to prevent the generation of heat and damage to the pulp, there are measures that should be taken.
Measures to be taken

• The cavity should be prepared as shallowly as possible, respecting the principle of cavity preparation
• Small and sharp burs should be used
• Appropriate cooling should be employed and minimal pressure exerted
• Excessive drying of dentin by air syringe should be avoided
When the caries process advances rapidly:

- There is elaboration of reparative dentine
- The blood vessels of the pulp dilate
- Scattered inflammatory cells become evident
- The inflammatory cells are found within the dentinal tubules
Reactions to operative procedures:

• Cutting a cavity without using water cooling might lead to irreversible changes in the pulp.
• The application of pressure increases the damage.
• Prolonged air blasts cools the pulp.
• A blast of air on dentine for 10 seconds is enough cool the odontoblastic nuclei.
Acknowledgement

• Slides were developed by Morenike Ukpong of the Department of Child Dental Health, Obafemi Awolowo University Ile-Ife.
• The slides were developed and updated from multiple materials over the years.
• We hereby acknowledge that many of the materials are not primary quotes of the group.
• We also acknowledge all those that were involved with the review of the slides.