Pulpal Protection: bases, liners, sealers, caries control

Module A: Basic Concepts

Readings: Fundamentals of Operative Dentistry, 3rd Edition; Summitt, et al Chapters 5, 6 and 8
Considerations for pulpal health in the placement of restorative materials

- Compromises to pulpal health (pulpal irritation)
  - Caries- bacterial infection causing pulpal inflammation
  - Rotary preparation- heat and trauma to odontoblastic processes

- Goal- preservation of pulpal health
- Goal-creation of barrier (seal of enamel and dentin with restoratives) to external irritation
- Goal- seal any marginal gaps between tooth and restoration
To have pulpal health...

The pulp must be vital!
Pulpal vitality testing

Cold test with cotton applicator using ethyl chloride
Or
Electric Pulp Test (EPT)
BONUS CLINICAL TIP

Use of pulpal vitality testing to verify profound pulpal anesthesia when doing restorative procedures

Cold test with cotton applicator using ethyl chloride
Or
Electric Pulp Test (EPT)
Before cavity preparation the radiograph provides a “window” looking in for what to expect of cavity depth and probable pulpal health!
Decision making in the use of sealers, liners and/or bases

- Remaining dentin thickness in tooth preparation
- Thermal conductivity of restorative material
Pulpal health evaluation

- Presence or absence of pulpal symptoms - pain to stimuli
  - Thermal
  - Sweets (osmotic changes)
  - Tactile touching of dentin
  - Occlusion
  - Duration of symptom
  - Spontaneous pain
  - Type of pain - sharp? Throbbing?
Remaining dentin thickness

- **Shallow cavity depth**
  - Preparation 0.5 mm into dentin (ideal depth)

- **Moderate cavity depth**
  - Remaining dentin over pulp of at least 1-2 mm

- **Deep cavity depth**
  - Depth of preparation with less than 1.0 mm of remaining dentin over pulp
Remaining dentin thickness

- Shallow cavity depth
  - Preparation 0.5 mm into dentin (ideal depth)
Remaining dentin thickness

- Moderate cavity depth
  - Remaining dentin over pulp of at least 1-2 mm
Remaining dentin thickness

- Deep cavity depth
  - Depth of preparation with less than 1.0 mm of remaining dentin over pulp

Base almost to the pulp
Causes of pulpal inflammation

- Bacterial toxins penetrating the dentinal tubules (leading edge)
- Bacteria can cause
  - Pulpal irritation-inflammation
  - Pulpal necrosis
  - Recurrent caries
- Leakage at the restoration-tooth interface due to gaps at that interface
- Trauma of tooth preparation
Bacterial penetration—pulpal inflammation

- Bacterial invasion at gap between Restorative-tooth interface
- Restorative material
- Mutans Streptococci
- Bacteria penetrating gap, invading dentinal tubules
- Inflammation
Not an inflammatory response

Postulated to be due to the hydrodynamic theory

Stimulus causes rapid fluid flow through tubules, nerve endings deformed- interpreted as pain

Mechanoreceptors perceive stimuli cold, hot, sweets as pain due to change in tubular flow

Gap at tooth - Restorative interface
Pulpal pain due to stimuli

- Gap at tooth-restorative interface: the restoration is not well sealed
- Explanation of root sensitivity

Mechanoreceptors perceive stimuli cold, hot, sweets as pain due to change in tubular flow
Marginal gaps at the restorative interface can lead to:

- Recurrent caries
- Marginal staining (composite resin)
- Tooth sensitivity
- Microleakage

Use of sealers to avoid marginal gaps.
Why are teeth sensitive to thermal shock?

Postulated that direct thermal shock transferred to pulp through thin dentin

- Metallic restorations more thermoconductive
- Liner-base thickness to prevent thermal transfer should be no thicker than 0.5-0.75 mm (thicker bases may weaken restoration)
Why are teeth sensitive to thermal shock?

- Usually cold stimulates response
- Air can trigger response
  - Air evaporates saliva-moisture from tooth creating a cooling effect
- Cold sensitivity due to recently placed restoration being in hyperocclusion
Why are teeth sensitive to thermal shock?

Postulated that thermal sensitivity may be due to pulpal fluid flow hydrodynamics:

- Cavity preparation cuts dentin leaving more tubules exposed (desication of dentin leads to pulpal inflammation)
- Deeper preparations have more dentinal tubules open
- Sealing dentinal tubules reduces sensitivity to thermal shock, osmotic stimulation, changes in dentin fluid flow
Materials to seal the tooth for pulpal protection

- Cavity sealers: materials placed in thin films to protective coating on the cavity walls creating a barrier to leakage
  - Varnish (Barrier) (for amalgam)
  - Etch and Rinse resin bonding systems (Scotchbond MP and OptiBond Solo) (for composites)
  - Self-etch resin bonding systems (Xeno IV)
Materials to seal the tooth for pulpal protection

- Cavity liners: cement or resin coating of minimal thickness (less than 0.5 mm) placed as a barrier to bacteria or to provide a therapeutic effect (pulpal sedative or antimicrobial effect). Applied to cavity walls adjacent to pulp (Dycal, VitreBond)
  - Dycal (calcium hydroxide) is not adhesive, very soluble
  - VitreBond (resin modified glass ionomer) is adhesive and would be placed to cover Dycal
Materials to seal the tooth for pulpal protection

- Cavity bases: placed to replace missing dentin, placed in thicknesses of 0.5-1 mm; used to blockout undercuts in cavity preparations for indirect restorations (VitreBond, Fuji IILC, Fuji IX) (all glass ionomers are self-adhesive to dentin)

- Bases are not commonly used today for thermal insulation; predominant use to block out undercuts in preparations
  - Inlay/onlay
  - Crown preparations (usually cervical due to tooth NCCL (tooth notching))
Pulpal Protection: bases, liners, sealers, caries control

Module A: Basic Concepts