Desensitization

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Who has experienced tooth sensitivity?

Learning Objectives

1. Define dentinal hypersensitivity.
2. Describe the potential causes of dentinal hypersensitivity.
3. Discuss treatment interventions for dentinal hypersensitivity.
4. List different in-office desensitization procedures.
5. Recommend desensitization treatment alternatives to patients to increase compliance.

What is dentinal hypersensitivity?

- Pain elicited by a stimulus and alleviated upon its removal
- Pain arises from exposed dentin structures
- Absence of other dental conditions

Statistics

Relatively common issue in clinical practice

Prevalence reports range from 3-98%

- Range may be related to methods of diagnosis and population differences
- Prevalence higher among periodontal patients

Patients most affected in the 20-50 year age range

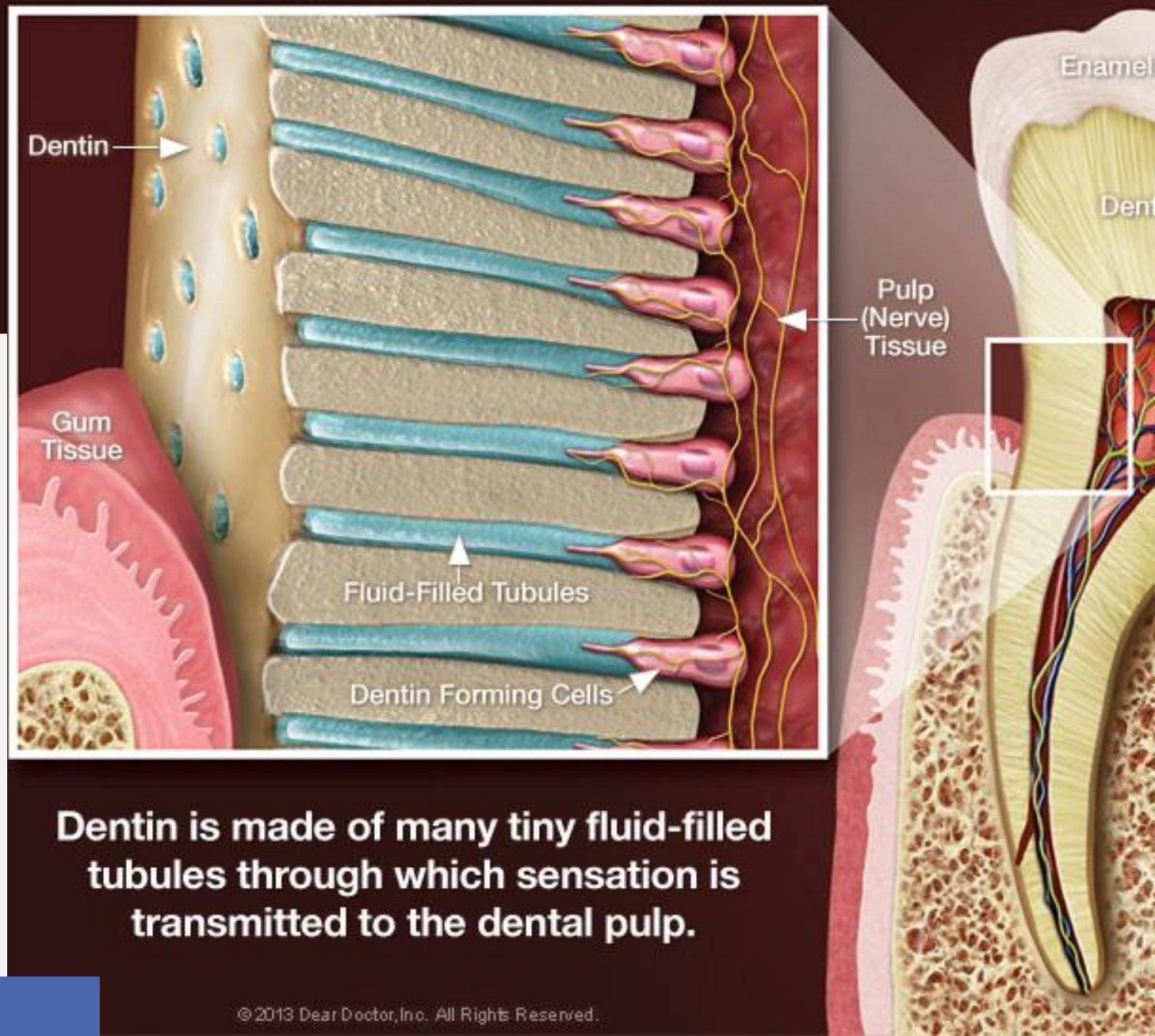
- Peak between 30-40 years

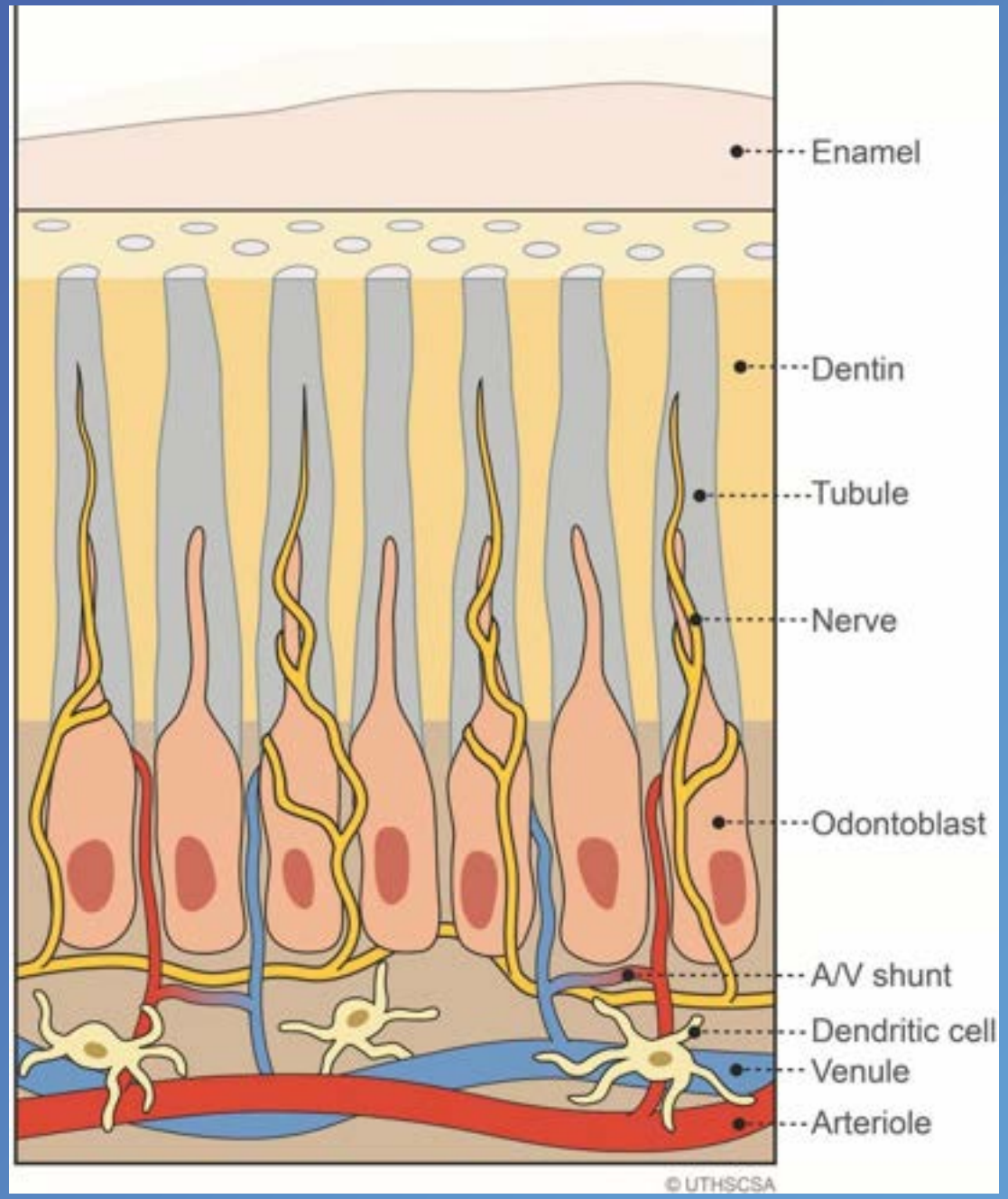
Canines and Premolars most affected

- Buccal surface, cervical area most affected

Anatomy Review - Dentin

- Covered by enamel on crown, cementum on root
- Composed of narrow, fluid filled tubules
  - Branch from pulp to dentinoenamel or dentinocementum junction
- Ends closest to the pulp are innervated with nerve fiber endings from the pulp chamber
- Sensitive areas are composed of wider tubercle openings
  - Openings are referred to as “lumen”



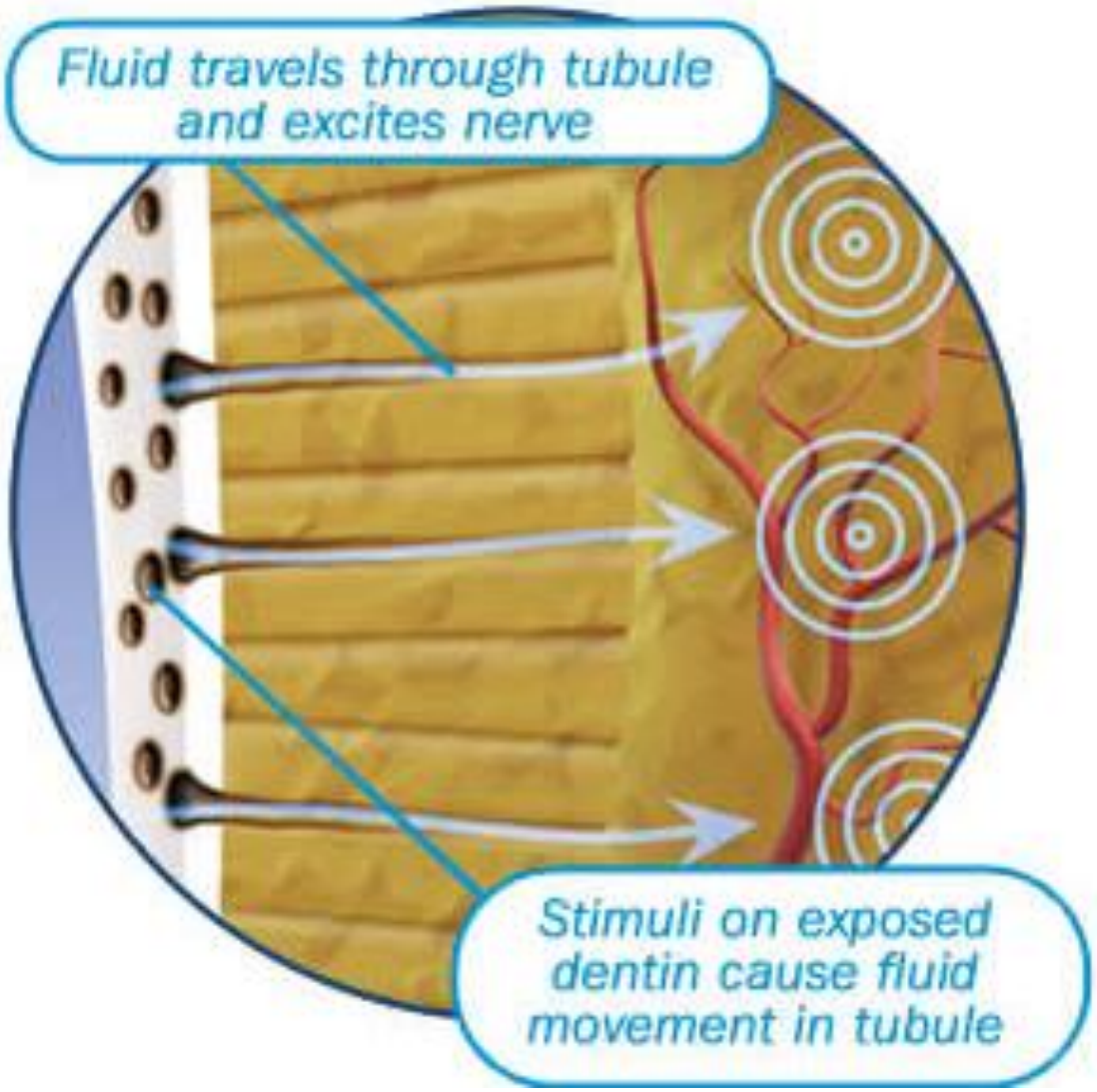


Anatomy Review – Pulp & Nerves

- Pulp
  - Highly innervated with nerve cell fiber endings
- Odontoblasts
  - Located adjacent to the pulp
  - Odontoblastic processes extend minorly into dentinal tubules
    - AKA Tomes Fibers
- Nerve
  - Nerve fiber endings wrap around the odontoblastic processes in the dentinal tubule

Hydrodynamic Theory

- Stimulus to the outside of the dentin layer causes movement of fluid within the dentinal tubules
- The movement of fluid creates pressure on the nerve endings and transmits the pain to the pulpal nerves
- Hypersensitive teeth have more widened dentinal tubules than non-sensitive teeth



Categories of Hypersensitivity

Tactile

- Contact with solid material

Thermal

- Temperature change
  - Hot and/or cold
- Cold is the most common

Osmotic

- Change in pressure within dentinal tubules through a selective membrane

Evaporative

- Dehydration of fluids

Chemical

- Acid or acidic products in oral cavity
  - Acidic foods or beverages
  - Acids produced by bacteria after exposure to carbohydrates
  - Gastroesophageal reflux

Etiology

The potential causes of dentinal hypersensitivity

Recession

- Loss of gingival tissue resulting in exposure of the root surface
- Causes of recession:
  - Aggressive oral care habits
    - Medium of hard bristle toothbrush
  - Metal oral piercings
  - Genetic or anatomical factors
  - Orthodontic treatment
  - Surgical procedures
  - Restorative procedures that abrade gingival tissue

Loss or Damage to Tooth Structure

- Damage or loss of tooth structure can be multifactorial
- Enamel and cementum do not always meet
  - Occurs in about 5-10% of teeth
- Damage can be mechanical or chemical in nature

Abfraction

- Mechanical tooth loss at the gingival margin
- Caused by flexing of the tooth at the weakest point
- Results in weakened tooth structure

Erosion

- Loss of tooth structure due to acid exposure in the oral cavity
  - Results in immediate drops in pH levels
- pH should come back to neutral in a few minutes
- Repeated or prolonged acid exposure can have severe consequences
  - Holding/swishing foods or beverages in your mouth, snacking or drinking throughout the day
- Gastric acid erosion is more likely seen on linguals of teeth

Abrasion

- Wear of enamel, dentin, or cementum due to mechanical habits
- Can be exacerbated by acid erosion

Attrition

- Wear of the enamel at the incisal or occlusal surface of the tooth
- Commonly the result of bruxism
- Exacerbated by acid erosion

Other Factors

- Instrumentation
- Overuse of abrasive agents
- Bleaching

Differential Diagnosis

- Ruling out other causes of pain to determine cause and treatment plan
- Should use interviewing techniques and diagnostic tests

What questions should we ask the patient?

Interviewing the Patient

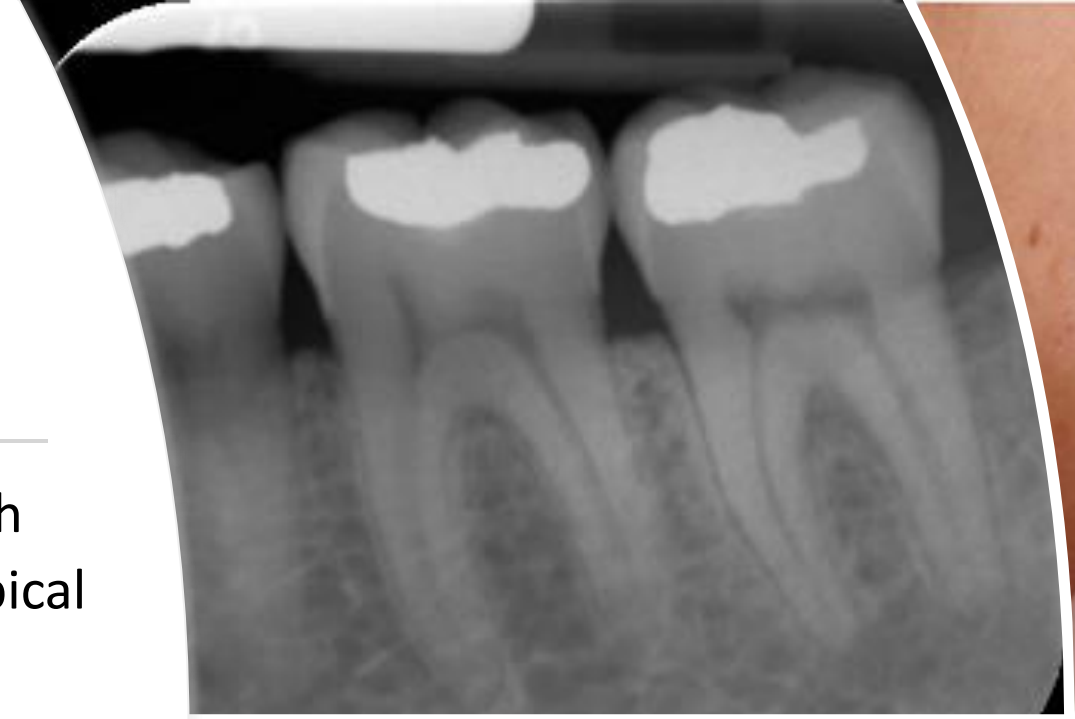
- Use open ended questions
- Questions should cover:
  - The teeth affected
  - Onset of the pain
  - Perception of pain
  - Impact of pain
- Remember that some questions, especially describing the pain may be difficult for patients

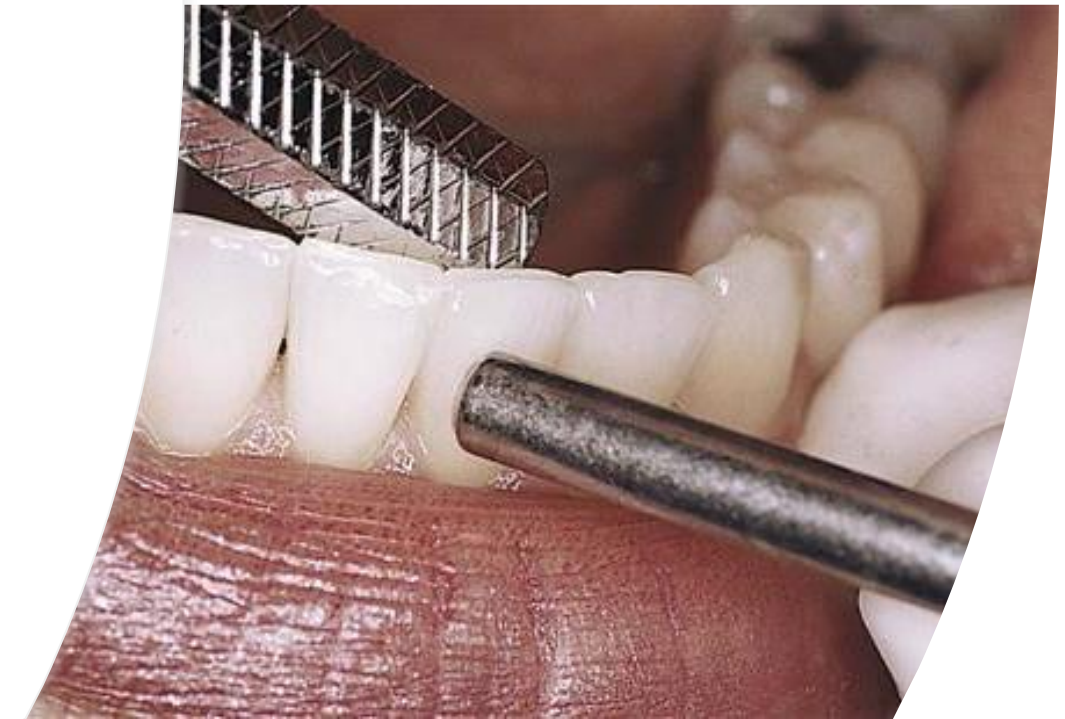
Assessment

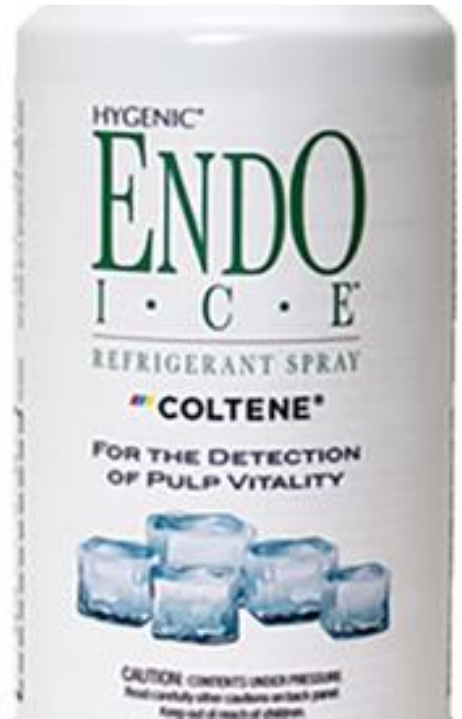
Visualize	Inspect the tooth and surrounding area
Palpate	Inspect the soft tissue around the tooth
Explore	Use the Shepard’s hook to feel the exposed area
Check Occlusion	Use occlusal paper to check for heavy occlusal forces

Assessment (cont).

- Periapical radiograph
  - Check for periapical pathology
- Test percussion response
- Check for mobility
- Illuminate
- Thermal testing
  - Blowing air
  - Endo Ice







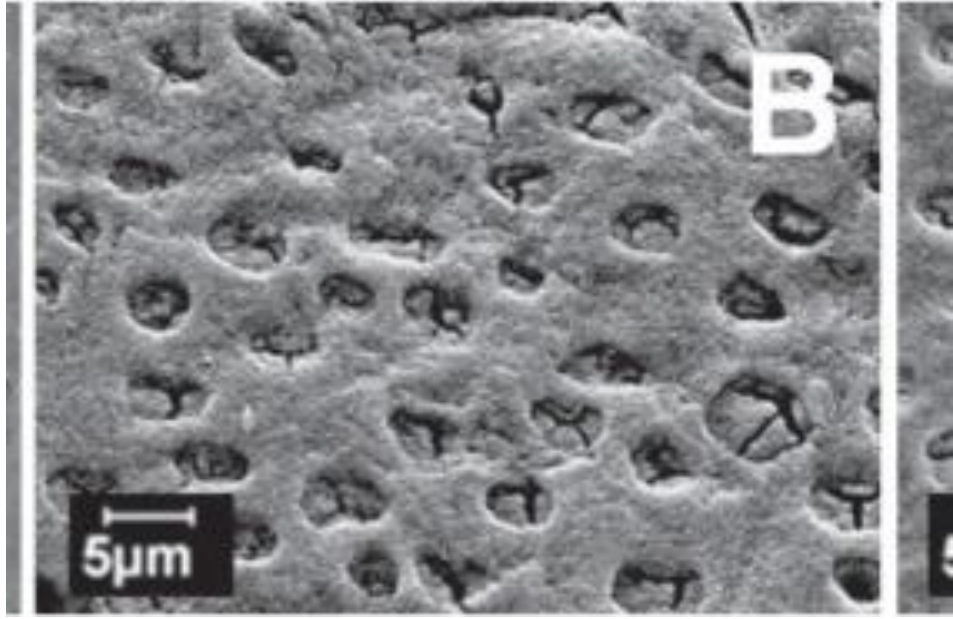
Differentiating Dentinal Sensitivity from Other Tooth Pain

- Abscess
  - Potential swelling, severe pain, possible tooth mobility, possible drainage
  - Radiographic, visual, and palpation exams
- Caries
  - Radiograph to help diagnose
  - Sweet sensitivity in addition to cold/hot
  - Pulpal caries can cause severe pain when chewing
- Fractured Tooth
  - Thermal sensitivity AND pain on pressure
- Occlusal Trauma
  - Recent restorations placed that are ”hitting high”
  - Malocclusion resulting in mobility of teeth

Differentiating Dentinal Sensitivity from Other Tooth Pain (cont.)

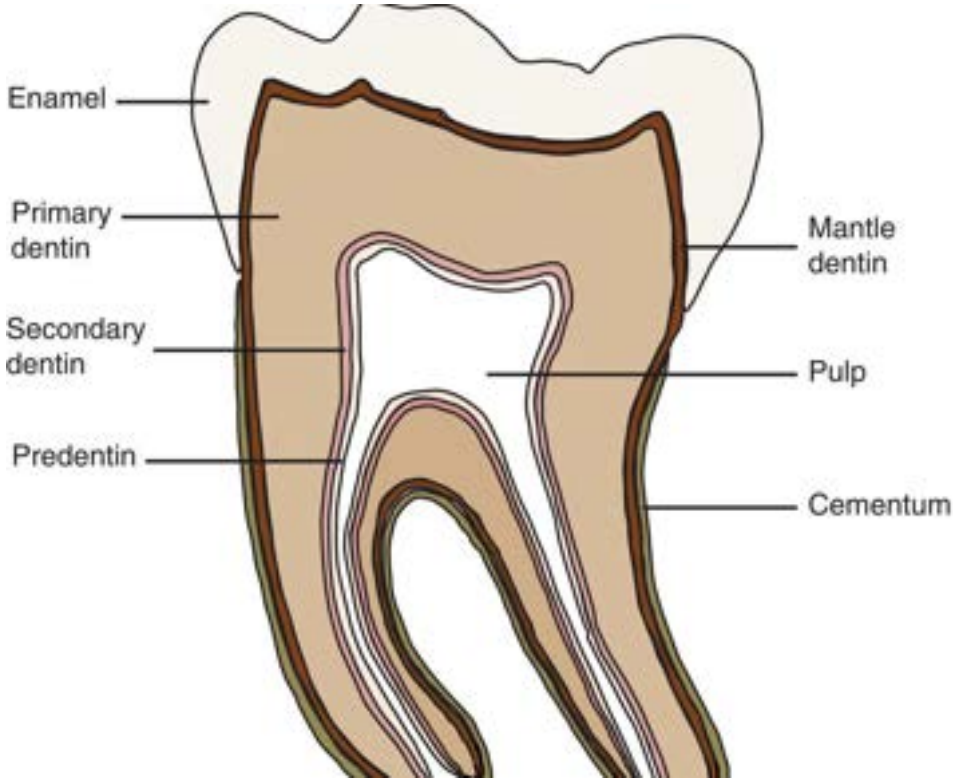
- Pulpitis
  - Severe, throbbing pain
  - Responds to thermal, electric pulp tests, and percussion
- Sinus Infections
  - Non-descript tooth pain – commonly in maxillary posterior teeth
  - Radiographic examination to rule out infection
- Galvanic Pain
  - Stabbing pain on contact with dissimilar metals
- PDL Inflammation
  - Pain on chewing – responds to percussion tests

Natural Desensitization



Sclerosis of Dentin

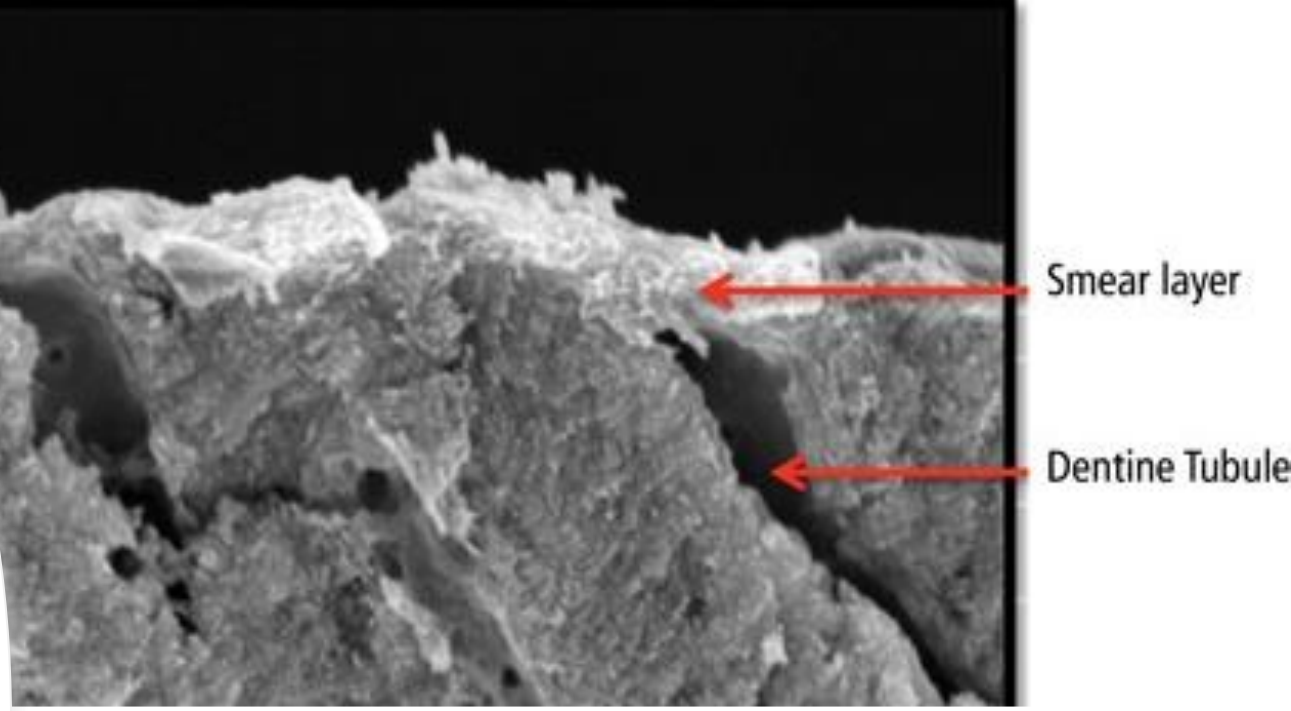
- Minerals deposited within tubules
  - Results from traumatic stimuli
- Creates a thick, highly mineralized layer of peri/intratubular dentin
- Mechanism of Action:
  - Decreased lumen size



Secondary Dentin

- Accumulates over time on the floor and roof of the pulp
- Leads to a smaller pulp chamber with less nerve endings

Natural Desensitization (cont.)



Smear Layer

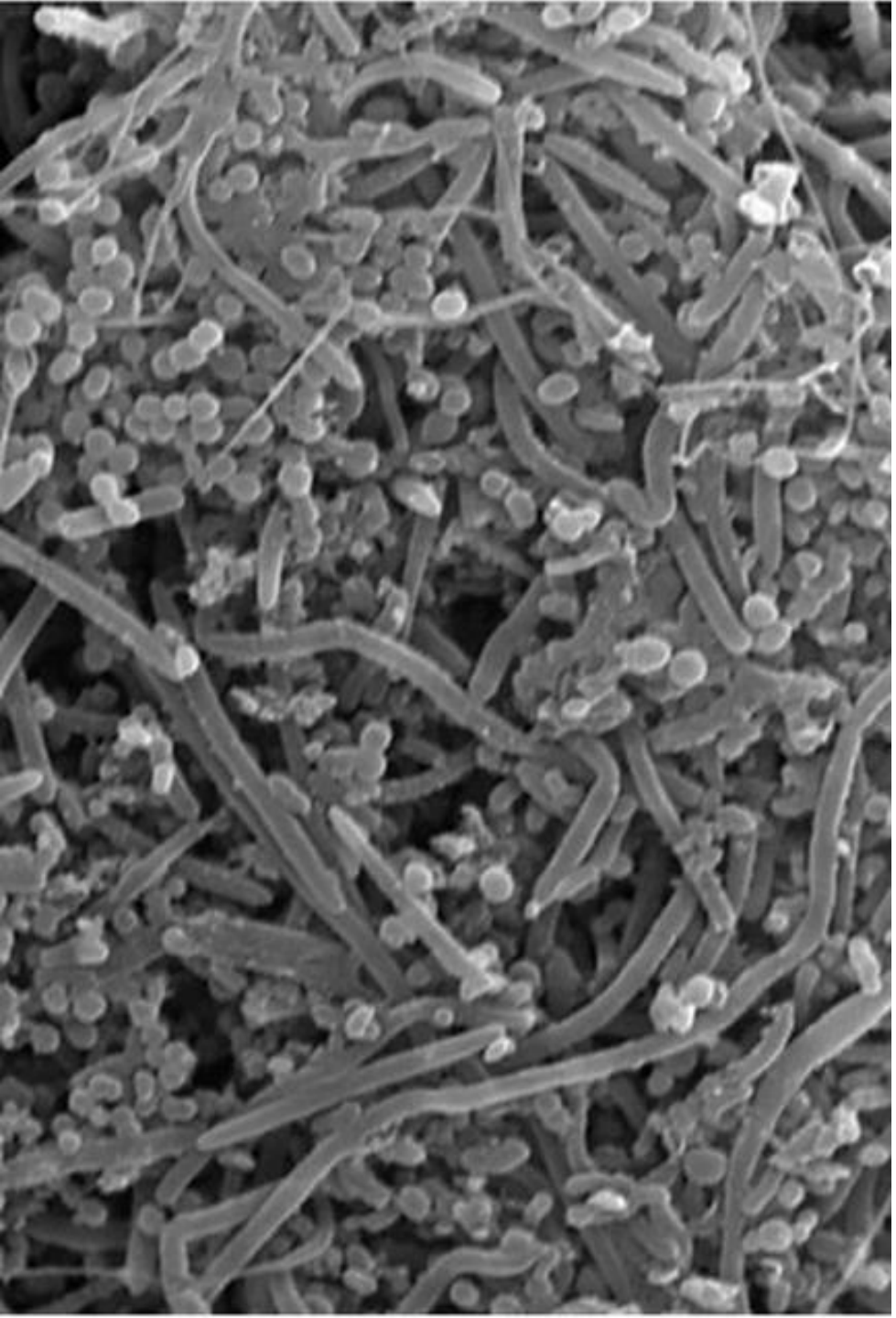
- Made up of organic and inorganic debris
- Mechanism of action:
  - Occludes dentinal tubules to block stimulus
- Builds up from:
  - scaling and root debridement, abrasive toothpaste particles, drilling, attrition, and abrasion
- Can be disrupted by mechanical effects and acid exposure

Calculus

- Provides protective layer over exposed dentin
- Dentinal tubules can be exposed following calculus removal

Treatment Interventions

Goals: Relieve pain & eliminate or reduce contributing factors



Biofilm Removal

- Biofilm presence increases size of dentinal tubules up to 3X
- Potential for increased sensitivity
- Biofilm control results in 20% reduction in lumen size

Amount of biofilm does not equal amount of sensitivity!

Toothbrushing Status

- Electric vs Manual
- Toothbrushing technique
  - Modified Stillman's for recession
- Bristle status & pressure

What are some recommendations we could make to help reduce pressure while brushing?

Traumatic Occlusion

- Assessment of bruxism
  - Question the patient
  - Teeth should only occlude when eating and swallowing
- Potential treatment:
  - Occlusal adjustments
  - Orthodontic treatment
  - Occlusal Guard

Diet Modifications

- Evaluation of diet history is important
- Determining if erosion due to diet is a factor in sensitivity
- Acidic foods include:
  - Citrus juices, fruit, carbonated drinks, wine, cider, energy drinks coffee, etc.
- Erosion is permanent enamel loss

Desensitization Agents – Potassium Salts

- Move through/along the dentinal tubules
  - Block the action of interdental nerve fibers
- Increase the threshold for stimulus reaction
  - Essentially depolarizing the nerve
- Examples:
  - Potassium citrate, potassium nitrate, potassium chloride, potassium oxalate

Fluoride

- Sodium Fluoride & Stannous Fluoride
- Occludes tubules through smear layer formation
- Resistant to acidic foods and beverages
- Said to reduce sensitivity in 2 weeks

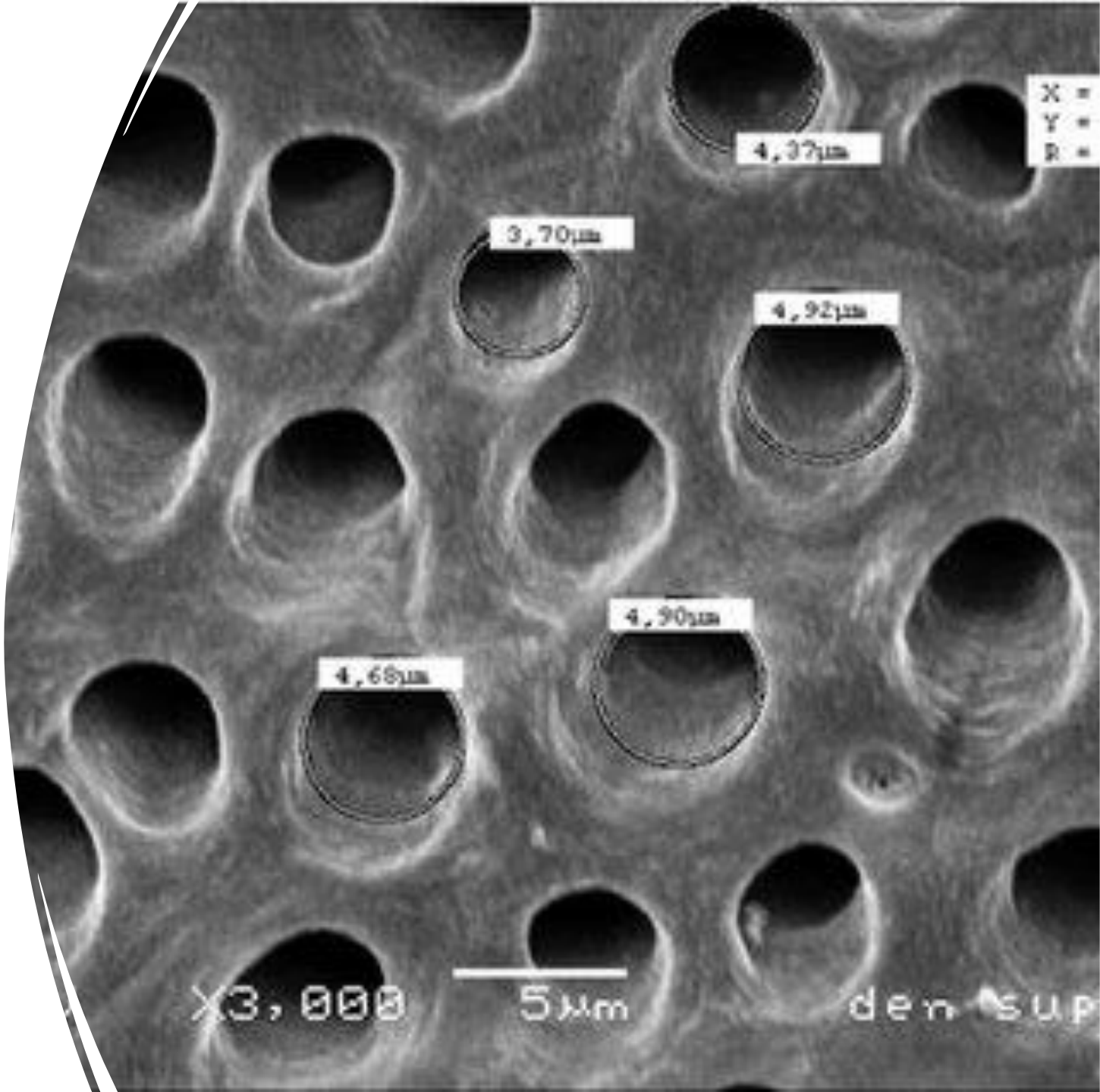
Oxalates & Glutaraldehydes

Oxalates

- Occlude open tubules
- Decrease tubule opening

Glutaraldehyde

- Decreases tubule opening
- Coagulation of proteins and amino acids within the tubule



Calcium Phosphate Technology

Amorphous Calcium Phosphate (ACP)

- Blocks tubules with calcium and phosphate precipitate
- Enhances fluoride delivery
- Remineralization of eroded/abraded hard tissue

Calcium Sodium Phosphosilicate (CSP)

- Contains sodium, silica, calcium, and phosphorous
- Bioactive glass particles releases calcium and phosphate that crystallizes into protective hydroxyapatite layer

Calcium Phosphate Technology (cont.)

Casein Phosphopeptide (CPP)-ACP

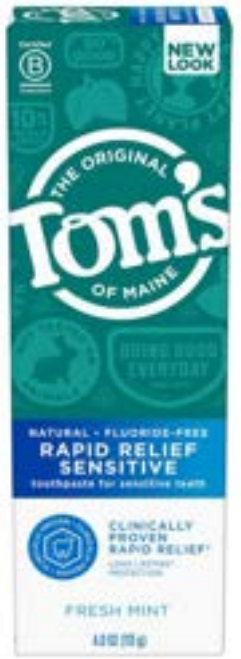
- Milk-derived protein
- Stabilizes ACP
- Useful during acidic food/beverage presence

Tricalcium Phosphate (TCP)

- Developed to combine a calcium material that coexists with fluoride
- Aims to provide greater effectiveness than fluoride alone

Arginine

- Amino acid present in saliva
- Occludes dentinal tubules
- Remains after acid exposure
- Prophy paste:
  - Can be used prior to dental treatment
- Over the counter:
  - Anywhere Anytime by Colgate



Topical Agents - Dentifrices

- **Over the counter**
  - **A**vailable in 5% potassium nitrate, sodium fluoride, or stannous fluoride
- **Prescription**
  - Highly concentrated fluoride (5,000 ppm)
  - Combined with abrasives to reduce extrinsic staining
  - Clinpro & PreviDent

Gels

- Highly concentrated fluoride (5,000 ppm)
- Good for generalized or localized sensitivity
- No abrasive agents for biofilm removal or extrinsic stain control
- Require use of custom fluoride or bleaching trays
- Good option for patients with a history of radiation treatments for head and neck cancer

In-Office Procedures

Fluoride Agents

- Varnish
  - 5% sodium fluoride varnish provides prolonged exposure to tooth surface
  - Tooth serves as a reservoir and releases fluoride ions in response to changes in oral acidity levels
  - Occludes dentinal tubules

Silver Diamine Fluoride (SDF)

- Directed for use as a desensitizing agent
  - Used off label for arresting caries
- Silver functions as an antimicrobial agent
- 38% fluoride
- Mechanism of Action:
  - Protein layer formation
  - Partially occludes dentinal tubules
- Considerations:
  - Turns carious lesions black

5% Glutaraldehyde

- Applied with microbrush to specific sensitive site
- Isolate tooth as solution can irritate soft tissue
- Works by decreasing lumen size

Oxalates

- Burnished into a dried tooth surface
- Provides immediate/short-term relief
- Not intended for long term relief
  - Will require adjunctive therapies for long-term sensitivity issues

Unfilled and Partially Filled Resins

- Covers dentinal tubules
- Requires acid etching prior to placement
- Removes the smear layer and can cause discomfort
- Tooth surface must be dry for placement
- Consider local anesthetic to manage discomfort

Dentin-Bonding Agents

- Seals dental tubule openings
- No acid or drying required
- May protect from erosion for 3-6 months

Glass Ionomer Cement & Restorative Materials

- Can be placed in the presence of moisture
- Blocks dentinal tubule opening
- Releases fluoride to tooth

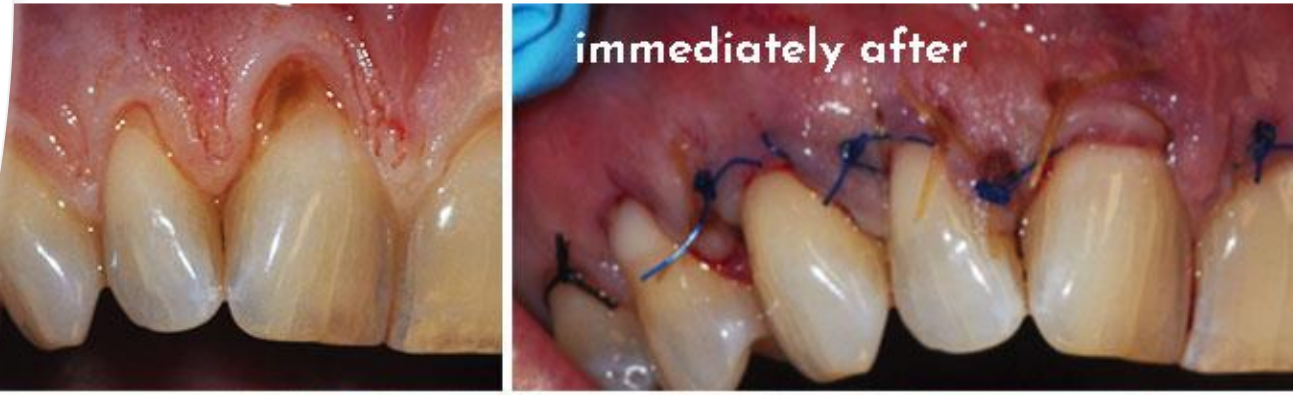
Iontophoresis & Soft Tissue Grafting

Iontophoresis

- Low voltage electrical currents
- Drives negatively charged fluoride ions further into the dentinal tubules

Soft Tissue Grafting

- Surgical placement of soft-tissue over a sensitive area.
- Need adequate bone to support graft
- Expensive & time-consuming



Lasers

- Nd:YAG obliterates dentinal tubules
  - “melting and resolidification”
  - Hygienists cannot use Nd:YAG
- Diode laser
  - Mechanism of action not completely understood
  - Shown to be more effective than fluoride treatment alone in reducing sensitivity
  - Can use sodium fluoride varnish after procedure for increased effects

Considerations

Fractures

- Difficult to diagnose on rads
- Potential for crown, endodontic treatment, or extraction

Tooth Whitening

- Reversible pulpitis
- Sensitivity may decrease on its own over time
- Recommend desensitization products in combination with whitening

Scaling and Root Debridement

- Explain potential for sensitivity before starting treatment
- Local anesthetic, topical anesthetic, or nitrous oxide may help with patient comfort
- Post-procedure desensitizing and education on home-care

Diet

- Inquire about changes in dietary habits – especially energy drinks
- Make recommendations for changes or modifications

Recommendations

- One size does not fit all
- Mix products
  - In-office, OTC, and RX
- Stress home care
- Gauge your patient

Documentation

- Identification of sensitive areas
- Oral findings and habits
- Differential diagnosis
- Recommendations
- Patient acceptance and implementation
- Patient compliance and outcomes

Summary

- Understand the different elements that can cause dentinal hypersensitivity
- Use the provided information to aid in examining your patient and developing a differential diagnosis
- Know that one solution will not work for every patient
- Communication is key to creating treatment plans and having patient compliance

Critical Thinking Activity: Case Study

Patient is a 30-year-old female who has been having generalized cold sensitivity for weeks. She has started using Sensodyne Clinical White every night, but reports she can no longer drink her favorite drink, Dr. Pepper, due to her sensitivity. She also reports noticing she may be clenching and grinding during the day.

Questions?