

Dental Caries Update 2017: It's About More Than Just Filling Holes!

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ENAMEL PREPARATION GUIDELINES

1. Remove as little tooth structure as possible.
 - At all costs, avoid an MOD preparation, especially on premolars.
2. Bond the restorative material to the tooth.
 - Unbonded amalgams do not strengthen teeth.
 - Bonded resins restore strength to teeth.

Connecting mesial and distal boxes or slots to form an MOD preparation weakens a tooth; this practise is contraindicated and should be avoided.

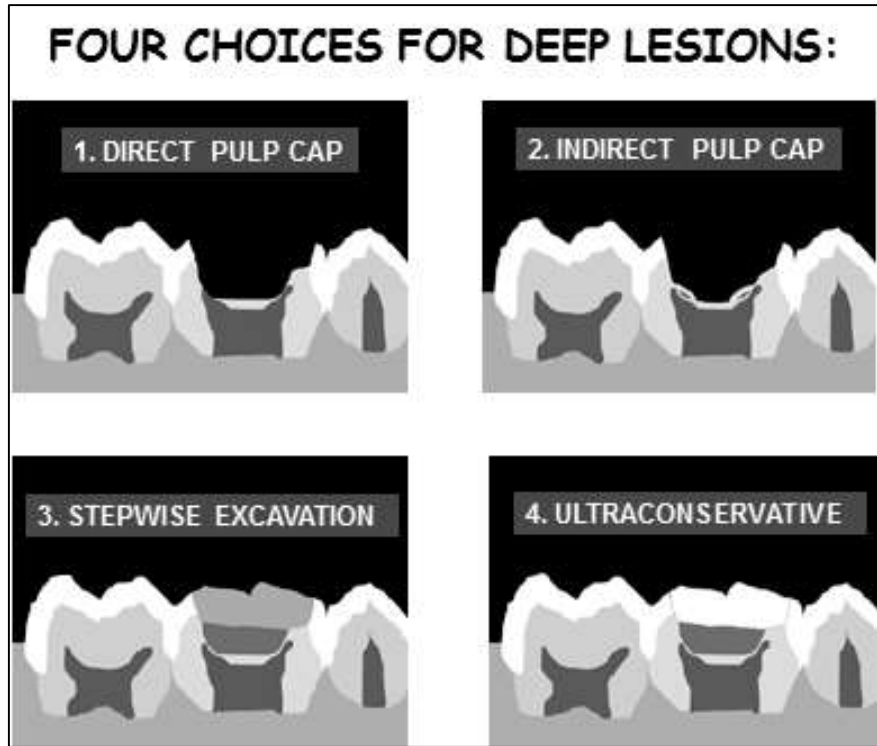
- A tooth with an MOD with a conservative isthmus has lost about 50% of its original stiffness.
- A tooth with an MOD with a large isthmus has as much as a 78% reduction in stiffness (strength).

RATIONALE FOR BONDING AMALGAM

- To strengthen MOD-prepared teeth
- To seal a restoration:
 - Over a pulp cap
 - For a patient with sensitivity
 - For a patient with a high caries risk
- As an alternative to pin placement
- To augment the use of pins
- For conservative, non-retentive preparations

CONTRAINDICATIONS FOR BONDING AMALGAM

- Repairing amalgam with amalgam
- Unable to isolate operating field
- Poor access
- Root surface? (Use a RMGI sandwich?)
- A small or moderate retentive preparation (bonding is not necessary)
- As a substitute for any retention or resistance



OPTION #1: DIRECT PULP CAP

DIRECT PULP CAPS

- Pulp exposures should be considered iatrogenic events that could have been avoided.
- Direct pulp caps should not be planned; they should only be necessary if the pulp is accidentally exposed.

WHY is an *indirect* pulp cap superior to a direct cap?

- Allows a remaining protective thickness of dentin
- Reparative dentin formation is enhanced
- Lowered chance of introducing bacteria into the pulp (which causes an inflammatory reaction)
- No hemorrhage from the pulp, which:
 - correlates with lowered success rates
 - can interfere with capping/bonding

What are the chances of success of a direct cap?

- Bacterial contamination threatens the pulpal health.
- Older pulps have less blood flow, and are less likely to be able to fight off bacteria.

What information do you need before treating these teeth?

- vitality?
- periapical pathology?
- spontaneous pain?
- lingering sensitivity?

FAVOURABLE CONDITIONS FOR PULP CAPPING

- vital pulp (TEST the pulp.)
- no spontaneous pain (ASK the patient.)
- no lingering pain after pulp testing, or after hot/cold stimulus (TEST & ASK.)
- no periapical lesion (TAKE A RADIOGRAPH.)
- restoration placed must have a good seal (margins)

CALCIUM HYDROXIDE

- Calcium Hydroxide (CaOH) might stimulate reparative dentin in *direct* pulp caps.
- CaOH has an antibacterial effect.
- CaOH eliminates most, if not all, of the bacteria.
- Traditional formulations of CaOH ("dycal") have poor physical properties.
- CaOH tends to dissolve if the cavity is not sealed.
- light-cured calcium hydroxide:
 - calcium hydroxide in UDMA matrix
 - NOT self-adhesive
 - cannot be bonded to tooth
 - available in opaque white and tooth shade
 - Light-cured CaOH liners show better physical properties and reduced solubility.
 - Light-cured CaOH liners are still weak.
 - So, they should be used over the smallest area possible to stimulate remineralization.
 - Thickness should not exceed 0.5 mm.

MTA

- High pH (similar to CaOH)
- Radiopaque
- Somewhat antibacterial
- Low microleakage
- Better compressive strength than CaOH
- Expensive
- Difficult to handle
- Long setting time (over 2 hours)
- Must be sealed with another liner

BIODENTIN

- a calcium silicate-based restorative cement
- better handling properties than MTA
- better mechanical properties than MTA
- shorter setting time than MTA (10-12 min) (but MTA can be sealed immediately)

What about BONDING over a pulp exposure?

- Some studies show bridge formation.
- Some studies show no bridge formation.

OPTION #2: INDIRECT PULP CAP

- The greatest impact on the pulp occurs when the remaining dentinal thickness (RDT) is no more than 0.25 to 0.3 mm.
- Calcium hydroxide is the best liner when remaining dentin is less than 0.5mm.
- A 0.5-mm thickness of dentin reduces the effect of toxic substances on the pulp by 75%.
- When remaining dentinal thickness is 0.5mm, calcium hydroxide or glass ionomer could be placed as a liner.
- A 1.0-mm thickness reduces the effect of toxins by 90%.
- When about 1mm remains, calcium hydroxide or glass ionomer could be used as a liner.
- Little pulpal reaction occurs when there is a remaining dentinal thickness (RDT) of 2mm or more.
- When more than 2.0mm remains, no liner is needed.
- Liners should not be thicker than 0.5mm.

GLASS IONOMER AS A LINER

Glass ionomer liners:

- bond chemically to tooth structure.
- release fluoride.
- are anticariogenic
- take in fluoride from adjacent tooth structure.
- have been shown to cause or allow remineralization of softened affected dentin.
- are tolerated by the pulp.
- reduce microleakage under amalgam restorations.

DOUBLE LINER RATIONALE FOR COMPOSITE

- Placing a glass ionomer over calcium hydroxide protects the calcium hydroxide from acid etching, which causes it to break down.
- Etched calcium hydroxide releases byproducts, which can interfere with bond strength of the resin adhesive.

DOUBLE LINER RATIONALE FOR AMALGAM

- Placing a glass ionomer over calcium hydroxide bonds it in place, and prevent it from being displaced during amalgam condensation.
- If the amalgam is not being bonded, placing a glass ionomer over the calcium hydroxide seals the area closest to the pulp from microleakage.

PROBLEMS WITH INDIRECT PULP CAPPING:

- We might accidentally hit the pulp.
 - Even if we don't, tubules are being exposed, which could lead to pulpal necrosis.
- “Cavity preparation will open up millions of tubules, each one a pathway to the pulp.”
- E. Kidd, 2004

THE DEEP CARIES LESION

- Infected dentin
- Affected dentin

If we remove the vital, repairing portion of the lesion, we will:

- Cause post-op sensitivity
- Destroy reparative, remineralizing dentin
- Introduce bacteria
- Spread the infection to injured, severed, open tubules.

CARIES DYES

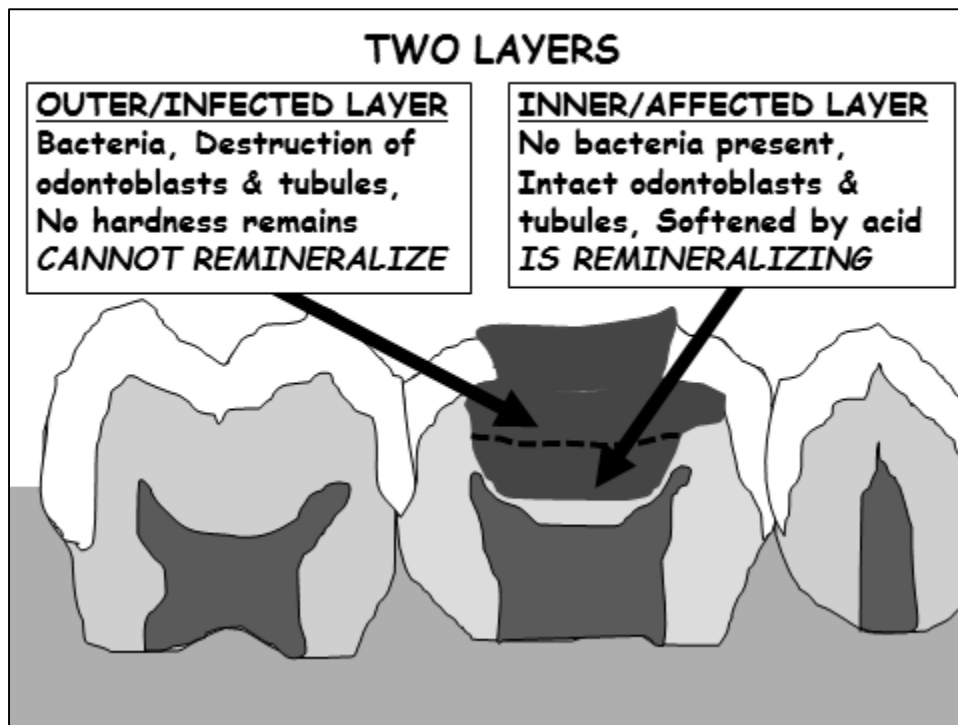
USES

- to visualize carious dentin under cusps
- to visualize carious cavity margins
- to locate fracture lines
- to locate canal orifices

DISADVANTAGES

- can create false positive near the pulp
- can create false positive at the DEJ
- could cause unnecessary removal of caries-affected dentin which could be retained and remineralized
- if not removed *completely*, may interfere with bond

TWO LAYERS OF THE CARIES LESION

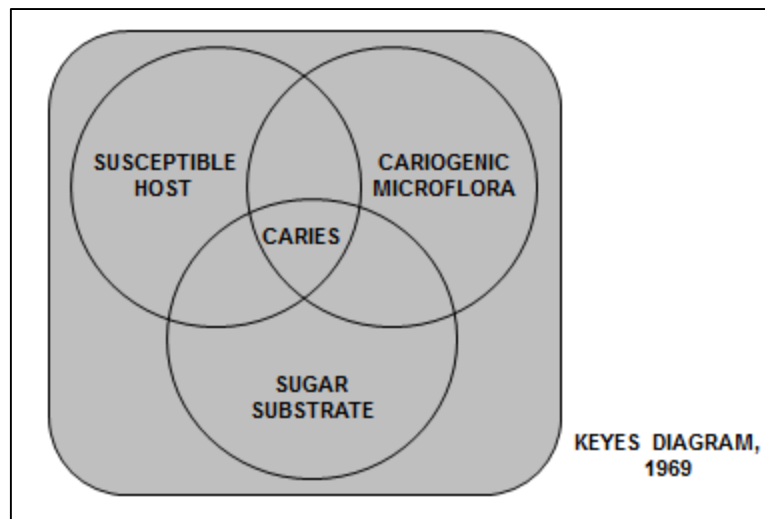


How do I know the difference between the vital layer and the non-vital layer?

THREE POSSIBLE ANSWERS:

1. Use a caries-detecting dye
2. Don't use anaesthesia. Let the patient tell you.
3. It doesn't matter if you leave non-vital dentin...

"There is little evidence that infected dentine must be removed prior to sealing the tooth." – E. Kidd, 2004



THE CARIES PROCESS

- Caries-producing bacteria digest sugars.
- Acid is a *side product*.
- The acid decalcifies the tooth, and forms a lesion. (Bacteria do not invade a tooth.)
- If you remove the sugar, acid production will cease.
- If you seal in the bacteria, the lesion will stop.

SEALANT STUDIES:

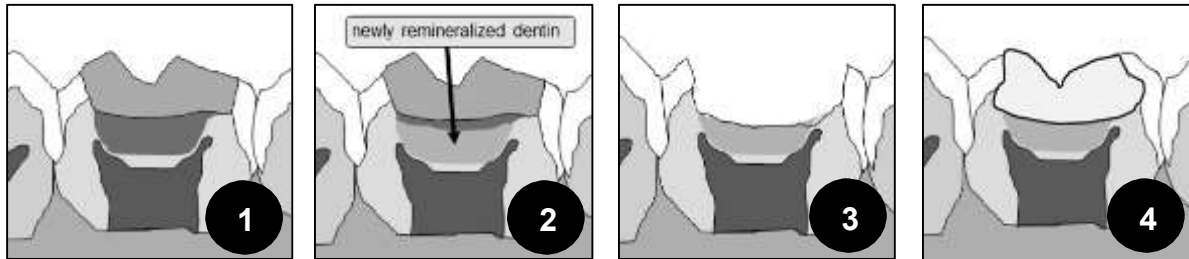
- Lesions that were sealed appeared to be arrested both clinically and radiographically.
- In sealed carious teeth, organisms decreased or disappeared.
- No pulpitis was seen in sealed teeth.
- In unsealed teeth, or teeth with lost sealants, the lesions progressed.

CLASSICAL EXCAVATION:

- Based on a belief that BOTH the plaque on the surface of the tooth AND the bacteria in the dentin drive the caries process.
- Remove all soft dentin - It's impossible to get rid of ALL the bacteria. - Remove all stained dentin – Bacteria remain whether you do or you don't. (Kidd et al, 1996)
- Calcium Hydroxide liner over thin, leathery dentin over the pulp reduces bacteria (indirect pulp cap).

OPTION #3: STEPWISE EXCAVATION

- Published for about 40 years
- Caries removal is accomplished over two visits.
- The interval between visits can be anywhere from 3 weeks to 2 years.



1
The lesion is restored provisionally.

2
At the second visit, the tooth is re-opened, and soft caries can be removed.

3
4
The tooth is now restored definitively.

STEPWISE EXCAVATION: GENERAL FINDINGS

- This technique is successful in avoiding a pulp exposure.
- Symptoms are rare.
- Dentin often appears altered on re-entry.
- Bacterial numbers decrease.
- *The amount of soft, dry dentin that remains is NOT related to the depth of caries removal in the first step.*

ADVANTAGES OF RE-ENTRY

- get to evaluate tooth / pulp
- see proof of remineralization
- might remove dead tissue

DISADVANTAGES OF RE-ENTRY

- second fee to patient
- anaesthesia again
- further trauma to tooth?
- second chance to hit pulp

Why GLASS IONOMER for the first step?

- excellent seal
- quick and easy to place
- releases fluoride
- shown to assist remineralization

Why GLASS IONOMER vs. RESIN-MODIFIED GLASS IONOMER?

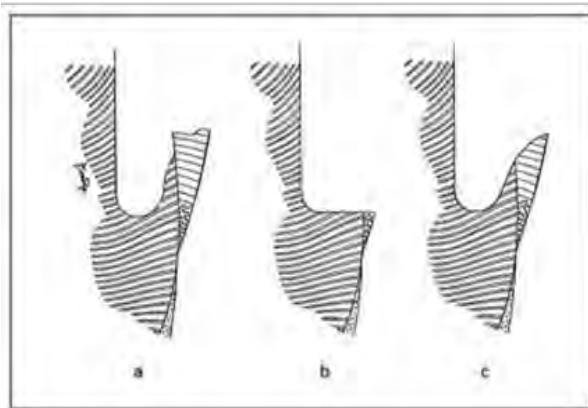
- generally more flowable
- usually less expensive
- theoretically releases more fluoride

Why a COLOURED glass ionomer for the first step?

- Easier to see = Easier to remove
- Easier to see = Safer to remove
- Alerts the dentist/hygienist if forgotten
- Alerts the patient if forgotten
- Sends a message to the next dentist/hygienist (that it should be removed)

OPTION #4: PARTIAL CARIES REMOVAL

- Soft, wet caries is covered with a restorative material (bonded composite).
 - Soft dentin is left over the pulp AND at the DEJ.
 - The lesion is arrested.
 - There are no more failures than with a control group (complete excavation).
- THIS INVOLVES A CHANGE IN MINDSET:
We are no longer passively waiting to see if we hit the pulp.
We are making a *conscious decision* that we WILL NOT hit the pulp.
We know the lesion won't progress. We don't know if the pulp will recover.



from Summitt, James B, *Fundamentals of Operative Dentistry: A Contemporary Approach, 3rd Edition*

This figure refers to a composite restoration.
“If the preparation is extended straight out to the cavosurface margin, remaining enamel for bonding is compromised (b). “

1. little remaining enamel
2. poor quality/bondability
3. challenging access

“Assuming removal of carious dentin created the situation shown in (a), the marginal configuration shown in (c) is preferable to that in (b).”

This is called the “INVERSE BEVEL” or “INTERNAL BEVEL” TECHNIQUE.

DISADVANTAGES OF LEAVING CARIES

1. It is NOT standard practise yet.
2. The next dentist might remove your restoration.
3. Softened dentin might not be a good foundation for your restoration.

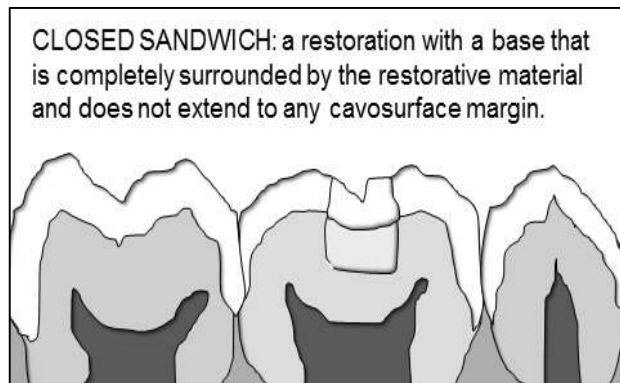
STUDIES HAVE SHOWN THAT ALL OF THE FOLLOWING CAN ARREST CARRIES:

- calcium hydroxide & zinc oxide eugenol
- glass ionomer
- resin-modified glass ionomer (RMGI)
- sealant
- resin composite
- amalgam
- sealed amalgam

THREE GENERAL PRESENTATIONS

1. Tooth is vital.
Patient has no symptoms or sensitivity.
Patient may not even be aware of lesion.
2. Tooth is vital.
Patient has some sensitivity. Patient has no spontaneous pain.
3. Tooth is vital.
Patient has some spontaneous pain.

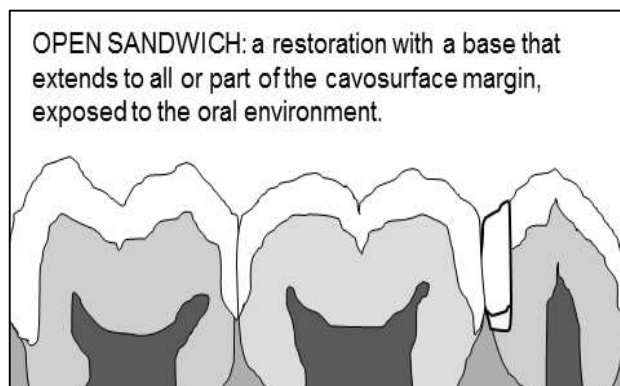
CLOSED SANDWICH



ADVANTAGES TO A CLOSED SANDWICH:

1. The primary restorative material (resin composite or amalgam) has better marginal adaptation than the sandwich material.
2. The primary restorative material has better wear resistance than the sandwich material.
3. The primary restorative material has better polishability than the sandwich material.

OPEN SANDWICH



ADVANTAGES TO AN OPEN SANDWICH (for a base containing Glass Ionomer):

1. The base could release fluoride externally if it is in contact with the oral environment. (good for patients with poor oral hygiene or high caries rate.)
2. The base has a better bond to the root surface than amalgam or an unbonded resin composite.
3. The base can be placed directly into areas of poor access. (example - where a matrix cannot be fitted)

Glass Ionomer Advantages in Class II's on Root Surfaces

- significantly better cervical margin adaptation than resin composite
- reduced postoperative sensitivity
- reduced demineralization adjacent to the gingival margin

BEST SEAL / LEAST MICROLEAKAGE (ON THE ROOT SURFACE):

1. Resin Modified Glass Ionomer
2. Traditional Glass Ionomer
3. Bonded Resin
4. Bonded or Sealed Amalgam
5. Unbonded Amalgam

GI or RMGI?

- Traditional glass ionomers do not show good longevity in sandwiches.
- Resin-modified glass ionomers have shown good longevity in sandwiches.

INDICATIONS FOR CLASS II SANDWICHES:

- in areas where there is little or no enamel for bonding
- patients with a demonstrated high caries risk

GLASS IONOMERS

WHY USE A CONDITIONER?

3 results of conditioning:

1. The weak acid removes the smear layer, allowing the chemical bond to occur.
2. Mild demineralization creates micro-porosities and increases surface area.
3. "Gel phase" formation: polyalkenoic acid reacts chemically with hydroxyapatite to form tags.

HANDLING

- Don't over-dry prep before placement.
- Keep field free of excess water while placing.
- Don't dry while finishing.
- Coat with a sealer after polishing.
- Don't dry a glass ionomer while evaluating it.

EFFECTS OF FLUORIDE

- An untreated adjacent tooth may be protected from lesion formation.
- Internal demineralized dentin may remineralize.
- Tooth structure adjacent to restoration margins might not develop a recurrent lesion.

GLASS IONOMER SUMMARY

- Expand at a rate similar to tooth structure.
- Have a chemical bond to enamel & dentin.
- Release fluoride
- Are recharged by fluoride
- Can cause remineralization of lesions
- Can prevent demineralization of margins
- Can prevent demineralization of adjacent teeth
- Resin modified glass ionomer is stronger than traditional glass ionomer
- Traditional glass ionomer has more fluoride than resin-modified glass ionomer
- Have the best retention for non-cariou cervical lesions
- Margins are inferior to resin and amalgam
- Not as polishable as resin and amalgam
- Wear more than resin and amalgam

GLASS IONOMER USES

- To restore non-cariou cervical lesions
- As a base over caries (closed sandwich)
- As an open sandwich on deep gingival preps
- As the first step of the stepwise technique
- To treat root caries
- To restore a patient with a high caries risk
- As an interim dental sealant
- As a crown core

ATRAUMATIC RESTORATIVE TREATMENT

ELEMENTS OF ATRAUMATIC RESTORATIVE TREATMENT

- No Anaesthesia
- Non-rotary entry into enamel
- Non-rotary cleaning of dentin
- Glass ionomer restoration
- Glass ionomer sealing of untreated grooves

POLYMER BURS

Polymer burs have been designed to:

- Remove only carious tooth structure
- Wear when contacting sound tooth
- Prevent pulp exposures (?)
- Allow excavation without anaesthesia

“Overall, hand excavation seemed to be the most suitable method for carious dentin excavation in deciduous teeth, combining good excavation time with effective caries removal.” – Celiberti et al, 2006

EXISTING RESTORATIONS & RECURRENT CARIES

- 60-70% of adult restorations placed in the U.S. are replacements of existing restorations, often placed by another dentist.
 - 50% of resin composite restorations are replaced after seven years;
 - 60% of amalgam restorations are replaced after ten years.
- There is a wide variation on the decision to remove and replace a restoration, and the reasons for doing it.
- Sound tooth structure is removed and the cavity is enlarged when a restoration is replaced.

RESTORATION REPAIR GUIDELINES

To repair old composite with new composite:

- Roughen or create retention.
- Etch with phosphoric acid.
- Bond with an adhesive.
- The old composite could be silanated.

To repair amalgam with composite:

- Roughen the amalgam.
- The amalgam could be silanated.

To repair amalgam with amalgam:

- Roughen the amalgam.
- The amalgam should not be bonded.

GUIDELINES FOR TREATING EXISTING RESTORATIONS (not in lecture)

- Loose restorations should be removed.
- Fractured restorations could be repaired. (Remove the weaker fragment.)
- Recurrent lesions could be repaired.
- Treatment may NOT be necessary for:
 - stained margins.
 - ditched margins.
 - amalgam shadows.
 - internal voids on radiographs.
- Replacing restorations:
 - can be traumatic to the pulp.
 - results in a larger restoration.
 - often results in more surfaces restored.
 - is not better than sealing, refurbishing or repair.
 - can reduce the longevity of a tooth.

DIAGNOSIS OF CARIES LESIONS

Three Questions to Ask:

1. Is this a LESION? (DETECTION)
2. Is this a CAVITATED lesion (DESCRIPTION)
3. Is this an ACTIVE lesion (DIAGNOSIS)

GLOSSARY TERMS: (from Fontana et al, 2010)

“noncavitated lesion”

- a lesion whose surface appears macroscopically to be intact
- a caries lesion without visual evidence of cavitation
- The lesion is still potentially reversible or arrestable.
- sometimes referred to as an *incipient lesion*, *initial lesion*, *early lesion* or *white-spot lesion*

“white-spot lesion”

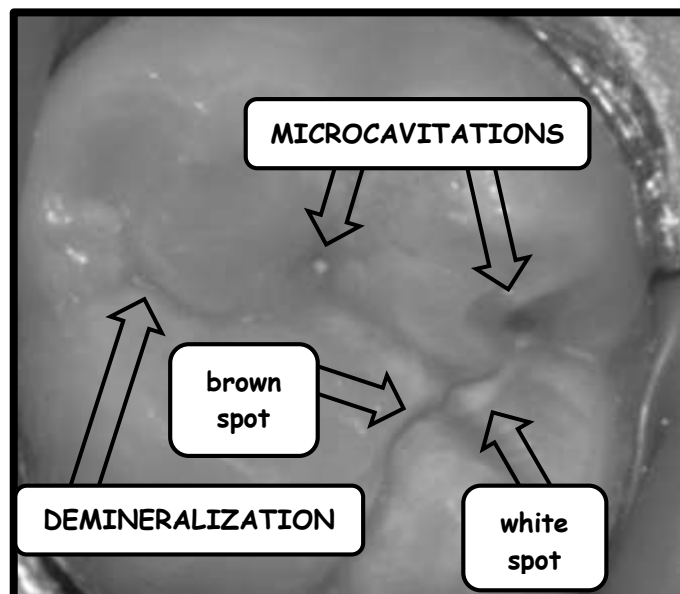
- a noncavitated lesion where mineral loss has produced changes in optical properties of enamel
- a loss of translucency results in a white appearance in the enamel
- not necessarily incipient
- may involve dentin

“brown-spot lesion”

- a noncavitated lesion where mineral loss has produced changes in optical properties of enamel
- the acquisition of intrinsic or exogenous pigments produces a brown discoloration.
- So, a brown-spot lesion is a stained white-spot lesion.
- It is *not* just a surface stain.

“microcavitation”

- a lesion with a surface that has lost its original contour/ integrity, without distinct cavity formation
- can involve ‘widening’ of the enamel fissure beyond its original features, *and/or*
- a very small cavity with no detectable dentin at its base



“active caries lesion”

- over a specified period of time, there is net mineral loss, that is, the lesion is progressing
- Clinical observations include:
 - visual appearance
 - tactile feeling
 - plaque accumulation

“arrested or inactive caries lesion”

- a lesion that is not undergoing net mineral loss, that is, the caries process in that lesion is no longer progressing.
- It is a “scar” of past disease activity.

CARIES AS A DISEASE PROCESS

“...placing a restoration only removes the bacteria from that particular cavity and **does nothing** to lower the bacterial levels in the remainder of the mouth.” – Featherstone, 2006

As a rule, patients who get carious lesions will *continue to get* carious lesions

WHAT IS CARIES RISK ASSESSMENT?

a determination of how likely your patient is to develop new lesions in the near future

- LOW risk
- MODERATE risk
- HIGH risk

“Risk assessment is an essential component in the decision-making process for the correct prevention and management of dental caries.” – Twetman & Fontana, 2009

We need to **make a plan** for preventing and treating each individual patient’s disease.

“Minimally Invasive Dentistry uses the medical model whereby disease is controlled by the “oral physician” and an affiliated dental team.

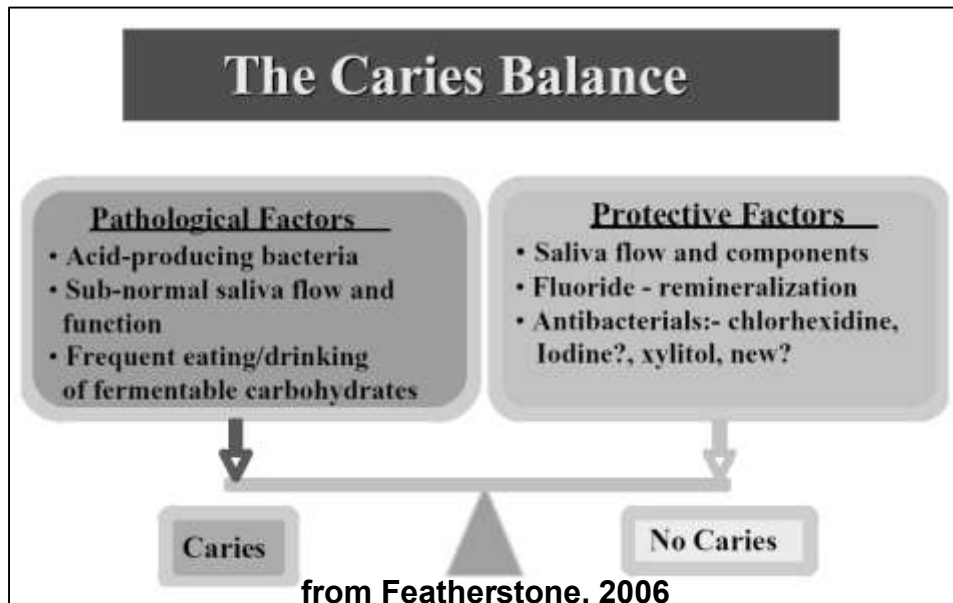
The main components of MID are

- assessment of the risk of new lesions
- emphasis on early detection and prevention
- remineralization
- sealants
- and surgical intervention (restorations) “**only when required** and **only after disease has been controlled.**” – Chalmers, 2006

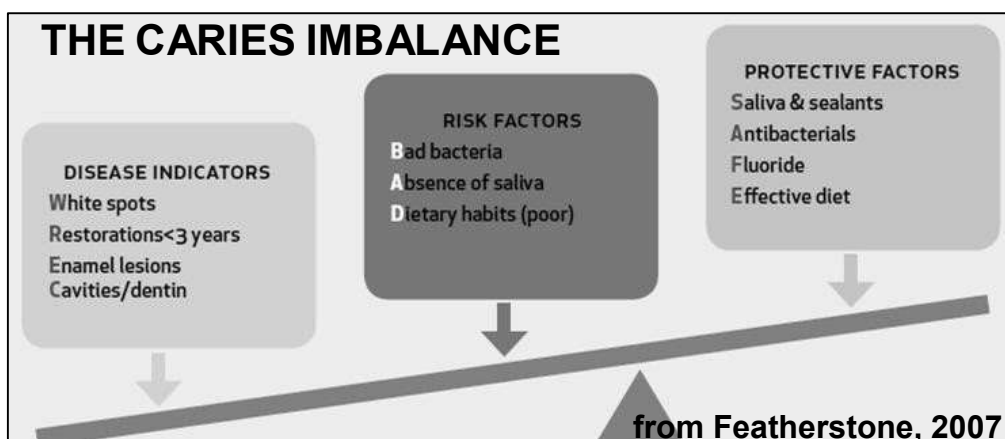
THE MEDICAL MODEL FOR CARIES MANAGEMENT

- What's the **PHYSIOLOGY** of the disease process? (What's happening?)
- What's the **ANATOMY** of the disease process? (What does it look like?)
- What are the **RISK FACTORS**? (What helps us predict the disease?)
- How do we perform **RISK ASSESSMENT**? (How do we identify who gets the disease?)
- How do we prevent the disease from starting?
- How do we prevent the disease from progressing?
- How do we treat the disease minimally? (How do we prevent surgery/operative?)
- Which patients should receive which treatment?

CARIES RISK ASSESSMENT



“For caries prevention or reversal, it is necessary to effectively increase the effect of one or more protective factors or to decrease the effect of one or more pathological factors.”
 – Featherstone, 2006



“Disease Indicators” help identify presence of the disease.
 These indicators place the patient at high risk of developing new or recurrent lesions, until the disease has been controlled.

PURPOSES of a CARIES RISK ASSESSMENT FORM

1. Identify patients at risk for new lesions
2. Identify specific risk factors for a patient
3. Manage specific risk factors
4. Record risk and risk factors in the chart

“Indicators of past caries experience are the strongest predictors.” - Summitt, James B, *Fundamentals of Operative Dentistry: A Contemporary Approach, 3rd Edition.*

“...there is a strong body of evidence to support that caries experience is still, unfortunately, the single best predictor for future caries development.” – Twetman & Fontana, 2009

So, a patient who HAS carious lesions will *continue* to have new carious lesions.

Aside from current caries, it is hard to assess which factors are promoting the disease (for most age groups).

As oral physicians, we need to treat each patient’s disease personally.

CARIES RISK ASSESSMENT FORM

DISEASE INDICATORS (Any one "YES" = High Risk)	YES = CIRCLE	RISK FACTORS (In the absence of indicators, risk determined by faculty)	YES = CIRCLE	PROTECTIVE FACTORS	YES = CIRCLE
Visible cavities and/or lesions, or radiographic penetration into dentin	YES	Visible plaque on teeth	YES	Fluoridated water intake	YES
Active radiographic proximal lesions	YES	Deep pits and fissures	YES	Fluoride toothpaste 1x daily	YES
Active white spots on smooth surfaces	YES	Saliva reducing factors/meds	YES	Fluoride toothpaste 2x daily	YES
Restorations (for caries) in last 3 years	YES	Patient reports "dry mouth"	YES	OTC fluoride rinse daily	YES
Extractions (due to caries), last 3 years	YES	Restorations with overhangs, open margins, or open contacts	YES	Rx fluoride toothpaste daily	YES
		Exposed roots	YES	Existing pit/fissure sealants	YES
		Ortho appliances, partials dentures	YES	Fluoride varnish in last 6 mo	YES
		Infrequent or irregular dental care	YES	Chlorhexidine 1 week/mo	YES
		Frequent snacks (>3x/day)	YES	Mt Paste in last 6 mo	YES
		High sugar intake or >6 exposures	YES	RISK LEVEL (Circle) HIGH MODERATE LOW	
		Recreational drug use	YES		



DISEASE INDICATORS (Any one "YES" = High Risk)	YES = CIRCLE
Visible cavities and/or lesions, or radiographic penetration into dentin	YES
Radiographic proximal enamel lesions	YES
White spots on smooth surfaces	YES
Restorations (for caries) in last 3 years	YES
Extractions (due to caries), last 3 years	YES

ANY circled “YES” places the patient at **HIGH risk**.

**step
2**

RISK FACTORS (1-2 = Moderate Risk; 3 or more = High Risk)	YES = CIRCLE
Visible plaque on teeth	YES
Deep pits and fissures	YES
Saliva reducing factors/meds	YES
Patient reports “dry mouth”	YES
Restorations with overhangs, open margins, or open contacts	YES
Exposed roots	YES
Ortho appliances, partials dentures	YES
Infrequent or irregular dental care	YES
Frequent snacks (>3x/day)	YES
High sugar intake or >6 exposures	YES
Recreational drug use	YES

- These risk factors help predict caries risk in a patient with *no indicators* (lesions).
- In patients *with lesions*, these risk factors help us understand the patient’s disease and design protective factors for that patient.
- ONE circled “YES” places the patient at MODERATE risk (in absence of lesions).
- MORE than one circled “YES” could place the patient at MODERATE or HIGH risk, depending on the risk factors, & the patient.

**step
3**

PROTECTIVE FACTORS	YES = CIRCLE
Fluoridated water intake	YES
Fluoride toothpaste 1x daily	YES
Fluoride toothpaste 2x daily	YES
OTC fluoride rinse daily	YES
Rx fluoride toothpaste daily	YES
Fluoride varnish in last 6 mo	YES
Chlorhexidine 1 week/mo	YES
MI Paste in last 6 mo	YES

- These protective factors can tip the balance.
- NOTE:** “YES” responses do not LOWER the risk; they help determine how protected the patient is currently.

PLAQUE REMOVAL

WHY DO LESIONS HAVE DIFFERENT SHAPES?

Caries lesions develop in the shape of the biofilms (plaque) covering the surface of the tooth.

from Ashkenazi et al, 2014:

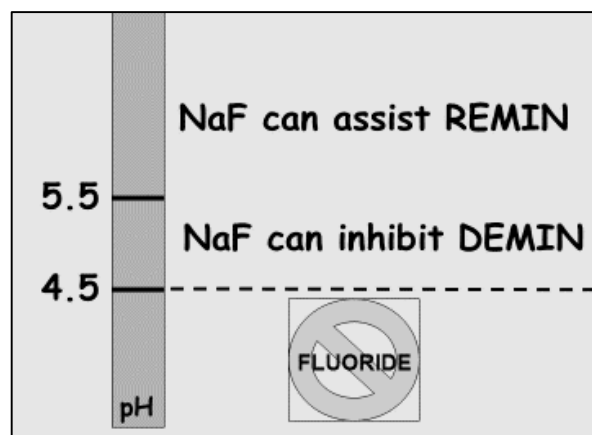
- Plaque removal tasks are difficult to perform.
- Most adults and children brush their teeth inadequately.
- Many patients only remove 50% of their plaque, even after brushing for two minutes.

FLUORIDE

“It is now well-accepted that the primary modes of action of fluoride are

- **enhancement of remineralization**,
- inhibition of demineralization, and
- inhibition of plaque bacteria,

with **remineralization** being the most important.” (Featherstone, 2009)



FLUORIDE USES:

- to prevent caries
- to provide surface remineralization
- to desensitize

FLUORIDE SUMMARY

- enhances remineralization (surface layer)
- inhibits demineralization
- inhibits plaque bacteria
- forms a substance harder than tooth structure
- has its effect topically
- is stored in bone; transported by blood
- constant 0.1% fluoride level would prevent caries
- also effective & necessary in adults
- not effective with >6 sucrose exposures/day
- not effective when pH drops below 4.5
- insufficient to prevent caries completely

AVAILABLE NaF REGIMENS

RINSES

OTC RINSE = 0.05% (226ppm)

Rx RINSE = 0.2% (920ppm)

TOOTHPASTES

OTC TOOTHPASTE = 0.24% (1100 ppm)

5000ppm FL TOOTHPASTE = 1.1% (5000ppm)

5000ppm FL GEL = 1.1% (5000ppm)

PROFESSIONALLY APPLIED (CHAIRSIDE)

GEL or FOAM = 2% (9000ppm)

VARNISH = 5% (22,500ppm)

FLUORIDE PROTOCOL, from ADA Council on Scientific Affairs, 2006

Professionally applied topical fluoride Evidence-based clinical recommendations

<u>LOW RISK</u>	MAY NOT BENEFIT FROM PROFESSIONALLY APPLIED TOPICAL FLUORIDE
<u>MODERATE RISK</u>	FLUORIDE APPLICATION EVERY 6 MOS
<u>HIGH RISK</u>	FLUORIDE APPLICATION EVERY 3-6 MOS

FLUORIDE FOAM

- Foam has NOT been shown *clinically* to be equivalent to gel or varnish.

FLUORIDE GEL

- There are considerable data on caries reduction for... fluoride gel treatments of **four minutes** or more.
- There is insufficient evidence ...whether or not there is a difference in the efficacy of NaF versus APF gels.
- *Gel & Foam should **NOT** be applied for only one minute; four minutes are recommended.*

FLUORIDE VARNISH

- Fluoride varnish applications take less time, create less patient discomfort and achieve greater patient acceptability than does fluoride gel, *especially in preschool-aged children.*
- Two or more applications of fluoride varnish per year are effective in preventing caries in high-risk populations.
- For *high risk patients*, there is new evidence suggesting that twice a year may NOT be enough.

INSTRUCTIONS FOR VARNISH APPLICATION:

- Teeth should be moist. (Wet teeth for xerostomia.)
- Open package. Mix varnish with brush.
- Load brush with varnish.
- Apply one quad at a time with a continuous stroke.
- Don't place into a pool of saliva
- Suction after placing
- Have patient spread around with tongue

INSTRUCTIONS FOR PATIENTS:

1. No alcohol, hot liquids, tooth brushing or sticky, chewy foods for four to six hours.
2. You can eat and drink and rinse.
3. If possible, do not brush your teeth until tomorrow morning.
4. Teeth will feel like they have a rough or sticky coating on them.
5. Spots may be visible on the teeth until brushed off.

ADA UPDATED CLINICAL RECOMMENDATIONS (2013)

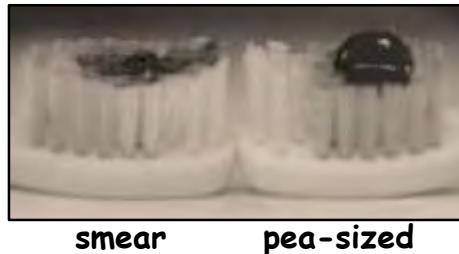
CHAIRSIDE APPLICATION SUMMARY

At risk <6yo: VARNISH every 3-6 mos
At risk 6 and >: VARNISH every 3-6 mos
OR GEL (4min) every 3-6 mos
Foam is NOT recommended (any age)

AT HOME SUMMARY

At risk <6yo: NO at-home Rx fluoride
At risk 6 and >: Rx Gel/Toothpaste 2x/day
OR Rx rinse at least weekly
Root Caries: Rx Gel/Toothpaste 2x/day
OR Rx rinse at least weekly

FLUORIDE TOOTHPASTE FOR YOUNG CHILDREN



- For children 5 years and younger, fluoride toothpaste (over-the-counter, not 500 ppm) is effective in reducing caries.
- Ingesting a pea-sized amount of toothpaste could lead to mild fluorosis.

RECOMMENDATIONS:

- For children under the age of 2 years, a “*smear*” of toothpaste should be used to brush twice daily, as soon as teeth erupt.
- For children ages 2 through 5 years, a “*pea-sized*” amount of toothpaste should be used to brush twice daily.

<p style="text-align: center;">fluoride protocols (AGES 6+)</p> <p>HIGH RISK:</p> <ol style="list-style-type: none">1. Fluoride varnish every 3-4 months2. Rx toothpaste 2x/day, including before bed <p>MODERATE RISK:</p> <ol style="list-style-type: none">1. Fluoride varnish every 6 months2. OTC toothpaste twice daily3. OTC rinse 1-2 times/day <p>LOW RISK:</p> <p>OTC toothpaste twice daily</p>

**With ANY fluoride toothpaste, patients should be instructed:
“SPIT, DON’T RINSE”**

WHAT TO SAY TO PATIENTS

“We’re getting really serious about trying to prevent cavities.”

“According the American Dental Association, you are at risk for developing more cavities.”

“I have to recommend that you have fluoride, but the choice is up to you.”

“We used to think that fluoride getting into your teeth before they come was the most important use of fluoride.”

“We now know that fluoride is most needed on the surface of your tooth, as sugar and acid try to soften your tooth.”

“The fluoride has to be on your tooth when you are having sugar or acid on your teeth.”

CHLORHEXIDINE

CHLORHEXIDINE FINDINGS (from Twetman, 2010)

- Bacteria in plaque & saliva can be reduced by 80% immediately after 0.12% rinse.
- Long-term use has not been shown to change resistance of bacteria, or to cause overgrowth of opportunistic bacteria.
- Mutans, and other targeted bacteria, return to original numbers weeks or months after cessation.
- Long-term use can stain teeth.
- Long-term use can alter taste sensation.
- Detergents in toothpastes can inactivate chlorhexidine, so two hours should separate brushing and rinsing.

CHLORHEXIDINE SUMMARY

- antibacterial and anti-mutans
- can eliminate mutans in young children
- can be applied as a gel
- available as a 40% professional varnish
- reduces bacteria in pits and fissure
- reduces bacteria in orthodontic patients
- reduces bacteria when applied to margins of restorations
- effects only last for 6 months, at most (not long lasting)
- may not translate into reduced caries lesion incidence
- may be inactivated by toothpaste (Wait two hours to brush after chlorhexidine rinse.)

Patients with high risk OR frequent dry mouth can be placed on 0.12% chlorhexidine rinse ONE WEEK EACH MONTH.

Patients could be asked to rinse 1 minute each day for the first week of each month.

Antimicrobial modification of bacteria in plaque happens slowly and it must be repeated.

XYLITOL

- Hexose sugars are fermented into acid by bacteria: *glucose, fructose, sucrose, maltose, dextrose*
- Sugar alcohols are not easily fermented by bacteria: *sorbitol, mannitol, xylitol*
- XYLITOL = “wood sugar” (Greek) It is found naturally in birch trees, sugar cane, and some mushrooms, berries and vegetables.

Clinical studies have demonstrated:

- Sucrose promotes caries.
- Sucrose stimulates plaque growth.
- Sucrose increases plaque adhesivity.
- Sucrose causes a more pronounced drop in plaque pH in patients who have a high caries risk.

Sorbitol, with or without Mannitol,:

- is slowly fermented by bacteria
- does not cause a critical pH drop in plaque
- does not appear to promote caries in clinical studies.

Xylitol in chewing gum:

- causes an increase in plaque pH.
- reduces mutans counts in plaque and saliva.
- encourages remineralization of early caries lesions.

- Xylitol should be used only as an adjunct to fluoride therapy.
- 5-6 grams/day is required.
- Patients should use xylitol at least 3 times/day.
- Patients should have exposures of 5-10 min.
- Xylitol products which stimulate saliva are best.
- Xylitol should be the only sweetener, and the majority of the weight in the product.

XYLITOL SUMMARY

- noncariogenic
- anticariogenic / caries-inhibitory
- decreases acid production
- decreases mutans counts in saliva / plaque
- remaining mutans are not as adhesive
- prevents mutans transmission to babies
- may reduce lactobacilli
- promotes remineralization
- has prolonged effect
- more effective than sorbitol or others
- safe sugar for diabetic patients
- causes intestinal discomfort in some patients
- must be kept away from dogs, cats and all non-primate animals

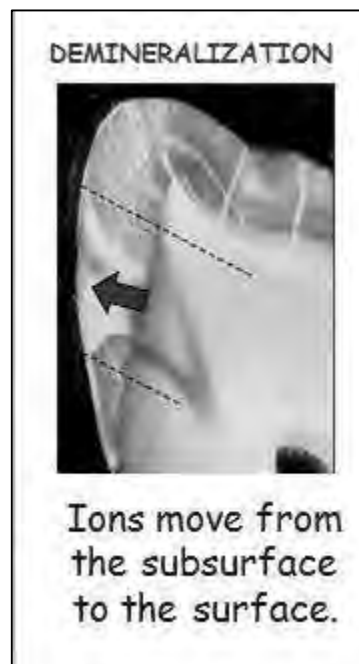
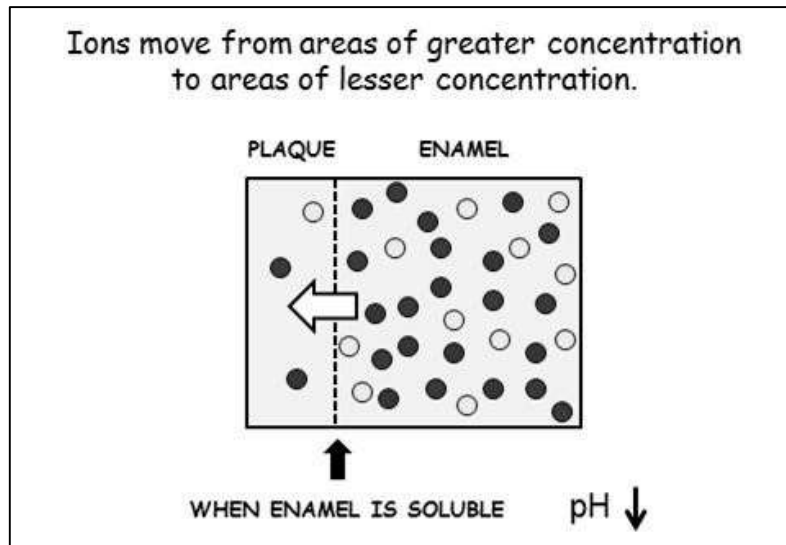
XYLITOL USES

- as a noncariogenic substitute
- as an anticariogenic therapeutic

XYLITOL HARD CANDY OR CHEWING GUM REGIMENS

- 6-10 grams/day
- 5 minute exposures
- 3-5 exposures/day

REMINERALIZATION: CALCIUM & PHOSPHATE PRODUCTS



As the surface demineralizes, the lesion spreads into dentin without breakage of the surface.

As a result, many lesions are not yet cavitated when they reach dentin.

The uncavitated lesion is likely free of bacteria because they cannot fit into the small diffusion spaces in the surface.



Eventually, minerals (calcium, phosphate and hydroxyl ions) appear in the plaque fluid outside the tooth, and balance is achieved.

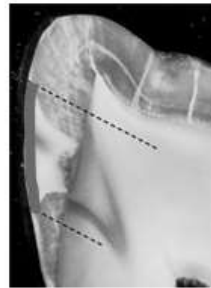
Then, the pH goes up.

SUPERSATURATION:

Now, demineralized enamel can remineralize.

So, remineralization not only depends on pH increase, but also on the availability of Ca & PO, and on the ionic strength of the plaque.

REMINERALIZATION

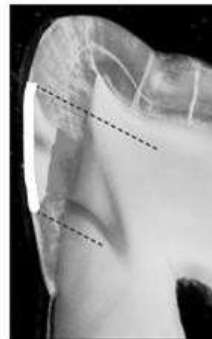


Fluoride hardens the surface layer of enamel.

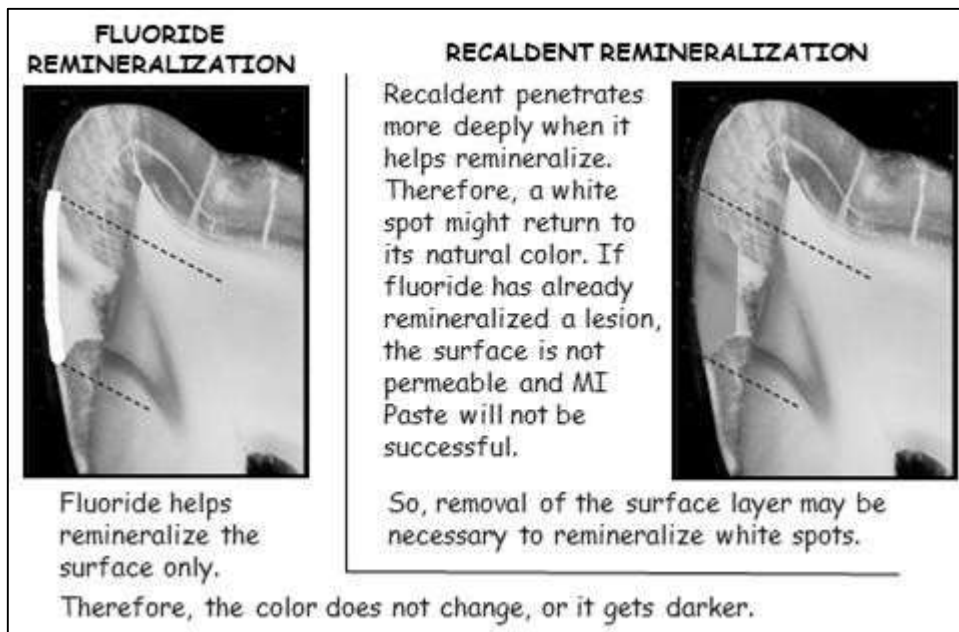
If the balance can be tipped, in favor of remineralization, the resulting surface is now more impermeable and resistant than before.

The SEALED subsurface may remain demineralized, which is not of clinical consequence UNLESS factors return that favor demineralization.

Often these remineralized lesions have white or brown surfaces.



Remineralization requires “bioavailable” calcium and phosphate. Remineralization is greatly enhanced by fluoride, which should be the first method of choice. Other remineralizing products are being developed and studied.



RECALDENT (CPP-ACP) SUMMARY

- delivers ca to the biofilm
- increases fluoride in the biofilm
- slows demineralization
- facilitates remineralization
- provides deep remineralization
- anticariogenic
- anti-mutans streptococci
- inhibits fermentation
- causes regression of lesions
- can be used by lactose-intolerant patients
- cannot be used by patients with milk protein allergies

RECALDENT USES

- to remineralize white lesions
- to remineralize interproximal lesions
- to prevent demineralization in orthodontic patients
- to prevent new carious lesions
- to desensitize

RECALDENT (CPP-ACP) REGIMENS

- CPP-ACP FOR WHITE SPOTS
 - Use with tray for 15 min BID
 - Wipe on teeth for 15 min BID
- CPP-ACP FOR INTERPROXIMAL LESIONS
 - Wipe on teeth for 15 min BID
- TRIDENT CHEWING GUM
 - Chew 2 pieces, 20 minute exposure, 4 times/day

PIT & FISSURE SEALANTS

Evidence-based clinical recommendations for the use of pit-and-fissure sealants

from ADA Council on Scientific Affairs, 2006

“The use of explorers is not necessary for the detection of early lesions, and forceful use of a sharp explorer can damage tooth surfaces.”

PRIMARY PREVENTION:

“interventions provided to avert the onset of caries”

SECONDARY PREVENTION:

“interventions to avert the progression of early caries to cavitation”

- Resin sealants reduce caries in *permanent* teeth.
- Sealants reduce the need for restorations in *permanent molars*.
- If teeth are sealed and the teeth still become carious, it will take longer and the caries will be less extensive.
- Sealants should be monitored and repaired or replaced as needed.
- Sealants placed over non-cavitated lesions significantly reduce progression of the lesion.
- When lesions are sealed, bacterial number decrease by as much as 100-fold.
- For patients of all ages, pit-and-fissure sealants should be placed on early (non-cavitated) carious lesions to prevent progression of the lesion.
- We should feel comfortable sealing a tooth if:
 - We don't see a hole or a shadow.
 - We can't feel a hole.
 - We don't see a huge lesion on x-ray.
- Resin sealants seem to be more effective than glass ionomer (GI) sealants in reducing caries.
- Resin-based sealants are the first choice.
- GI can be used as a *temporary* sealant if isolation is an issue.
- Evidence that air abrasion increases retention is limited and conflicting.
- Substituting air abrasion for acid etching **LOWERS** sealant retention.
- Evidence that preparing enamel with a bur increases retention is limited and conflicting.
- Routine preparation of enamel with burs is not recommended.
- Retention of resin sealants is improved with a four-handed technique.
- The dental professional placing the sealant should be assisted whenever possible (for resin *and* GI).
- Retention of resin sealants can be improved if a bonding agent is used.
- A bonding agent can be used when the dentist thinks it might improve retention.
- Self-etching bond agents (without a separate etching step) often result in lower sealant retention rates.
- Self-etching bond agents should not be used with sealants.

- *Primary teeth* should be sealed when either the tooth or the patient is at risk.
- *Permanent teeth in children* should be sealed when either the tooth or the patient is at risk.
- *Permanent teeth in adults* should be sealed when either the tooth or the patient is at risk.

SEALANT SUMMARY

- Recommended when the tooth or the patient is at risk.
- Effective for primary and permanent teeth.
- Sealants over non-cavitated lesions are effective at stopping lesion progression.
- Bacteria decrease, or disappear, when Sealants are placed over cavitated lesions.
- Resin sealants are retained longer than glass ionomer sealants.
- Air abrasion / bur preparation is not necessary.
- A bonding agent might increase longevity.
- Glass Ionomer sealants can be used temporarily (if isolation is a problem).
- 4-handed placement increases longevity.
- Sealants should be monitored and repaired.

WHAT TO SAY TO PATIENTS

“We’ve changed the way we look at this, and we now consider this a cavity.”
 “It needs to be treated but we’re just not going to drill into it...”

INTERPROXIMAL LESION SUMMARY (not in lecture)

- Approximately 20% of interproximal lesions in the outer half of the enamel are cavitated.
- Approximately 47% of interproximal lesions in the inner half of the enamel are cavitated.
- Many interproximal lesions at the DEJ or just inside dentin are still not yet cavitated.
- Tooth separation for 24 hours, followed by resin sealant placement, can arrest or reverse interproximal lesions.
- Tooth separation for 24 hours, followed by a glass ionomer sealant (Fuji Triage) placement, can arrest or reverse interproximal lesions.
- Repeated, direct application of fluoride varnish can arrest or reverse interproximal lesions.
- “Resin infiltration” involves etching with 15% hydrochloric acid. After application of a “drying agent” (alcohol), a resin is applied. Deep penetration occurs.
- Each step is repeated before proceeding to the next step.
- Resin infiltration can arrest or reverse interproximal lesions.
- Resin infiltration can arrest or reverse facial “white spot” lesions.
- Resin infiltration can change the colour of a white spot lesion.
- A low number of patients will comply with flossing.

“WATCH”

(from Fontana et al, 2010)

(Obsolete Term) This is a term sometimes used to indicate early, white-spot lesions in either smooth or occlusal surfaces. The term is used to either indicate uncertainty regarding the state of activity of the lesion, or to indicate confusion uncertainty as to whether it is actually a caries lesion to begin with. As it is not a diagnostic term, it cannot lead to any management decision; the decision not to do anything or just “watch” should be eliminated from our choices of treatment. The term may have previously been used as a way to delay restorative intervention for sites that we were unsure about when we did not have many treatment options for these earlier stages of the disease. However, with the availability of better detection methods and noninvasive interventions, it is necessary to avoid using this term and make the best possible diagnostic call at any one point in time. Instead of “watching” over time, we should be “monitoring” the effect of our therapies and treatments on the lesions we are following.

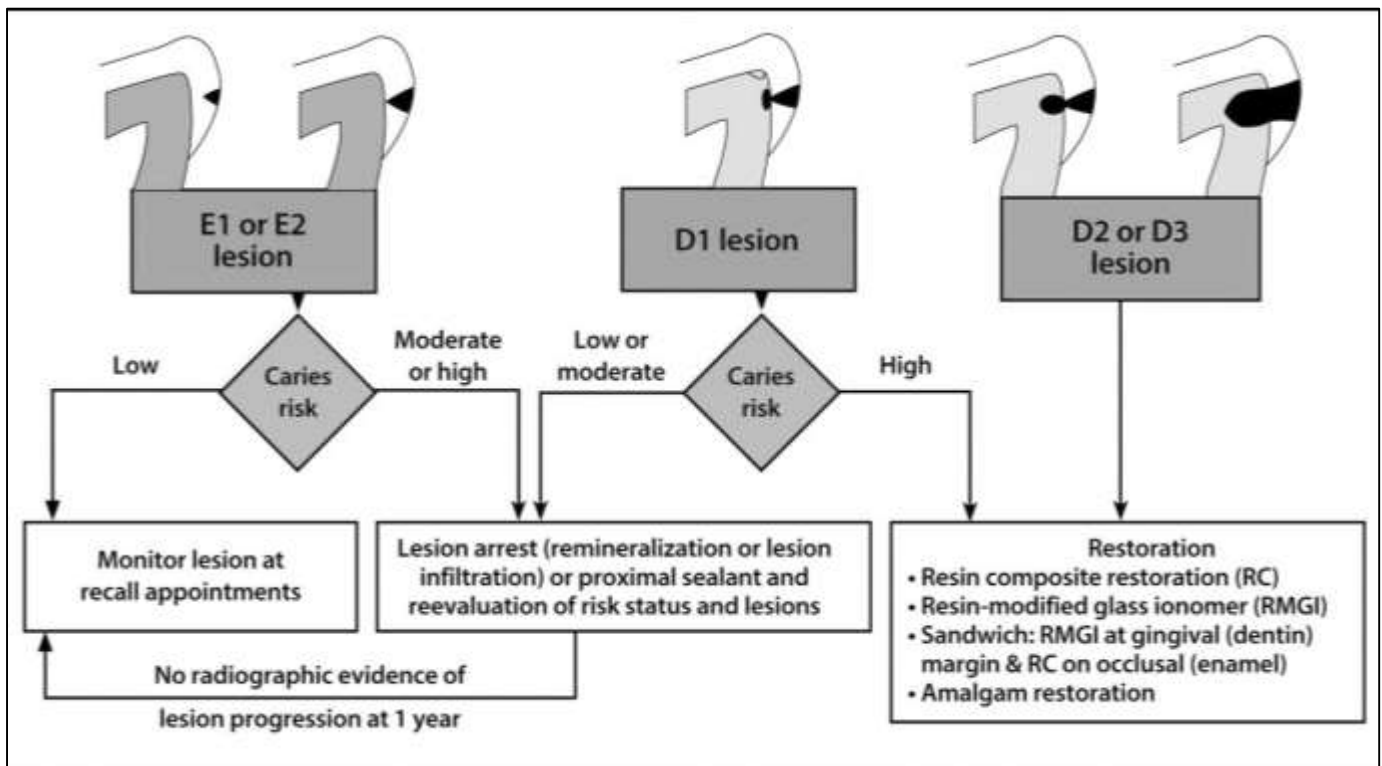
INTERPROXIMAL LESION OPTIONS

- CPP-ACP BID for 15 min
- Separation and fluoride varnish every 3 mos
- Separation and resin sealant
- Separation and glass ionomer sealant
- Resin infiltration (ICON)

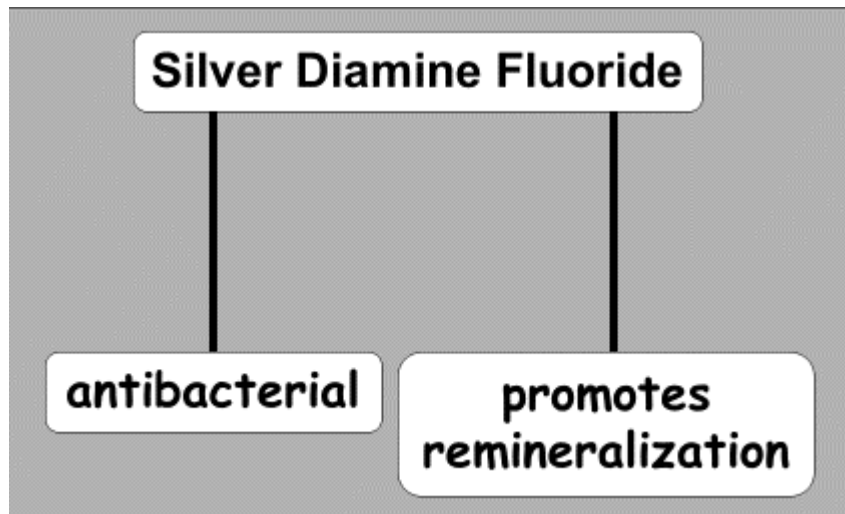
If we suspect a lesion is active, it should NOT be “watched”; it should be treated with one of the above options.

If we determine a lesion is inactive, it does not need treatment, and it does NOT need to be “watch”.

PROXIMAL LESION DECISION TREE



Hilton, *Summitt's Fundamentals of Operative Dentistry: A Contemporary Approach, 4th Edition.*



Silver diamine fluoride:

1. arrests the lesion
2. is easy to use
3. is not expensive
4. is non-invasive
5. requires little training and time

Possible disadvantages:

1. Irritation of soft tissue
2. Irritation of the pulp
3. Fluorosis
4. Staining of the lesion
5. Staining of skin & clothing
6. Staining of open composite margins

Possible Indications for silver diamine fluoride:

1. To arrest a deep lesion before the restoration visit
2. For young children who cannot sit for restorations
3. For the frail elderly who cannot sit for restorations
4. For lesions that are not restorable but retainable
5. To arrest multiple, deep, complex lesions quickly

Patient groups for silver diamine fluoride:

1. The very young
2. The very old
3. The very sick
4. The very disabled
5. Patients with individual deep lesions
6. Patients with many, many lesions
7. Patients who cannot afford treatment
8. Patients who have no access to care
9. Patients who are institutionalized

ACTION STEPS TO CONSIDER

- Avoid creating isthmuses & MOD preparations (*top of page 1*)
- Consider bonding amalgams, when indicated (*bottom of page 1*)
- Avoid pulp exposures (*middle of page 2*)
- Consider GI liners over top of CaOH liners ("*double liner rationale*", *page 4*)
- Consider two-step excavation for healthy teeth with very deep lesions, to avoid pulp exposure (*page 7, top of page 8*)
- Consider placing open RMGI sandwiches when margins are on root surfaces (especially for high caries risk patients). (*bottom of page 9, top of page 10*)
- Use RMGI to restore root surfaces (*middle of page 11*)
- Try hand (spoon) excavation of caries (without anaesthesia?) (*bottom of page 11*)
- Use a #12 scalpel blade (not a bur) to trim and finish root margins
- Consider repairing restorations over replacement (for composite or GI) (*page 12*)
- Use the perforated band technique for root lesions

- Use a Caries Risk Assessment form (*pages 16 and 17, and separate forms*)
- Implement ADA Fluoride Protocols by risk (*bottom of page 21*)
- Switch to Fluoride Varnish for kids <6yo ("*chairside application summary*", *bottom of page 20*)
- Switch to Fluoride Varnish or 4 min Fluoride Gel (no foam) for patients >5yo ("*chairside application summary*", *bottom of page 20*)
- Recommend 5000ppm Toothpaste for high risk patients >5yo ("*at home summary*", *bottom of page 20*)
- Use a form for chairside dietary sugar *analysis* (*separate form, with key on the back*)
- Stop "watching" and try to arrest active lesions (*page 29, including decision tree*)
- Seal teeth, even for adults, when indicated (*page 27, top of page 28*)
- Consider xylitol chewing gum for some patients (*top of page 24*)
- Consider CPP-ACP paste for some patients (*bottom of page 26*)
- Offer resin infiltration for white spot patients

Dental Caries Update 2017: It's About More Than Just Filling Holes!

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RECOMMENDED READING

1. **How 'Clean' Must a Cavity Be Before Restoration?**¹ - E.A.M. Kidd, Caries Res 2004;38:305-313
2. **Ultraconservative and Cariostatic Sealed Restorations: Results at Year 10**² - Eva J. Mertz-Fairhurst, D.D.S.; James W. Curtis Jr., D.M.D.; Janet W. Ertle, C.D.A.; Fred A. Rueggeberg, D.D.S., M.S.; Steven M. Adair, D.D.S., M.S., JADA, Vol. 129, January 1998
3. **Caries risk assessment in practise for age 6 through adult**³ – Featherstone JD, Domejean-Orliaguet S, Jenson L, Wolff M, Young DA, J Calif Dent Assoc. 2007 Oct;35(10):703-7, 710-3
4. **Caries risk assessment appropriate for the age 1 visit (infants and toddlers)**³ - Ramos-Gomez FJ, Crall J, Gansky SA, Slayton RL, Featherstone JD, J Calif Dent Assoc. 2007 Oct;35(10):687-702
5. **Caries management by risk assessment: implementation guidelines**³ - Young DA, Featherstone JD, Roth JR, Anderson M, Autio-Gold J, Christensen GJ, Fontana M, Kutsch VK, Peters MC, Simonsen RJ, Wolff MS., J Calif Dent Assoc. 2007 Nov;35(11):799-805.
6. **Professionally Applied Topical Fluoride: Evidence-Based Clinical Recommendations**⁴ - American Dental Association Council on Scientific Affairs, J Am Dent Assoc 2006;137;1151-1159
7. **Topical fluoride for caries prevention: executive summary of the updated clinical recommendations and supporting systematic review**⁴, - Weyant RJ, Tracy SL, Anselmo TT, Beltrán-Aguilar ED, Donly KJ, Frese WA, Hujoel PP, Iafolla T, Kohn W, Kumar J, Levy SM, Tinanoff N, Wright JT, Zero D, Aravamudhan K, Frantsve-Hawley J, Meyer DM; American Dental Association Council on Scientific Affairs Expert Panel on Topical Fluoride Caries Preventive Agents, J Am Dent Assoc. 2013 Nov;144(11):1279-91

- ★ 8. **Evidence-Based Clinical Recommendations for the Use of Pit-and-Fissure Sealants⁴** - American Dental Association Council on Scientific Affairs, J Am Dent Assoc 2008;139;257-268
9. **Sealants and dental caries: dentists' perspectives on evidence-based recommendations⁴**, Tellez M, Grey SL, Grey S, Lim S, Ismail AI, J Am Dent Assoc. 2011 Sep;142(9):1033-40.
10. **Sealants and dental caries: insight into dentists' behaviours regarding implementation of clinical practise recommendations⁴**, O'Donnell JA, Modesto A, Oakley M, Polk DE, Valappil B, Spallek H, J Am Dent Assoc. 2013 Apr;144(4):e24-30.
11. **Concordance between clinical practise and published evidence: Findings from The National Dental Practise-Based Research Network⁴**, Norton WE, Funkhouser E, Makhija SK, Gordan VV, Bader JD, Rindal DB, Pihlstrom DJ, Hilton TJ, Frantsve-Hawley J, Gilbert GH; National Dental Practise-Based Research Network Collaborative Group, J Am Dent Assoc. 2014 Jan;145(1):22-31.
12. **Minimally invasive resin infiltration of arrested white-spot lesions: a randomized clinical trial⁴**, Senestraro SV, Crowe JJ, Wang M, Vo A, Huang G, Ferracane J, Covell DA Jr., J Am Dent Assoc. 2013 Sep;144(9):997-1005.
- ★ 13. **Chairside Diet Assessment of Caries Risk⁵** - Teresa A. Marshall, J Am Dent Assoc 2009;140;670-674
- ★ 14. **ADA CENTRE FOR EVIDENCE-BASED DENTISTRY**
<http://ebd.ada.org/>
 Click on "Clinical Recommendations" on the top menu bar.
 Topical Fluoride and Sealants are found here, among other EBD topics.
This website is open to everyone. You do not need to be an ADA member.

¹ To get a free copy, google the title, or go to Karger: <http://www.karger.com/Article/Pdf/77770>

² Available on the JADA website to ADA member dentists,
http://jada.ada.org/content/129/1/55.full.pdf+html?login_referer=http://jada.ada.org/content/129/1/55.abstr.act

³ The California Dental Journal can be accessed at <http://www.cda.org/member-resources/journal>. On the website, go to Journal Archive in the middle of the page and select the year and month of the article. You will get a free copy of that month's issue, and you can flip to the article.

⁴ Available on the JADA website. Google the title and look for the link that leads you to the JADA website.

⁵ Available on the JADA website to ADA member dentists, through archives: <http://jada.ada.org/>