
Good
Morning

PIT AND FISSURE SEALANTS

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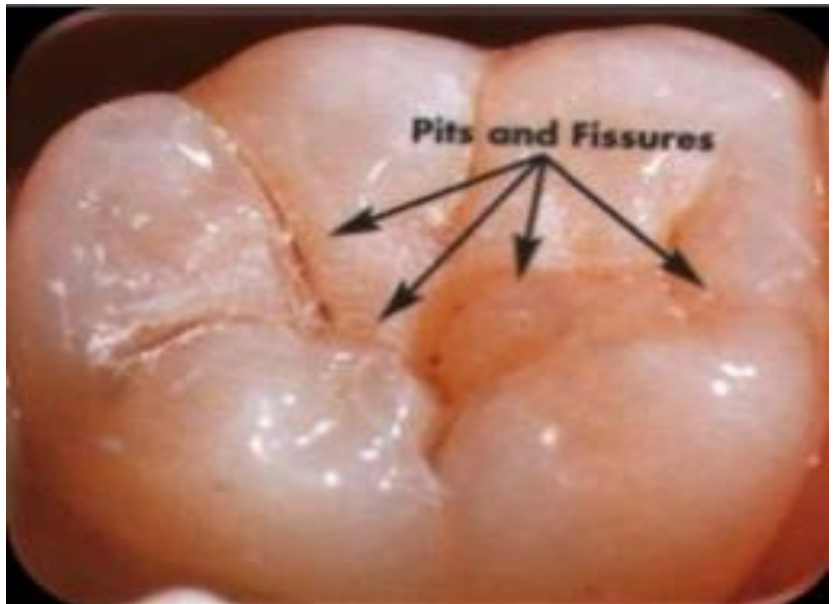
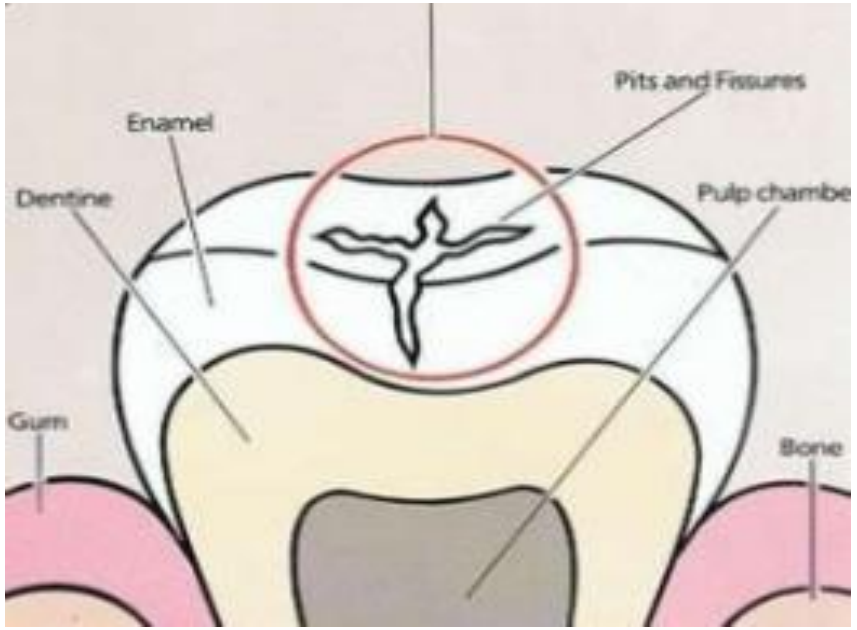
INTRODUCTION

- The prevalence of caries has decreased in the past 2 decades and contributing to this decline are water fluoridation, dentifrices, improved oral hygiene and changes in diet and awareness.
- Despite the dynamic reduction in caries in fluoridated community, the disease still continues to occur during childhood and there is a sustained caries susceptibility of pits and fissures.
- Pit and fissure sealants are major cornerstone of modern preventive dentistry in prevention of caries in susceptible teeth.

TERMINOLOGIES

- **Pit(Ash 1993)**: It is defined as a small pinpoint depression located at the junction of developmental grooves or at terminals of those grooves.
- **Fissure (Orbans 1954):** Fissure is defined as deep clefts between adjoining cusps.





- **Pit and fissure sealant:** A material that is introduced into the occlusal pits and fissures of caries susceptible teeth, thus forming a micromechanically bonded, protective layer cutting access of caries producing bacteria from their source of nutrients.
- **Fissure sealant:** It is a material that is placed in the pits and fissures of teeth in order to prevent or arrest the development of dental caries.

HISTORY

- **1867- Arthur:** Stated that decay was inevitable and that obliteration of the fissures could prevent its occurrence.
- **1905-Miller:** Used silver nitrate for fissure restoration
- **1922-Hyatt:** "prophylactic odontomy".He advocated filling the fissures with silver/ copper oxyphosphate cement as soon as the teeth erupted, and later after fully erupting; a preparing a small cavity and filling it with amalgam.
- **1939-Gore:** Used polymers as fissure sealants
- **1955-Buonocore:** Introduced a method of adhering resin to an acid etched enamel surface.

- **1965-Gwinnett and Buonocore:** approximately 50% phosphoric acid solution etched enamel and a porosity resulted that was penetrated by the cyanoacrylate with the production of a strong bond
- **1965-Bowen:** developed Bis-GMA from bisphenol A and Glycidyl methacrylate.
- **1966-Cueto and Buonocore:** Initiated critical studies of fissure sealing using a methyl cyanoacrylate monomer filled with silicate filler.
- **1968-Rodyhouse:** Reported on use of Bis GMA monomer using methyl methacrylate as diluents together with a peroxide amine polymerization system.

- **1970-Buonocore:** Used an UV –sensitive polymerization initiator (bezoin methyl ether) in Bis GMA system that allowed more flexibility in the clinical application of the material
- **1971-Nuva Seal:** 1st pit and fissure sealant develped and commercially introduced by ***LD Caulk Company*.**

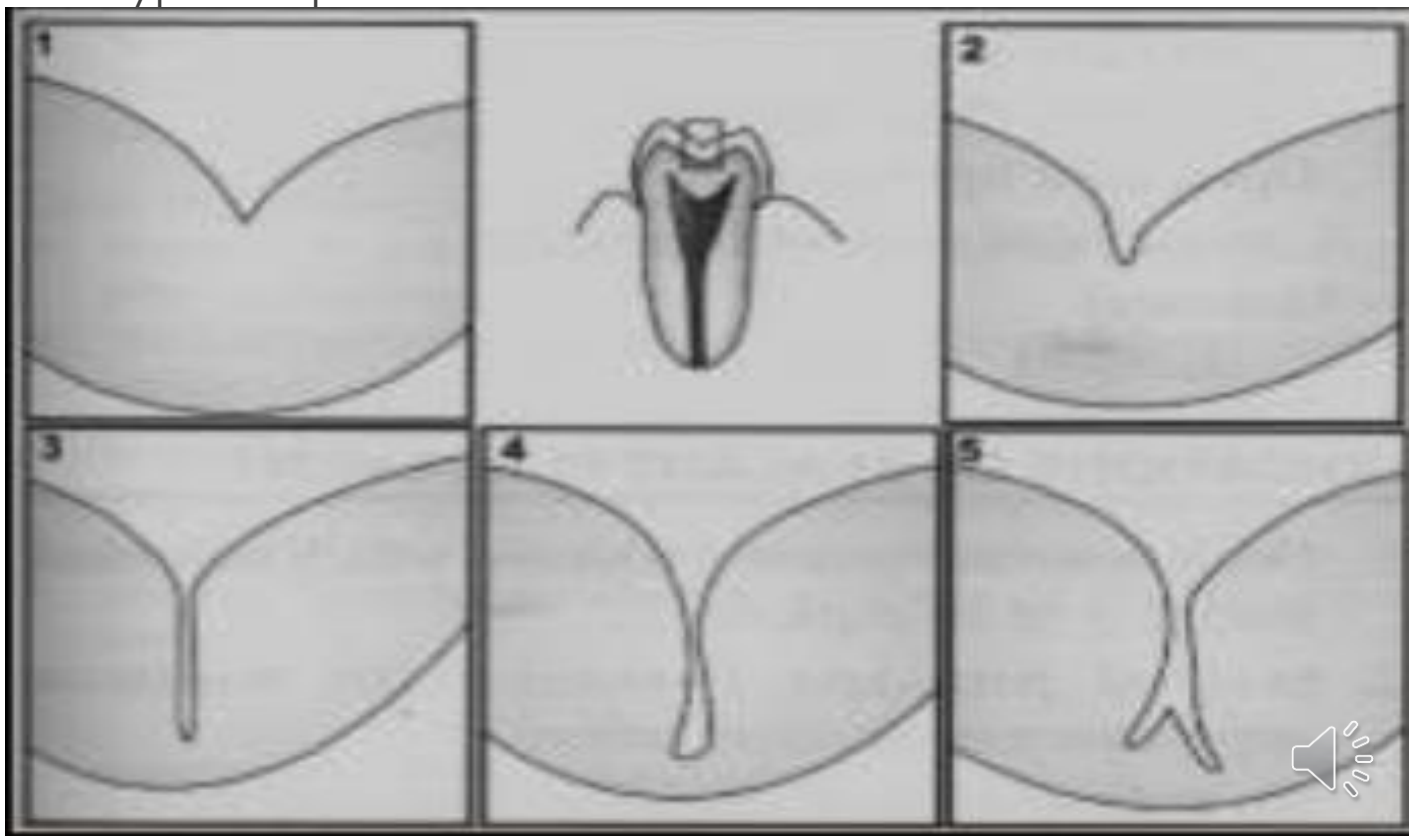
MORPHOLOGY OF PITS AND FISSURES

- The fissure contains organic plug composed of reduced enamel epithelium, micro organisms, forming dental plaque and oral debris.
- The increased susceptibility of this surface to caries is due to the fact that fissure provides a protected niche for plaque accumulation.
- Recently erupted teeth have a porous enamel lining and the fissures are rich in cellular and organic debris .
- This porous zone of enamel bordering the fissures offers a 3-dimentional honeycombed structure into which fissure sealants could be locked.

- Any procedures must be carried out at the earliest possible time after eruption to make effective preventive use of fissure sealants.

TYPES OF PITS AND FISSURES

- According to Nagano 1961, there are 5 types of pits and fissures
- 1. V-type (34%)
- 2. U-type (14%)
- 3. I-type (19%)
- 4. IK-type (26%)
- 5. Inverted Y-type (7%)

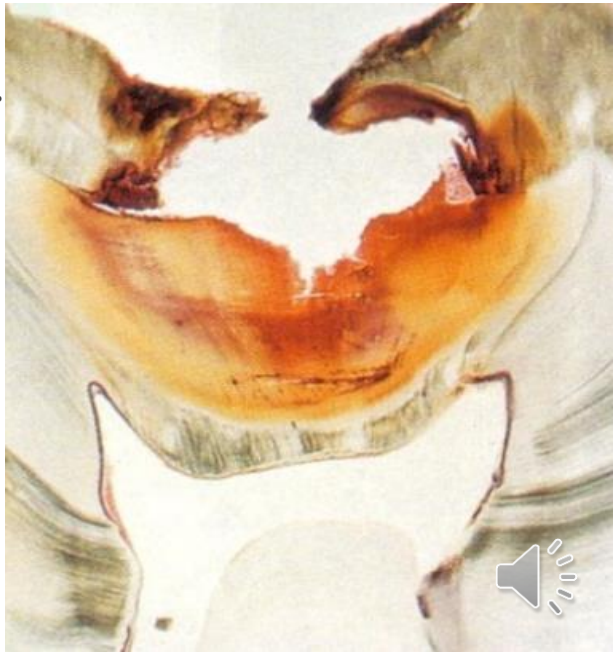


HISTOPATHOLOGY OF FISSURE CARIES

- 1st evidence of lesion formation occurs at the orifice of the fissure and is represented by 2 bilateral lesions in enamel on opposing cuspal inclines
- Lesion progresses and depth of fissure wall becomes involved
- 2 lesions coalesce into 1 at the base of the fissure

- The enamel at the base is affected and the lesion spreads laterally along the enamel adjacent to the depth of fissure towards DEJ

- Cavitation occurs owing to loss of mineral and structural support from affected enamel and dentin resulting in a clinically detectable lesion.



CLASSIFICATION OF PIT AND FISSURE SEALANTS

- **1.According to chemical structures of monomers used**
- Methyl methacrylate(MMA)
- Triethylene glycol dimethacrylate (TEGDM)
- Bis phenol dimethacrylate(BPD)
- Bis-GMA is the reaction product of bisphenol A and glycidyl methacrylate(GMA) with a MMA monomer ESPE monomer
- Propyl methacrylate urethane(PMU)

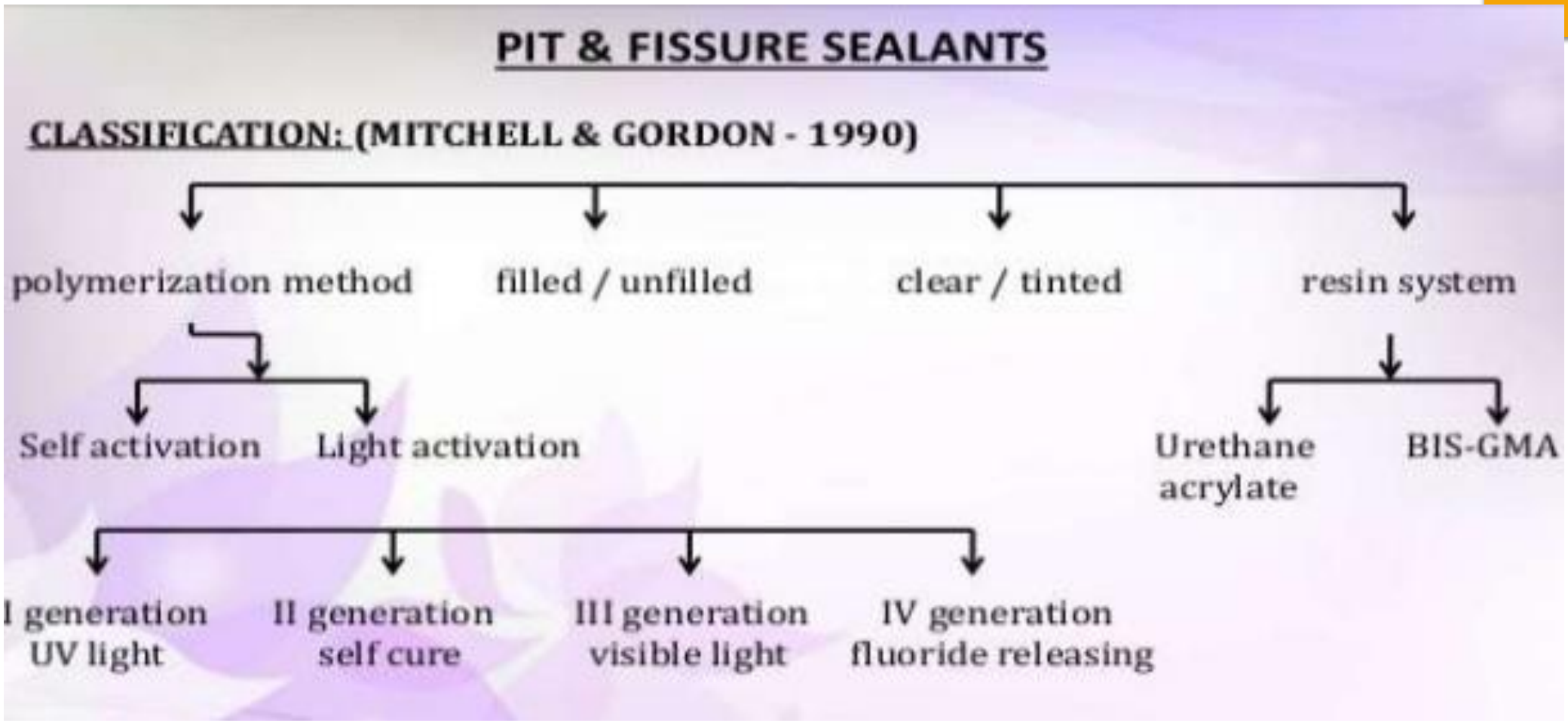
- **2.Based on generations**
- First generation sealants:
- Polymerized with UV light with wavelength of 356um
- Had excessive absorption and incomplete polymerization of sealant at its depth
- For eg; Nuva lite (Caulk/Dentsply)
- Second generation sealants:
- Self cure or chemical cure resins

- Based on accelerator catalyst system
- For eg; Concise White (3M)
- Third generation sealants:
- Light cured with visible(blue) light of 430-490um
- For eg; Helioseal
- Fourth generation
- Fluoride releasing sealants
- For eg; Seal right (Pulpdent)

- **3. Based on filler content**
- Unfilled : Advantages include better flow and more retention but abrade rapidly
- Filled: Advantages include resistance to wear but may need occlusal adjustments.
- **4. Based on color**
- Clear:
- Esthetic
- Difficult to detect in recall visit

- For eg: Helioseal (changes from green to white)
- Tinted / Opaque
- Can be idendified
- For eg; Delton
- Colored
- Based on color change technology
- Easy to see during placement and recall
- For eg; Clinpro pink (changes to pink on setting)

- **5. Based on curing**
- Autopolymerizing
- Light cure


PIT & FISSURE SEALANTS
CLASSIFICATION: (MITCHELL & GORDON - 1990)
polymerization method
filled / unfilled
clear / tinted
resin system
Self activation
Light activation
Urethane acrylate
BIS-GMA
I generation UV light
II generation self cure
III generation visible light
IV generation fluoride releasing

IDEAL REQUIREMENTS OF PIT AND FISSURE SEALANT

- Brauer in 1978 suggested the following pre requisites for a sealant to be effective
- Viscosity allowing penetration into deep and narrow fissures even in maxillary teeth
- Adequate working time
- Rapid cure
- Good and prolonged adhesion to enamel
- Resistance to wear
- Minimum irritation to tissues
- Cariostatic action

American Academy of Pediatric Dentistry (AAPD) guidelines

- *Sealants should be placed into pits and fissures of teeth based upon the patient's caries risk, not the patient's age or time elapsed since tooth eruption.*
- *Sealants should be placed on surfaces judged to be at high risk or surfaces that already exhibit incipient carious lesions to inhibit lesion progression.*
- *Sealant placement methods should include careful cleaning of the pits and fissures without removal of any appreciable enamel.*
- *A low-viscosity hydrophilic material bonding layer, as part of or under the actual sealant, is recommended for long-term retention and effectiveness.*
- *Glass ionomer materials could be used as transitional sealants.*

INDICATIONS

- Deep, retentive pits and fissures, which may cause wedging of an explorer
- Stained pits and fissures with minimum appearance of decalcification
- No radiographic or clinical evidence of proximal caries
- Possibility of adequate isolation
- Questionable enamel caries in pits and fissures
- Caries free pit and fissures
- If the patient desires
- Caries pattern indicative of more than one lesion per year

- Morphology of pits at risk of caries
- Factors associated with increased caries incidence
- Routine dental care with active preventive dentistry program
- Community based sealant program

CONTRAINDICATIONS

- Well coalesced, self cleansing pits and fissures
- Radiographic or clinical evidence of interproximal caries tooth not fully erupted
- Isolation not possible
- Life expectancy of tooth is limited
- Dentinal caries
- Lack of preventive practices

CLINICAL TECHNIQUE FOR PLACEMENT OF PIT AND FISSURE SEALANT

- **Step 1: Tray setup**

- **Step 2: Isolation of tooth**

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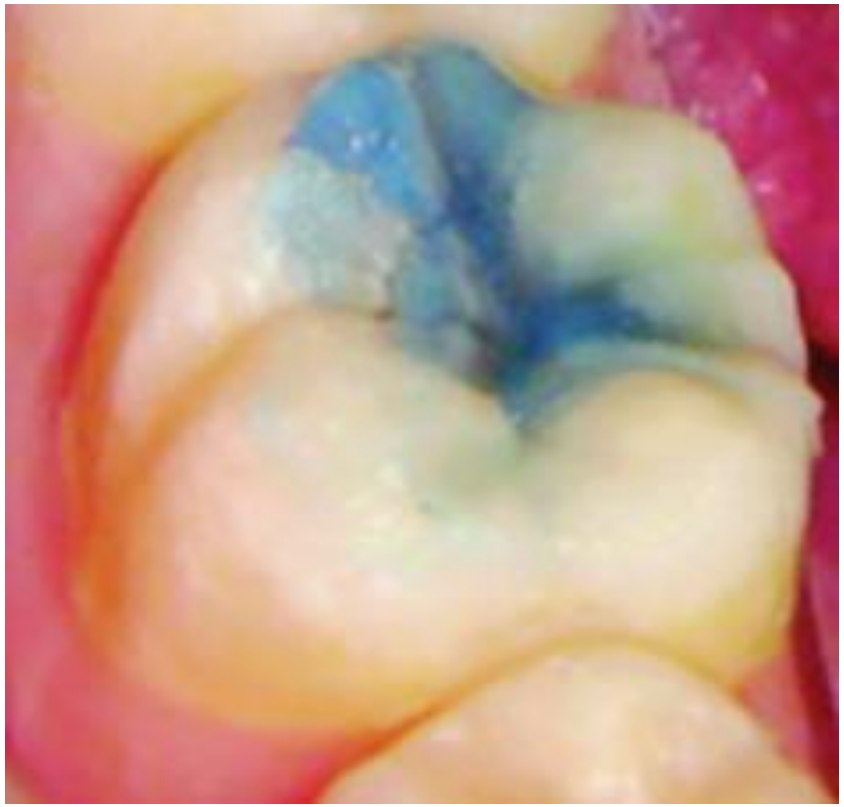
- Step 3: **Tooth preparation**
- Air abrasion with aluminium oxide particles
- Use of sodium bicarbonate air polishing system
- Enameloplasty

Enameloplasty

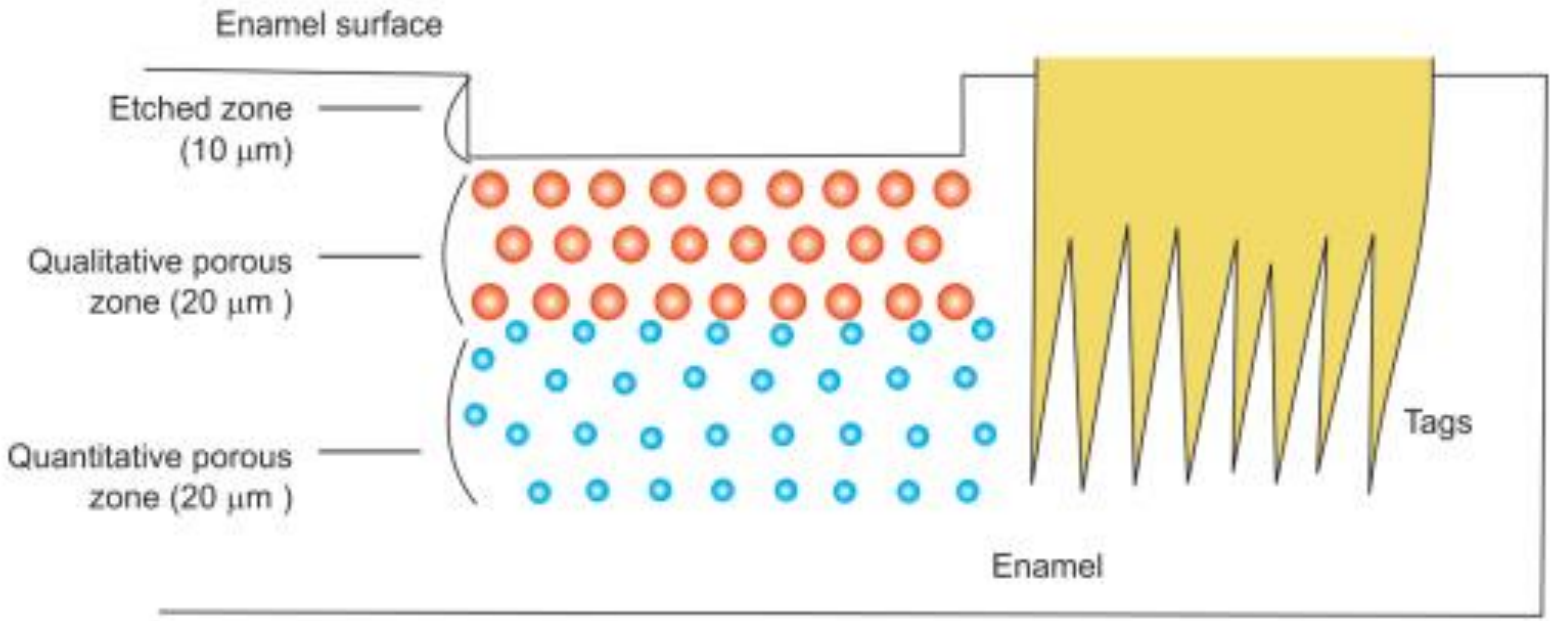
- **Step 4:Acid Etching tooth surface**
- 37% phosphoric acid is recommended
- Most acceptable acid etching time given in International Association for Dental Research(IADR) sealant symposium in 1991.

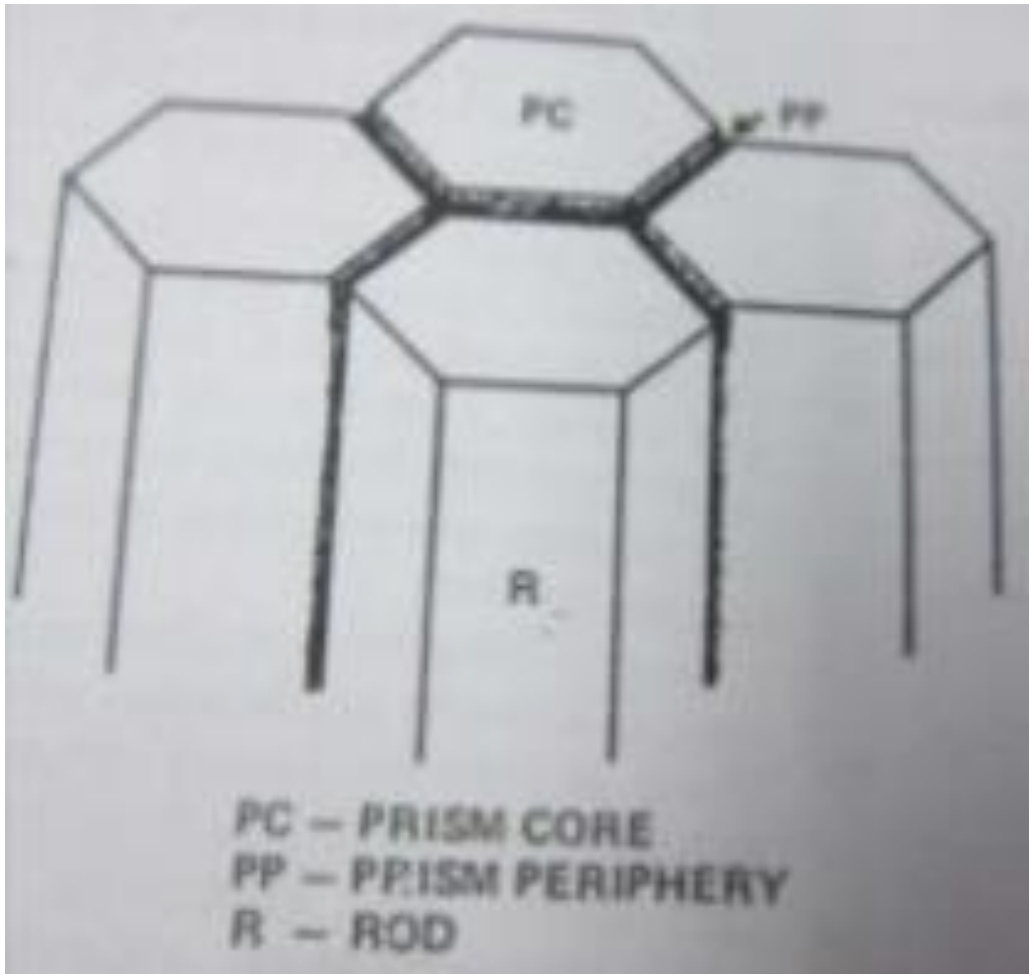
Step	Primary teeth	Permanent teeth
Acid etch	30 sec	20sec
Wash	30sec	30sec
Dry	15sec	15sec

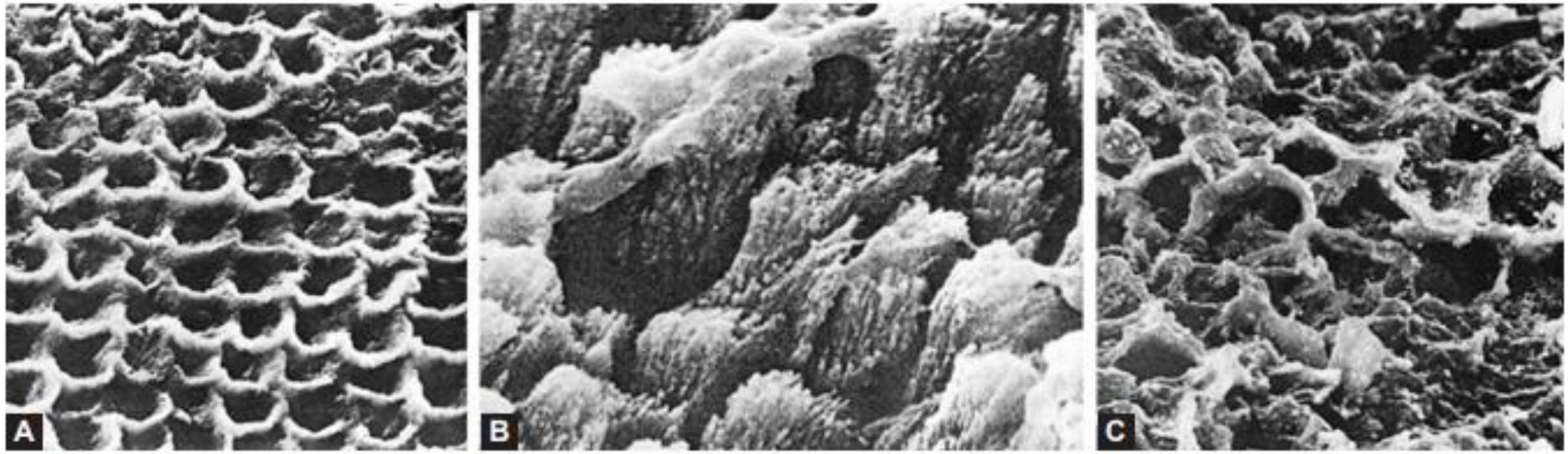


Acid etching

- Zones of etching




PC
PP
R
PC – PRISM CORE
PP – PRISM PERIPHERY
R – ROD



Type 1(A): There is generalized roughening of enamel surface but with a distinct hollowing of prism centers and relatively intact peripheral regions

Type 2(B): Prism peripheries appear to be damaged. Prism cores are left projecting toward original enamel surface

Type 3(C): Show neither type 1 nor 2 etching pattern but appear as generalized surface roughening

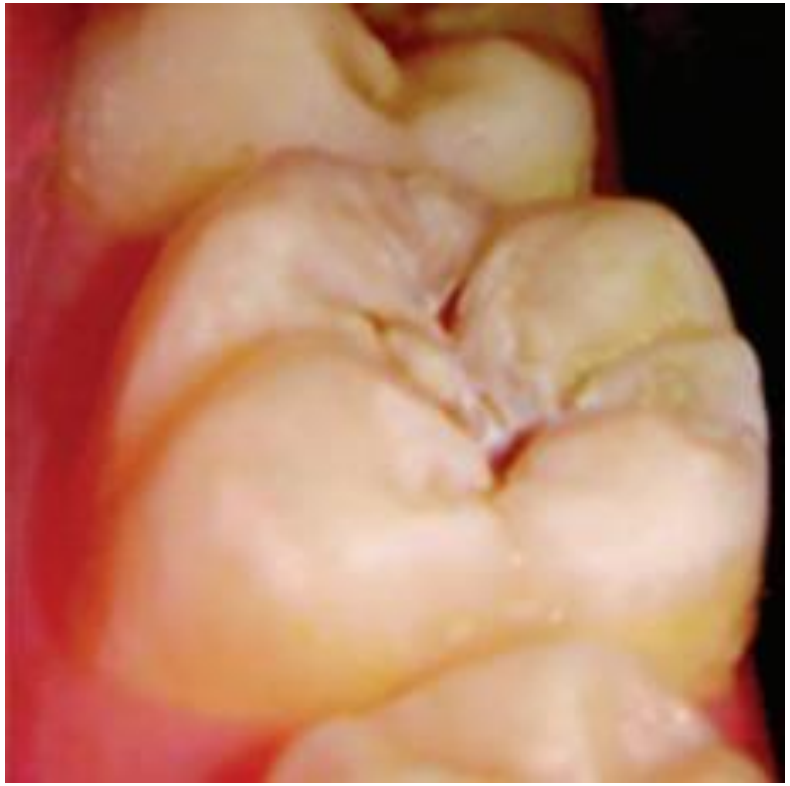
- **Step 5: Rinse and dry etched tooth surface**
- Rinse the etched tooth surface with air water spray for 30 seconds.

• This removes the etching agent and reaction products from etched enamel surface.

• Dry the tooth for 15 seconds with uncontaminated compressed air.

• The dried etched enamel should have a frosted white appearance

• If salivary contamination has occurred, re-etch for 10 seconds and repeat the procedure.



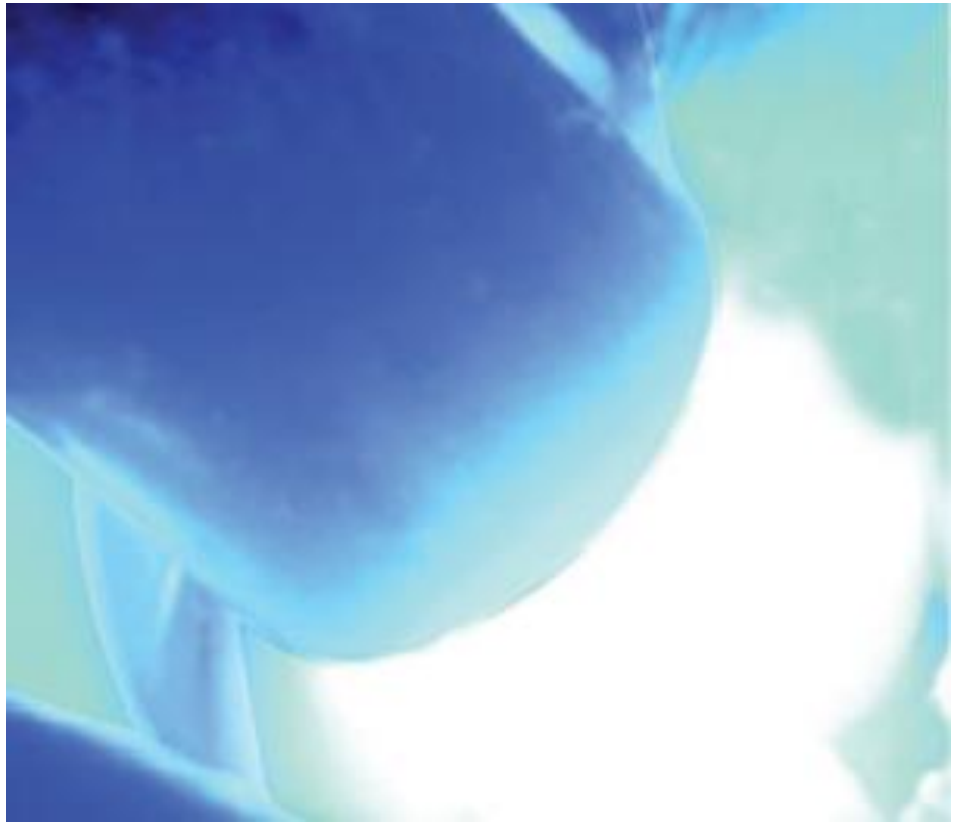
Etched tooth surface

- **Step 6: Application of bonding agent**
- Application of halogenated bonding agent after etching displaces saliva from enamel thereby improving sealant wetting of surface and increases the bond strength both in saliva-contaminated enamel and in uncontaminated enamel.
- Apply a hydrophilic bonding agent, prior to sealant application may improve the retention with teeth that cannot be isolated properly.
- Then cure it.

- **Step 7: Application of sealant**
- Sealant material is then applied to the tooth acc to manufacturers instructions.
- Be careful not to corporate air bubbles in the material
- With mandibular teeth apply the sealant at the distal aspect and allow it to flow mesially and with maxillary teeth vice versa.
- Then using a fine brush/applicator carry a thin layer up the cuspal inclines to seal secondary and supplemental fissures.

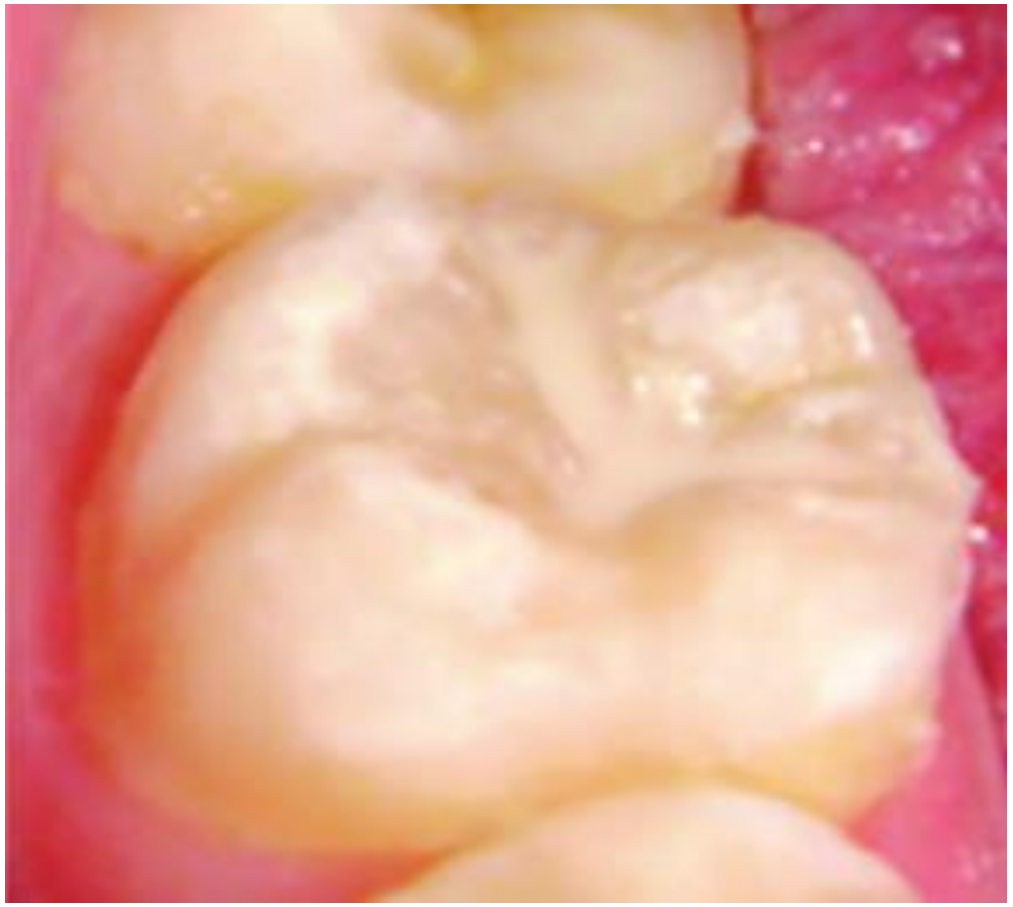
Appplication of sealant

- **Step 8: Cure sealant**
- Cure according to the manufacturer's recommended time for curing
- For light cured sealants, polymerization should be initiated quickly after the sealant is placed on the etched surface to help minimize potential contamination.



Curing the sealant

- **Step 9: Explore the sealed tooth surface and evaluate occlusion**
- Explore the entire tooth surface for pits and voids that may have not been sealed.
- Evaluate occlusion of sealed tooth surface with articulating paper to determine if any excessive sealant is present and needs to be removed.
- A small discrepancy in occlusion in case of unfilled sealant is easily tolerated as the cement abrades away but in case of filled resin sealant occlusal adjustment is a must to avoid discomfort.



Post sealant application

- **Step 10: Recall and Re evaluation**
- Recall and check the patient at subsequent visits.
- It is necessary to re-evaluate sealed tooth surface for loss of material, exposure of voids and caries development, especially in the first 6 month of placement.
- Although a single application of resin fissure sealant has been shown to be beneficial in reducing caries of a population, on an individual basis, there is general agreement that the caries preventive effect of resin fissure sealant relies on the maintenance of integrity of the fissure sealants.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What we discussed in the last class…….!

CRITICAL ISSUES REGARDING PIT AND FISSURE SEALANT USAGE

- Sealant retention
- Parental attitude toward sealants
- Physicians knowledge regarding sealants
- Cost effectiveness of a sealant
- Estrogenicity issue

FLUORIDE RELEASING SEALANTS

- Garcia Godoy (1997): Found out that all the fluoridated sealant had the greatest amount of fluoride release by 24 hours after mixing and the fluoride release declined sharply thereafter.
- For example, Seal-Rite® (Pulpdent), FluoroShield® (Dentsply (SDI).

CLEAR PIT AND FISSURE SEALANT

- This type of sealant is esthetic
- Difficult to detect in recall visit
- For example, Helioseal®: Changes from green to white

COLORED PIT AND FISSURE SEALANT

- The sealant is clear to begin with but after polymerization it changes its color.
- The degree of color change is also an indicator of its setting and adequate polymerization.
- Easy to see during placement and recall
- For example, Clinpro®—changes to pink on setting

FLUORESCING PIT AND FISSURE SEALANT

- This sealant eliminates the guesswork involved with placing sealants and confirming placement during recall appointments.
- Through the use of a UV pen light, this sealant fluoresces a blue/white color.
- The fluorescent glow provides clinicians with a visual verification of the sealant margins at the time of placement and offers the easiest way to verify retention and inspect margins during patient recall appointments.
- For example, Delton Seal-N-Glo (Dentsply).

MOIST BONDING PIT AND FISSURE SEALANT

- This is the first pit and fissure sealant resin that can be applied in a moist field.
- Embrace WetBond incorporates di-, tri- and multifunctional acrylate monomers into an advanced acid integrating chemistry that is activated by moisture.
- When placed in the presence of moisture, the sealant spreads over the enamel surface (A traditional sealant does not spread over a moist tooth surface because of its hydrophobic nature). Because of its unique chemistry, Embrace WetBond is miscible with water and flows into moisture-containing etched enamel and combines with it.

- It forms a unique resin acid-integrating network (RAIN) that improves penetration into pits and fissures and provides superior sealing of the margins.
- It bonds chemically and micromechanically to the moist tooth, integrating with the tooth structure to create a strong, margin-free bond that virtually eliminates microleakage.
- Its advantages include wet bonding, tooth integrating, no marginal chipping, no need of bonding agent and contains no Bisphenol A; Bis-GMA or Bis-DMA.

- For example, Embrace WetBond™ (Pulpdent Corporation).

PIT AND FISSURE SEALANT WITH ACP

- It is a light-cured sealant that contains the “smart material” amorphous calcium phosphate (ACP) that is more resilient and flexible, creating a stronger, longer lasting sealant.
- ACP is referred to as a “smart material” because it only releases calcium and phosphate ions when the pH drops to 5.9. Once the calcium phosphate is released, it will act to neutralize the acid and buffer the pH.
- ACP acts as reinforcement to the tooth’s natural defense system only when it is needed.

- It has a controlled flowability that keeps the sealant on the tooth structure while completely filling occlusal surfaces and it forms a chemical and thermal barrier protecting the tooth enamel on the occlusal surface from carious attacks.
- For example, Aegis® Pit and fissure sealant.

HYDROPHILIC FLUORESCENT BPA FREE PIT AND FISSURE SEALANT

- This is a new sealant developed which combines the best properties of nearly all sealants.
- Some of its major properties are hydrophilic chemistry, advanced adhesive technology, fluorescent properties, thixotropic viscosity, BPA-free formula.

- Thus not only can it be used in wet environment but also is easy to place owing to thixotropic viscosity and is easy to follow up due to fluorescence.
- To prevent any estrogenicity issues the manufacturer has kept it BPA free.
- For example, UltraSeal XT® hydro.

CONCLUSION

In summary, clinical recommendations for the use of pit and fissure sealants are beneficial. The main recommendations are that sealing pit and fissures of primary and permanent teeth is safe and effective both in preventing and in arresting caries. However, the long term success is dependent on regular checkups and the renewal of the sealing if required.

PREVENTIVE RESIN RESTORATIONS (PRR)

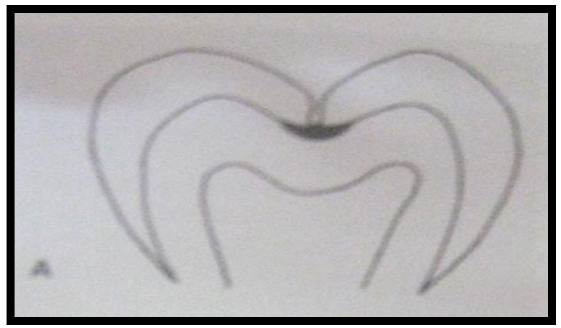
FISSURE SEALANT OR SEALANT RESTORATION

- It is a natural extension of Pit and Fissure sealants.

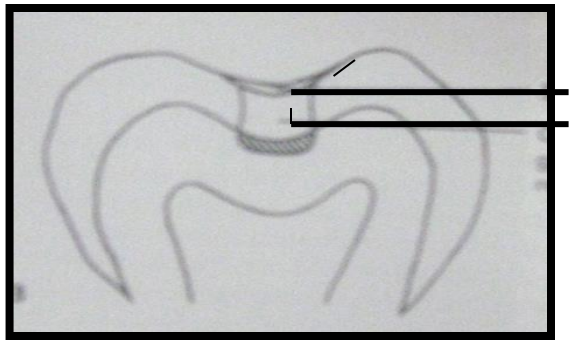
- INDICATIONS
- If caries is present in one area or part of the pits or fissures then that particular caries is restored and remaining pits and fissures are protected with sealants.

PREVENTIVE RESIN RESTORATION

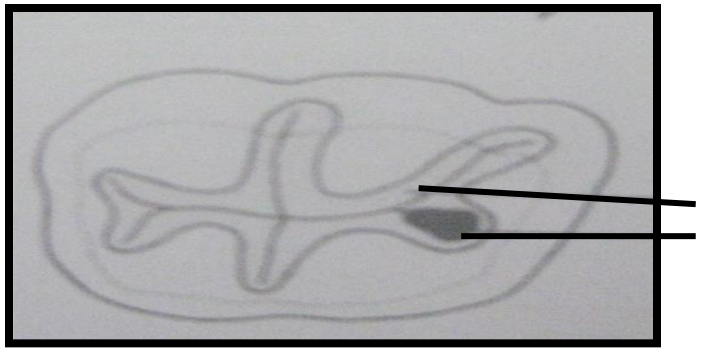
- ALTERNATIVE PROCEDURE TO RESTORE YOUNG PERMANENT TEETH
- REQUIRE MINIMAL TOOTH PREPERATION



CARIES IN DENTIN

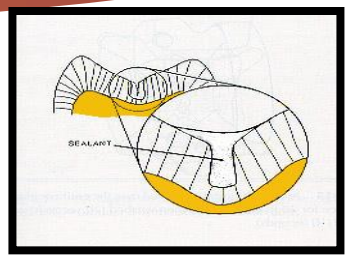


PREPERATION WITH COMPOSITE AND SEALANT

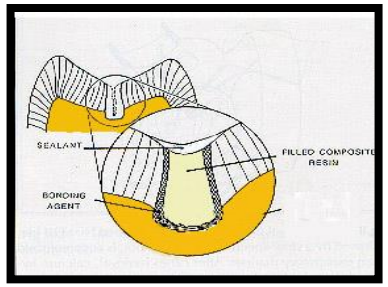


OCCLUSAL VIEW

- Three types of PRR – based on extent and depth of carious lesion as determined by exploratory preparation.



- TYPE A: suspicious PF where caries removal limited to enamel
- TYPE B: incipient lesion in dentin that is small and confined



- TYPE C: is characterized by deep caries and need for greater exploratory preparation in dentin

QUESTIONS????


thank
you