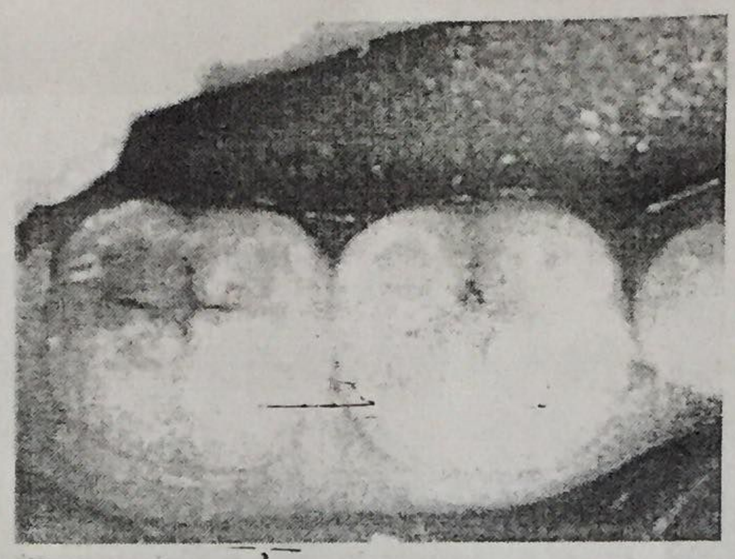
natural chewing function without developing occlusal caries, then the risk is over; examinations can be more cursory and less frequent.

3- Functional wear of occlusal surfaces:

Bruxism is one of the most prevalent, complex, and destructive dental functional disorders.



History

1-In 1895, Wilson reported the placement of cement in pits and fissures to prevent caries.

2-Bodecker in 1929 suggested that deep fissures could be broadened with a large round bur a procedure that is called enameloplasty.

3-In 1923 and again in 1936, Hyatt advocated the early insertion of small restoration in deep P. and F. before carious lesions had the opportunity to develop .He termed this procedure " prophylactic odontotomy". Again, this operation is more of a treatment procedure than a preventive approach because it requires the cutting of tooth structure.

4-In the late 1960s and early 1970, an other option become available – the use of pit and fissure sealants. With this option, a liquid plastic is flowed over the occlusal surface of the tooth where it penetrates the deep fissures to fill areas that cannot be cleaned with the toothbrush.

5-Several methods have unsuccessfully used in an attempt either to seal or to make the fissure have more resistant to caries. These attempts have included the use of topically applied e.g. zinc chloride, The use of ammoniacal silver nitrate ,The use of copper amalgam packed into the fissures.

Background on sealants

Three different kinds of plastics have been used as occlusal sealants:

1- Polyurethanes.
2- Cyanoacrylates.
3- Bisphenol A- glycidyl- methyl-acrylate (Bis –GMA).

The polyurethanes were the first to appear on the commercial market.

1- Too soft
2- Totally disintegrated in the mouth after 2 to 3 months.

The cyanoacrylates: also disintegrated after a slightly longer time

Bis – GMA: is now the sealant of choice

It is a mixture of Bis – GMA and methyl methacrylate. It's successful use was first reported by Buonocore in the late 1960. In 1972 Nuva – seal was the first successful commercial sealant to be on the market.

Some of them contain fillers, which makes it desirable to classify the commercial products into filled and unfilled sealants. In addition to the Bis-GMA, the filled sealants contain microscopic glass beads, quartz particles and other fillers used in composite restorations. The fillers make the sealant more resistant to abrasion. The fillers are coated with products such as Silane, to facilitate their combination with the Bis-GMA plastic.

Recommendations for use of fissure sealants in clinical practice

Patient selection

1- Children with special needs.
2- Children with caries in their primary dentition (dmfs > 2.1).

Tooth selection

Sealing of teeth should be undertaken whenever necessary, used in fluoridated and non-fluoridated area

1- Active fissure has been diagnosed
2- A high risk has been established
3- Fissures are deep and the patient or the parent either cannot, or will not, remove plaque effectively.
4- Advised in young children with long erupting teeth duration.
5- An intact occlusal surface is present where the contralateral tooth surface is carious or restored; this is because teeth on opposite sides of the mouth are usually equally prone to caries.
6- An incipient lesion exists in the pit-and-fissure.
7- Deep lingual pit.
8- In adult patients at risk for caries.
9- In deep pit and fissures of primary teeth.

Contraindication

1- Patient behavior does not permit use of adequate dry field techniques.

2- Caries exist on the other side of the tooth.
3- Large occlusal restoration already exists on occlusal surface.
4- Uncooperative parents.
5- Partially erupted teeth and moisture control not possible
6- Teeth show no signs of caries after 4 years in the oral cavity and patient is at low risk for caries.

Clinical circumstances

Where doubt exists over the caries status of a susceptible site, a radiograph should be taken. If it is certain that the carious lesion is confined to the enamel surface, a sealant should be placed and monitored closely. If caries is found to extend to dentine, a restoration should be placed.

The time for placing preventive sealant is based on the potential risk of an individual surface. Sealants may be most beneficial shortly after eruption of the teeth, and the time frame is often mentioned as 2–4 years after eruption. However, some studies show that though majority of pit and fissure caries occurs within the first few years after eruption, the development of decay may continue through adolescence and well into young adulthood.

Recent recommendations leave the decision of placing a sealant to the clinical judgment of the dentist. Therefore, sealants can be prescribed for adults and for primary teeth, when the dentist judges that there is sufficient risk of caries development or progression in that particular tooth. This has extended the use of sealants; however, most sealants are placed within the first few years after eruption.

Diagnosis of Occlusal caries:

Isolation, Dryness, Good lightening:

1- Mirror and blunt probe
2- X-ray
3- Diagnodent
4- Caries Detection Dye

Requisites for sealant retention:

For sealant retention the surface of the tooth must:-

1- Be clean.
2- Have deep, irregular pits and fissures.
3- Have a maximum- surface area.
4- Be absolutely dry at the time of sealant placement and uncontaminated with saliva residue.

Surface Cleanliness

The need and method for cleaning the tooth surface prior to sealant placement are controversial. Usually the acid etching alone is sufficient for surface cleaning. Some studies were accomplished without use of a prior prophylaxis, and others advocate the use of pumice and water slurry to clean the occlusal surface, which adds an extra time-consuming operation. Whatever, the cleaning preferences, all heavy stains, deposits, and debris should be off the occlusal surface before applying the sealant.

Pit and Fissure Depth

1- Deep irregular pit and fissure offer a much more favorable surface contour or sealant retention compared with broad, shallow fosse.
2- The deeper fissures protect the plastic sealant from the shear forces occurring as a result of masticatory movements.

Increasing the Surface Area:

Sealants do not bond directly to the teeth. They are retained mainly by adhesive forces .To increase the surface area, which in turn increases the adhesive potential, tooth conditioners (also called etchants), which are composed of a 30% - 40% conc. of phosphoric acid, are placed on the occlusal surface prior to the placement of the sealant.

Other factors affecting sealant retention:

1- Type of sealant
2- Position of teeth in the mouth (mandibular more than maxillary)
3- Clinical skill of the operation
4- Age of the child
5- Eruption status of the teeth

Application of the Sealant:

It is best to regard sealants as almost noninvasive (micro-invasive) therapy, as they are placed with no or very little mechanical modification of the surface. The procedures and materials are similar to those used when a restoration is placed. Therefore, sealants require the same care and attention to detail as do fillings.

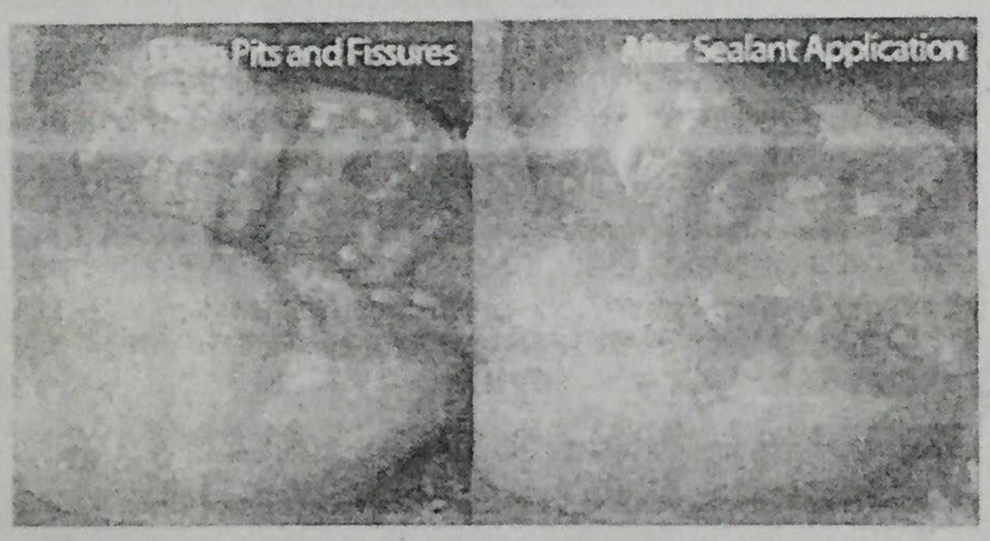
- **Tooth preparation:** The tooth to be fissure sealed must be plaque free and free from debris. This can be achieved using a prophylaxis cup or brush, with or without pumice or any non-fluoride, non-oil based paste, or by the use of air abrasion.
- **Enamel etch** Phosphoric acid etchant gel is applied for the manufacturer's recommended time, usually 20-30 seconds, 37% phosphoric acid is normally used to create micro-porosities within the enamel.
- **Rinsing and drying the teeth:** The tooth is fully **washed 20 s dried 15 s** replacing wet isolation materials with dry ones. The tooth surface should be frosty white, and not

shiny. If the tooth becomes wet by contamination from saliva, the etching procedure must be repeated.

- **Application of sealant** Sealant material is applied:
  1- Allowing it to flow into the pits and fissures; this reduces the risk of air bubbles forming.
  2- Pits and fissures are not overfilled.
  3- Occasionally the sealant material flows towards the distal surface of the tooth and a probe should be used to ensure that excess material is not left on this aspect as it could interfere with the occlusion or create an overhang, providing a susceptible site for dental caries to occur in the future
- **Curing** The sealant should be cured for the manufacturer recommended curing time usually between 20 – 30 s.
- **Finishing** All isolation materials should be removed and the tooth rinsed well. The surface of the sealant should be examined.

A probe is used gently to ensure that all fissures are sealed and the tooth surface is smooth. A successful sealant feels hard and smooth without the presence of bubbles.

The occlusion should be checked with articulating paper and any 'high spots' should be removed with a finishing bur or white stone as they will interfere with normal occlusion.



- **Follow-up** All sealed surfaces should be regularly monitored, and radiographs taken at appropriate intervals. When sealants are either partially or totally lost, it is important to maintain the tooth surface by re-applying the sealant. Risk assessment of the surface should be done, and if there is still need for protection against caries, a sealant can be placed on the location where it was lost. Therefore it is good practice to monitor sealed teeth on a yearly basis.

Preventive resin restoration

Some of pits and fissures are very narrow. They easily lead to plaque stagnation, which can then lead to lesion formation needed. This essentially changes the procedure to an invasive treatment, which is sometimes called "preventive resin restoration." Fissure preparation should then be done with very fine burs, where the shape of the bur and its

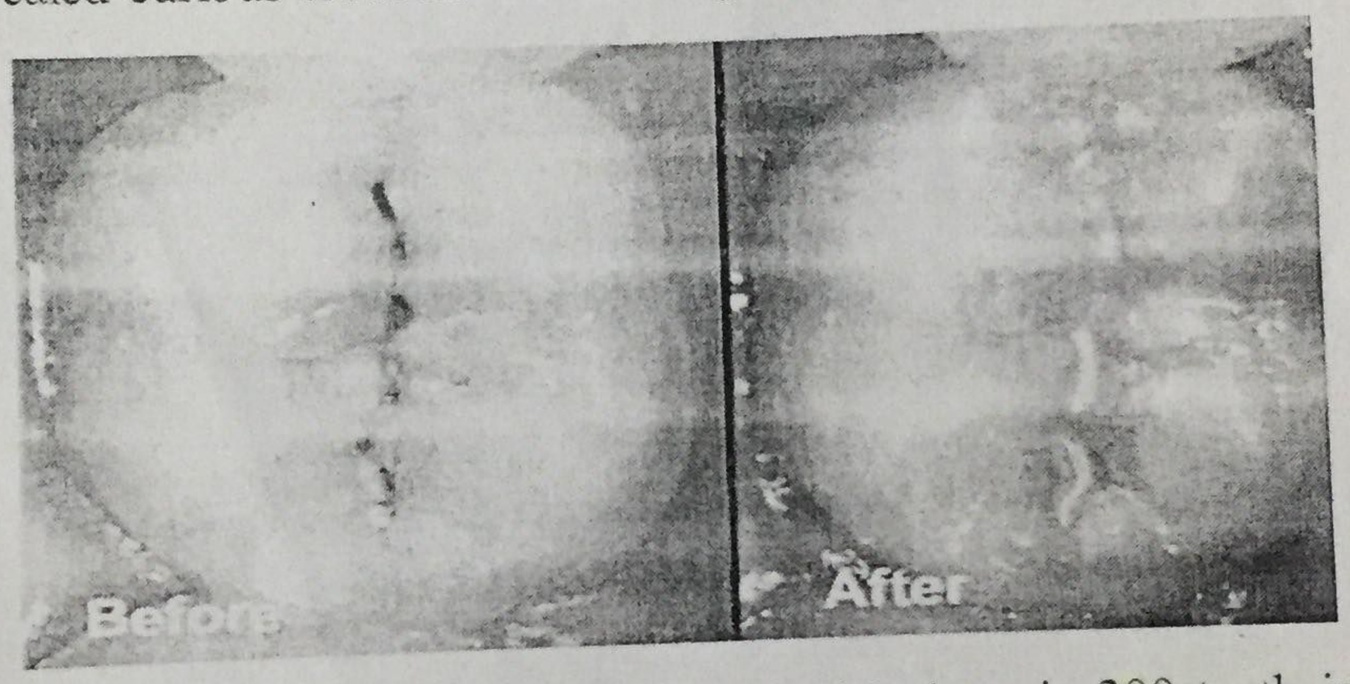
use result in minimal removal of tooth structure. Fissure preparation may assist in two ways.

First,by providing a more predictable surface for bonding of sealant material by removing unsupported carious enamel, the amorphous enamel layer, and some of the organic material in the fissure.

Second, due to the widening of the fissure space, the sealant will penetrate more easily and deeper than in an unprepared fissure. On the other hand, if fissure preparation is performed, the dentist might consider using a filled resin such as a flowable resin for replacement of the lost structure, since unfilled resin is not likely to show good wear characteristics in the widened fissure. This means that a restoration, though being rather small, is placed and not only sealing of the surface performed.

The placement of sealants over carious areas

Sealing over a carious lesion is important because of the professional concern about the possibility of caries progression under the sealant sites. In some studies sealants have been purposely placed over small, overt lesion, when compared with control teeth, many of the sealed carious teeth have been diagnosed as sound 3 years and 5 years later.



In another study, clinically detectable lesions small lesions in 300 teeth in to the dentin were covered for 5 years with Nuva - seal. After that time the bacterial cultures were essentially negative, and an apparent 83%reverrsal from a caries- active to a caries – inactive state was achieved ,during clinical and x-ray observation over the 5 years period, so long as the sealant remained intact the caries arrested.

Effect of sealants on enamel maturation and caries

In the past some have expressed concern that sealants will interfere with the natural process of enamel maturation of newly erupted teeth. This process of ion exchange and mineral deposition from the saliva begins as a new tooth emerges into the oral environment and continues throughout the life of the tooth. In a healthy environment the process is generally believed to be beneficial since it can lead to a hardening of the enamel as more resistant ions are deposited within the enamel surface.

From the point of view of the clinician as well as the patient, it would seem much more beneficial to seal the fissure and allow the underlying enamel to remain "immature" .than to expose the teeth to the dangers of occlusal caries and the subsequent removal of "mature" enamel during cavity preparation and restoration.

Effectiveness and Cost Effectiveness of Sealants

The sealants are effective in reducing caries. A review of studies on sealants found the effectiveness to be 87% at 1 year, and 60% at 4.0–4.5 years for preventive sealants. Another review found the reduction to be slightly lower with an average effect of 33%.

They are a simple, cost-effective means of preventing unnecessary suffering, and for preventing the start of the patient's downward spiral of fillings, crowns, root canal therapy, and finally extraction of teeth.

Sealant vs Amalgams

Sealant

1- Sealant used to prevent occlusal caries
2- Need 6-9 min.
3- The longevity 3-7 yrs
4- No damage in resealing
5- Painless procedure.

Amalgam

1- Amalgam is used to treat occlusal caries
2- Need 13-15 min. To place
3- Up to 10 yrs
4- Replace due to marginal decay,
5- Require more cutting tooth structure.

Glass Ionomer Sealants

The retention rate of glass-ionomer sealants is consistently found to be low. The caries preventive effect is often found to be equivalent to resin-based sealants. This is probably attributed to remnants of the glass-ionomer being found deep within the fissure, although no visible remnants is found on the surface. However, they are recommended only in situations where conventional resin sealants cannot be successfully used, such as erupting teeth, where complete moisture control may not be achieved, or where only part of the surface has erupted but considered to need the protection of a sealant, and then as an interim measure.