PIT AND FISSURE SEALANTS

AN OVERVIEW OF ISSUES RELATED TO DIAGNOSIS AND TREATMENT DECISIONS

Prepared by

William F. Vann, Jr., D.M.D, M.S., Ph.D., Professor
and
F. Thomas McIver, D.D.S., M.S., Professor

Department of Pediatric Dentistry
University of North Carolina School of Dentistry

A Maternal and Child Health
Center of Leadership in Pediatric Dentistry Education

U.S. Department of Health & Human Services
Public Health Service
HRSA
Health Resources & Services Administration
Maternal & Child Health Bureau

PIT AND FISSURE SEALANTS

Definition

A sealant is a clear or opaque plastic material that is applied to the pits and fissures of teeth where decay occurs most often. The purpose of the sealant is to provide a physical barrier to occlude pits and fissures and to protect them from bacteria and food. Because the sealant obliterates the deeper and more tortuous anatomy, it also facilitates oral hygiene efforts because the sealed tooth is easier to clean. Note Figure 1.

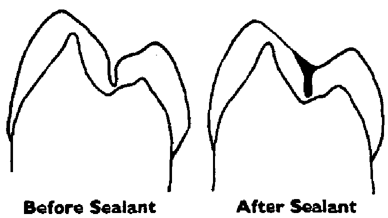

Figure 1. *Fissure filled by sealant*

Sealants have been used in clinical practice for nearly 30 years. The **first generation** sealants were liquid resins placed on the tooth, then polymerized with an ultraviolet light. The ultraviolet light has been replaced today by chemically-cured materials or materials that are cured with a more safe and efficient source of light polymerization than ultraviolet light waves.

Most sealants today are made of Bowen's formula called BIS-GMA, an acronym for a monomer that is the reaction product of bisphenol A and glycidyl methacrylate. This is the same material that comprises the matrix of composite resin filling materials. All sealants can be assigned to two basic categories according to the method of polymerization: (1) autopolymerizing or chemically-cured sealants, which are referred to also as **second generation sealants** and (2) **photopolymerizing** or light-cured sealants, which are referred to as **third generation sealants**.

Rationale

Why are sealants necessary? By nature of their anatomy, pit and fissure surfaces are often difficult to clean and thus at higher risk for caries. As illustrated in the magnification of an occlusal tooth surface cross-section in Figure 2, this deep and tortuous anatomy lends itself to the entrapment of food debris, plaque formation and bacterial growth. The illustration shows that the fissure is so small that a toothbrush bristle will not reach the depth of the fissure. Thus, even excellent home care efforts may not be successful in cleaning a deep fissure.

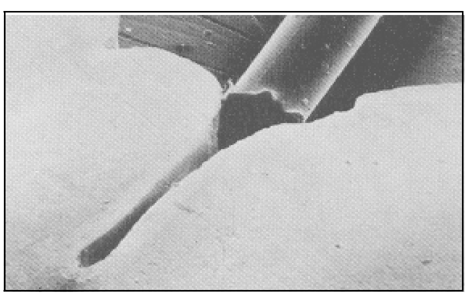

Figure 2. *Even a single tooth brush bristle is too large to clean fissure*

Another concern with pits and fissures is related to their susceptibility to fluoride protection. Research demonstrates that topical fluorides are less effective in protecting the pit and fissure surfaces than the smooth surfaces of enamel. This does not imply that fluorides are ineffective on pit and fissure surfaces; however, topical fluorides selectively benefit the smooth surfaces to a greater extent than pit and fissure surfaces and this difference is believed to be related to tooth anatomy.

The rationale for sealants is documented further by considering those surfaces that are most at risk for dental decay. Epidemiological investigations confirm that the occlusal surfaces alone account for well over 50% of the caries in children ages 6-18. This percentage is particularly dramatic when one considers that the occlusal surfaces represent only 12.5% of the tooth surfaces. To underscore the problem of pit and fissure decay further, recent studies show that over 90% of new carious lesions are confined to pits and fissures; thus, if sealants are used in all developmental fissures including facial pits and lingual fissures, significant decay reductions are possible.

Effectiveness of Sealants

Pit and fissure sealants were introduced to the profession in 1967 and their effectiveness was recognized by the ADA in 1971. Currently 10 different sealant materials are accepted by the ADA's Council on Scientific Affairs (JADA 127:353, 1996).

The best research methodology to assess sealant effectiveness is a half-mouth investigative approach wherein sealed teeth are compared to unsealed control teeth in the same mouth. This methodology was the foundation of the earliest sealant clinical trials. Once it became clear that sealants were effective, however, this research method had to be abandoned because it is unethical to *deny treatment proven to be effective treatment* from a control group in an investigation.

It is widely accepted today by both the research and practice communities that when sealants are totally retained on teeth, they will prevent caries. Therefore, sealant effectiveness is assessed today using sealant retention as a measure of effectiveness. Equations have been derived to calculate sealant effectiveness once retention is known. First generation sealants (ultraviolet-polymerized sealants) are vastly inferior to second (auto-polymerizing) and third generation (light-polymerizing) sealants. Second and third generation sealants perform about the same.

There are several studies that have followed sealants for over 10 years and dozens of studies have spanned 5-7 years (Caries Res 27:77-82, 1993). The highest rate of sealant loss in clinical studies is always in the first year following placement, reflecting the extent that success depends on meticulous operator technique in placing the sealant. In general, at 5-7 years complete retention rates are around 50% in those studies where sealants have been placed and monitored yearly without repair or re-sealing. In those studies where sealants have received maintenance and retreatment, a half dozen different studies report 85-95% success in study periods of 7-10 years.

Several factors should be noted relative to sealant effectiveness. While some studies show partially-retained sealants to be effective over a one or two year period, over the long-term partially-retained sealants are not effective. Accordingly, sealant maintenance is essential and this is probably the most difficult with adolescents who may be beyond the traditional risk period for caries. Unless these patients are monitored closely, sealants may serve only to delay the first restorations from childhood until adolescence. There are three other factors that weigh heavily in influencing sealant retention (Int Dent J 30:127-39, 1980). These include:

1. *Position of teeth in the mouth* — retention increases for more anterior teeth; retention is better in the mandible than the maxilla.
2. *Skill of the operator* — more skilled and/or clinically experienced operators produce better retention.
3. *Age of the patient* — the younger the child, the more difficult to maintain a dry field because of behavior and/or eruption status of teeth, resulting in poor retention.

Indications for Sealant Use

Please review the decision tree for the management of questionable pits and fissures found later in this section. Consideration for sealing teeth should take into account the following factors:

(1) patient age	(4) fluoride environment and history
(2) oral hygiene status	(5) dietary habits
(3) family and individual history of dental caries	(6) tooth-type and morphology

These factors may influence the decisions to seal or not to seal. More specific guidelines include:

1. Placement of sealants generally should be accomplished as soon as possible following the eruption of posterior teeth because this is the time when they have the greatest probability of decay. Thus, most indications for sealants will be for the child and adolescent patient population. However, sealant placement may be indicated at other times when a given child's caries risk status is modified. Examples might include changes in health status (e.g. xerostomia) or changes in oral hygiene status (e.g. compromised hygiene secondary to orthodontic appliances).
2. The placement of sealants should be limited to previously unrestored pits and fissures. All surfaces to be sealed should be scrutinized carefully for evidence of dentin caries. Presence of interproximal caries should be ruled out prior to the placement of pit and fissure sealants.
3. The surfaces of the tooth should contain pits and fissures susceptible to caries. Because they are more difficult to clean, deep and narrow pits and fissures are more susceptible to decay than wide and shallow pits. Usually primary teeth do not have deep pits and fissures, but they may be sealed if their anatomy makes them susceptible to decay. In brief, the judgement about whether a given tooth should be sealed is based strongly on the extent to which the tooth's fissures are coalesced.

4. A tissue flap (operculum) can interfere with the application procedure and lead to sealant loss or poor retention. For this reason the sealing of partially-emerged teeth is performed typically only on patients at high risk for caries development. When sealing partially erupted teeth, care must be taken to retract such tissue flaps with retraction cord, cotton pellets, or a rubber dam. Sometimes tissue flaps will make it necessary to defer placing the sealant until more eruption occurs. Occasionally, on maxillary molar teeth, half of the tooth will be erupted sufficiently to seal the mesial pit and the distal aspect can be sealed later, after further eruption. Sometimes local anesthesia is essential to provide comfortable sealant placement for emerging teeth.
5. Ideally, patients receiving sealants should be on some type of preventive fluoride program to reduce the risk of smooth surface caries.

Sealant Application Technique

1. **Preparation of Tooth**: An entire quadrant or a single tooth may be prepared for sealant application. A careful examination should be used to verify that there is no decay using careful lighting and illumination after air drying. The explorer should be used sparingly or with care because a sharp explorer can damage the fragile outer enamel morphology. There is good evidence that desiccation/illumination without an explorer examination may be superior to the use of the explorer as an adjunct to desiccation and illumination.

   The tooth is cleaned well (10-15 seconds) with a prophy brush and a mixture of flour of pumice and water. It is important that the pumice mixture contain no oil or fluoride. Also, because fluoride renders the outer layer of enamel more resistant to demineralization or acid etching, fluoride treatment if indicated should be accomplished ***after*** the sealant is placed, ***not before***. After the surfaces to be sealed have been cleaned thoroughly, they are **washed well for 10-15 seconds** and **dried well for 10-15 seconds**.

2. **Isolation Techniques**: Prior to placing sealants, careful consideration should be given to the method of isolating the teeth because the maintenance of a dry field is absolutely essential to the success of sealant retention. Maintaining a dry field of operation for sealant placement may be accomplished by two basic methods: (1) the use of the rubber dam or (2) the use of cotton roll holders, cotton rolls and Dri-Angles®.

   Research suggest that either method of isolation results in similar sealant retention rates. It is important to emphasize that retention depends heavily on the maintenance of a dry field during sealant placement.

   A. **Use of the rubber dam**

      If restorative is planned for the quadrant in which teeth are to be sealed, a rubber dam should be used because the teeth will be isolated already with the rubber dam after administration of local anesthesia. Some clinicians prefer to always use the rubber dam to place sealants. By using a topical anesthetic around the gingival tissues of the nonanesthetized tooth to be clamped for the dam, the clamp can usually be placed comfortably. Also, topical anesthetic can be placed around the rubber dam clamp beaks to assist with this procedure. (For permanent molars, Ivory 14 or 14A clamps are excellent. For newly erupted permanent molars, an Ivory 8A is excellent. The SSW 27 clamp is the clamp of choice for primary molars.)

   B. **Use of cotton roll holders, cotton rolls and Dri-Angles®**

      For maxillary teeth a Dri-Angle® is placed next to the tooth to be sealed. This both covers the parotid duct and isolates the tooth. The patient should be cautioned to stay open and to avoid licking the teeth. The mouth prop may be helpful. It is often helpful to use the mirror as a barrier between the tooth and tongue.

      In the mandibular arch, the use of the Dri-Angle® is unnecessary. The mirror is often a valuable aid in retracting the tongue away from the field of operation. Cotton roll holders are quite helpful in isolating the mandibular teeth and providing a barrier for the tongue. *Note that these instruments come in left and right versions.* In some instances the tooth may be kept dry by placing additional dry cotton rolls over the wet rolls. It may be necessary for the operator to use the mirror or fingers to retract the tongue and buccal vestibule while the assistant works with the cotton rolls.

3. **Acid Conditioning of the Tooth**: The next step is the acid etching or acid conditioning procedure. This is the most critical step in the sealant application technique because the retention of the sealant depends on the proper acid conditioning of the tooth's surface. Etching enhances the tooth's receptivity to bonding with the sealant. During this critical step, meticulous maintenance of a dry tooth surface is essential for bonding to be successful.

   The tooth is etched with 30-50% solution of unbuffered phosphoric acid. The etching time is 60 seconds for both primary and permanent teeth. It is important to keep the acid agitated gently and replenished during the acid conditioning period. Acid conditioning enhances enamel porosity, increases the surface area and further cleans the enamel surface. Acid conditioning should be limited to the tooth surfaces that will be sealed and care should be taken to keep the acid away from all soft tissues.

   After conditioning, the tooth is rinsed again with water for 10-15 seconds to remove the acid and its residues. Then the tooth is dried thoroughly for 10-15 seconds and examined carefully. The etched surface should not be disturbed with further instrumentation. If conditioning is adequate and the etch is good, the tooth will appear white, opaque and frosty. If the tooth does not have this appearance, it should be re-etched for another 30 seconds. Should saliva contact the tooth at any time during etching, the etching procedure should be repeated from the start. If saliva should contact the tooth after etching, re-rinse and dry the tooth and re-etch for 30 seconds. Reassess the tooth for the desired white, opaque frosty appearance. When a good etch has been achieved, the tooth is ready to be sealed.

4. **Sealant Placement**: The sealant procedure to be discussed first will be that for autopolymerized Delton®. This sealant system requires mixing a catalyst and base to form an unfilled BIS-GMA resin. One drop of base and one drop of catalyst are dispensed into the mixing well and mixed together for 15 seconds.

   Then, the sealant is carried to the tooth with a customized application dispenser used for the Delton® material. Alternately, a small brush or plastic instrument may be used to spread the sealant material smoothly on the tooth. The sealant should not be painted back and forth on the tooth surface because this may cause air bubbles to be trapped in the fissures. In placing the sealant, it is important that all pits and fissures be covered thoroughly with the sealant material.

   The resin tags of a sealant penetrate the etched and porous enamel, resulting in a mechanical, interlocking bond. This *resin tag phenomenon* is the critical feature for sealant retention. The necessity of a dry operation field is essential because contamination of the etched enamel with saliva or water will lead to bond failure.

   The mixing time is 15 seconds, the working time for placement is 45 seconds, and the polymerization or setting time starts in 60 seconds. It is critical that the sealant be applied within 60 seconds; otherwise, the polymerization process will be disturbed and resin bond to enamel may be compromised. Another 60 seconds are necessary for complete polymerization. Thus, a total time of 120 seconds is required from start to finish.

   When using a light-polymerization system, the sealant material is placed on all susceptible pits and fissures and a few seconds are allowed for the material to flow into the deep pits and fissures. The sealant is next cured with the light source according to the manufacturer's recommendations. Generally this will be at minimum a 20-second cure time for each surface that is being sealed.

5. **Checking the Polymerized Sealant:** After complete polymerization, any resin flash and ledges of sealant that extend beyond etched enamel should be removed with a sharp scaler, curette, or carbide finishing bur.

   An explorer should be used to examine the sealant after it has polymerized. Aggressive attempts to remove the sealant should be used to ensure that the bonding is successful. If the sealant has been placed properly in only the deep pits and fissures, occlusal adjustment will be unnecessary. Still, the occlusion should be examined for high spots and the sealant may be adjusted with round carbide finishing bur.

6. **Sealant Maintenance at Recall Appointment:** The sealant should be checked at subsequent recall appointments to evaluate its retention. The effectiveness of pit and fissure sealants is increased by monitoring and maintaining the intact sealant. If the sealant has been lost or only partially retained, more sealant can be added by repeating the steps in the application technique already described. It is not

necessary to remove residual sealant before reapplication. Any sealant material could be used to repair a partially retained sealant.

EXAMINATION OF VARIOUS MODIFICATIONS IN SEALANT TECHNIQUE

Many modifications have been suggested in the technique-related aspects of sealants use. While not all inclusive, this list explores some options.

(1) Options for Tooth Preparation

No tooth preparation
Preparation with only a toothbrush
Rubber cup with pumice slurry
Rotation brush with pumice slurry
Hydrogen peroxide "bubble-out"
Enameloplasty with a bur or burs
Prophy-jet® or Cavi-jet® unit preparation
Air Abrasion Preparation

Most of the work in this area has been done *in vitro*. (For a review see Main C. *et al*. Surface treatment studies aimed at streamlining fissure sealant application. *J Oral Rehabil* 1983;10:307-17). Almost all clinical trials have relied upon brush/pumice preparation. One that did not is reported by Donnan MF and Ball IA: A double-blind clinical trial to determine the importance of pumice prophylaxis on fissure sealant retention (*Brit Dent J* 1988;165:283-86). While several methods show promise, the preponderance of evidence supports the brush/pumice preparation, which is the standard against which all other methods are judged. This technique also is inexpensive and easy to use, so this represents our current teaching philosophy.

(2) Isolation Techniques

Rubber dam isolation
Cotton roll holder/Dri-Angle® isolation
Antisialogogue treatment

The literature supports isolation by any means. Good moisture control is the issue, not the particular method used.

(3) Acid Application Issues

Brush application
Sponge application
Cotton pellet application
Acid agitation *versus* no agitation
Etch solution *versus* etch gel

Frequent acid **replenishment** is believed to be desirable, but there are no data on this topic. Gels and solutions appear to work equally well, but gels need more thorough post-etch rinsing.

(4) Etch Time Considerations

One minute etch
Less than one minute etch

Scores of long-term clinical trials have relied upon a 60-sec etch time. Recently many manufacturers and clinicians have recommended a 15-sec etch time. While the 15 sec etch time may be appropriate for etching certain surfaces (e.g., smooth surfaces) or certain types of enamel (e.g., adult enamel), there are no clinical studies examining a 15-sec etch for sealants in children. Two clinical trials in children have examined a 20 sec etch time. (Eidelman E, Shapira J, Houpt M. The retention of fissure sealants using a 20 sec etching time: three year follow-up. *ASDC J Dent Child* 1988;55: 119-20 and Stephen *et al*. Retention of a filled fissure sealant using a reduced etch time: a two-year study in 6 to 8-year children. (*Br Dent J* 1982; 1553:232-3). The weight of evidence for etch time prior to sealants for children is on the side of a 60 sec etch and this represents our current teaching philosophy.

(5) Method of Placement

There is no data-driven support for any particular method. Care should be taken to avoid the incorporation of tiny air bubbles within the sealant. This will result in voids. Care should be taken **not** to apply too much sealant material. This will result in peripheral ledges and high occlusion.

(6) What Type of Sealant to Place?

Generation 1 Sealant (photo-cured via UV light)
Generation 2 Sealant (auto or chemically-cured)
Generation 3 Sealant (photo-cured via visible light)
Unfilled *versus* filled sealant
Tinted *versus* non-tinted *versus* opaque sealant
Nonfluoride *versus* fluoride-containing sealant
BIS-GMA *versus* non BIS-GMA sealant

The Generation 1 Sealants are no longer available because they were found in long-term clinical trials to be much less effective than the Generation 2 and 3 products. There are no significant differences in Generation 2 and 3 products, although in many long-term studies the auto-polymerized materials show slightly better, but not statistically significantly better performance. Recently there has been some speculation that this improvement might be related to the concept that auto-cured sealant gain better pit/fissure penetration than the photo-cured materials, which in some instances may be polymerized **on command** before they ooze fully into the depths of the pits and fissure. Accordingly, when using photo-cured sealants it may be beneficial prior to photo-curing to allow a few seconds for the material to flow into the depths of the tooth's fissures.

Theoretically one would anticipate that filled sealants would undergo less wear and abrasion than unfilled sealants, but clinical trials do not support this expectation; indeed, long-term studies show no differences in these two material-types. This material selection choice is largely one of the clinician's personal choice.

The use of tinted *versus* non-tinted *versus* opaque sealants is another in which the clinician's choice rules the day because long-term clinical trials do not support any given material. Some clinicians feel that they can see colored sealants better; others prefer clear because they want to be able to "see and monitor" stained fissures underneath the sealants. In the past, some white colored *opaque* sealants have been found to be more brittle than their clear counterparts and this is thought to be related to the additives that make the sealant material white in color. Some clinician still claim that opaque sealants are more brittle, but this criteria has not been supported with data.

There has been considerable excitement in recent years over fluoride-containing sealants and products on the market have been documented in laboratory studies to "release fluoride". However, the clinical outcomes of fluoride-containing sealants have not been documented.

All sealants are comprised of BIS-GMA constituents. In 1996 a study from Spain reported that the BIS-GMA material in sealants might be leached from BIS-GMA containing sealants and absorbed into the body (Olea, N et al. Estrogenicity of resin based composites and sealants used in dentistry *Environmental Health Preventive* 1996;104:298-305). Because BIS-GMA has been found to mimic ectogenic activity *in vitro,* concerns have been expressed that sealants might mimic the female estrogen hormone. The ADA Statement on this article is as follows: “The article entitled, ‘Estrogenicity of Resin-based Composites and Sealants Used in Dentistry,’ is interesting, but all estrogenic activities that have been observed in this paper are in a laboratory cell-culture environment. Whether this observation can be reproduced in clinical trials is questionable. Estrogenic potential may or may not survive the acid environment in the gastrointestinal tract after swallowing. The amount of leachable materials still needs to quantified. The biological implication of this observation needs to be further elucidated. Until more data can be cumulated, the ADA cannot at this time draw definitive conclusions from this observation" (3/5/96).

(7) Are there differences in sealant technique for primary versus permanent teeth?

Some clinicians suggest a longer etch time and/or mechanical preparation of the tooth prior to sealing primary molars. Theory and one clinical trial argue for no tooth preparation and a 60-sec etch time. See Ripa LW. "Sealant retention in primary teeth: A critique of clinical and laboratory studies." *J Pedod* 1979;3:279. Our teaching philosophy embraces the 60-sec etch time prior to sealing primary teeth.

PREVENTIVE *VERSUS* THERAPEUTIC SEALANTS

Since their introduction to the profession in the mid-1970's, pit and fissure sealants have been advocated only for the use of ***caries prevention*** and their use for carious lesions has not been advocated. Because pit and fissure caries is not always easy to detect, the use of sealants on *questionable* carious pits and fissures has always been controversial. It is widely accepted that most pits and fissures are inoculated with mutans streptococci or other caries-causing microorganisms, so many argue that sealants should not be placed over *questionable* lesions. At the same time, the criteria for sealing those pits and fissures that are susceptible to an explorer catch has also come into question; indeed there is considerable evidence that the use of a sharp explorer may mislead clinicians or do harm. Several studies conclude that good illumination and air drying are superior to use of the explorer. Use of the explorer has been challenged because of the potential to damage fragile enamel that has the potential to remineralize. Furthermore, there is evidence the explorer may act to inoculate previously uninfected pits and fissures in the other quadrants.

There have been several excellent clinical trials to examine the effect of sealing carious lesions. Although the primary issue has been to determine the effect of sealing over incipient carious lesions, several clinical trials have examined sealing over frank caries (for review, see Swift ET "The Effect of Sealing Over Caries: A Review" *JADA* 1988;116:700-04). Findings from these studies have been impressive and collectively they have shown a decided decrease in the numbers of viable microorganisms in lesions under intact sealants. Furthermore, caries progression appears negligible. These benefits seem to result mainly from the sealant's ability to block nutrients from bacteria within the carious lesions. In addition, the acid-etching process and the inherent reparative ability of dentin may be involved to some extent. That is, acid-etching probably kills most microorganisms within its reach and dentin is amendable to repair via pulpal nutrients.

In early 1994 a National Workshop on Guidelines for Sealant Use developed guidelines for the use of pit and fissure sealants in public and private programs (see proceedings published in the *J Pub Hlth Dent* 1995;55(5):263-73). These guidelines, illustrated in the Sealant Decision-Tree on the next page, recommend the *sealing of enamel caries* rather than the restoration of ***enamel caries***. This concept was endorsed by the American Dental Association (*JADA* 1995;126:185, Special Supplement, June), and it represents the current teaching philosophy in our department.

For purposes of nomenclature and patient record documentation, however, any sealant placed on questionable or frank enamel caries will be called a ***therapeutic sealant***. The conventional sealant placed for preventive purposes will be referred to simply as a ***sealant***. For purposes of ADA coding, all sealants will be coded as 01351.

Page for decision tree

DIAGNOSTIC ISSUES

The following interpretation table can assist in making the correct diagnosis for the extent of caries in occlusal pits and fissures. ***The clinician should in all instances examine radiographs carefully for evidence of dentinal caries. Dentinal caries should be treated with restorative procedures.***

Clinical Finding	Interpretation	Treatment
Chalkiness of the tooth structure at the base of the fissure/pit	Demineralized enamel	Sealant
* Softening in the tooth structure at the base of the fissure/pit	Demineralized enamel only	Sealant
* Softening in the tooth structure at the base of the fissure/pit	Demineralized enamel and cariously involved dentin	Restoration
Brown-gray discoloration radiating peripherally from the fissure/pit	Undermining carious lesion beneath the enamel	Restoration
Radiolucency beneath the occlusal enamel surface	Radiographic evidence of a carious lesion into dentin	Restoration

* Clinical judgement is used to differentiate these two findings and interpretations.

CRITERIA FOR DETERMINING PIT AND FISSURE CARIES RISK IN CHILDREN AND ADOLESCENTS

Caries is unlikely if:

1. No fissures/pits are present.
2. Fissures/pits are present and all of the following conditions are met:
   a. Patient is not in a high risk age group.
      >15 years of age.
   b. Good dental health as defined by the following:
      Good oral hygiene.
      Good dietary habits.
      Limited carious lesions in the past.
      Negative microbiologic assays.
   c. Good medical health.
      No current illness with oral manifestations.
      No medications with oral manifestations.
      No disability influencing oral health.

Caries *is* likely if fissures/pits are present and any one of the following criteria is met:

1. Patient is in a high risk age group.
   <15 years of age.
2. Compromised dental health.
   oral hygiene is suspect (gingivitis).
   Dietary habits are suspect (high sucrose intake).
   Several carious lesion in the past.
   Positive microbiologic assays (elevated *Strep. mutans/lactobacilli* counts).
   Fixed appliances are present.
   Sudden change in oral habits occurs.

Caries *may* be likely if fissures/pits are present and the patient has:

1. An illness with oral manifestations.
2. An illness requiring medication with oral side effects.
3. A disability influencing oral hygiene.

TREATMENT OF DENTINAL CARIES RELATED TO PITS AND FISSURES

Caries Excavation:

At the site of maximum carious involvement, enter the fissure/pit with the appropriate high speed instrument (245 or the appropriate sized round bur) and uncover the carious lesion. Then, excavate any carious tooth structure with the appropriate instrumentation (high speed round bur at stall-out speed or the largest slow speed round bur that will pass through the entry cut).

Restoration:

The selection of the restorative material will depend on the following conditions:

1. **Size of the lesion.** The larger the area of carious involvement, the weaker the remaining tooth structure will be and the greater the stress placed on the subsequent restorative material. While weakened tooth structure may be strengthened by bonded composite resin restorations, this must be considered against the potential for increased wear of large composite resin restorations. Generally, if a large area of the occlusal surface requires restoration, then amalgam should be used, because amalgam will be stronger and more wear resistant than composite resin.
2. **Occlusion.** While generalized occlusal wear occurs with composite resin restorations, the wear is intensified in areas of functional contact. Therefore, when most of the occlusion of a tooth will rest on the restorative material, amalgam should be selected over composite resin.
3. **Potential risk for future caries.** If the occlusal surface has pits and fissures in close proximity to the small carious lesion and if the tooth has some increased risk for future caries development, then the combined conservative composite resin restoration/sealant procedure should be used. This technique would preserve more tooth structure than an amalgam restoration.
4. **Ability to isolate the operating area.** It is beneficial for all amalgam and composite resin restorations to be performed in an isolated environment. However, it is mandatory that a composite resin or sealant procedure be done in an isolated environment that prohibits contamination of the etched tooth surfaces. If an area presents isolation difficulties, then amalgam should be used, because high copper amalgam restorations may be successful even if contaminated slightly with moisture.
5. **Esthetics.** If the patient desires an esthetic restoration, then composite resin should be considered as the restorative material.
6. **Material sensitivity.** If a patient has a known sensitivity to a certain restorative material, that material should not be used. There are a few case reports that document patients' sensitivity to mercury and composite resin.
7. **Economics.** Composite resins are usually more expensive than amalgams. Cost is higher because composite resins are more technique-sensitive and usually require more time.

Clinical Technique:

Conservative Amalgam Restoration. Once the decision has been made to place an amalgam, then conventional principles of cavity preparation, including enameloplasty, are utilized.

Conservative Composite Resin Restoration (CCRR). If a composite resin material is to be used to restore the tooth, the principles for cavity design for composite resin material must be followed. If fissures/pits adjacent to the cavity preparation are determined to be at risk for carious involvement in the near future, then they must be etched at the same time the enamel of the cavity preparation is etched. Bonding agent is applied according to the manufacturer's instructions to the preparation and other etched areas and cured. The composite resin material is then used to restore the preparation. Placement of a sealant over the resin and adjacent tooth structure can be used to further seal the at risk fissures/pits. This is accomplished by using a large burnisher to condense the composite resin material down into the fissures/pits (operative Dentistry's preferred method).

An alternative method would involve restoring the prepared area with composite resin material and then using sealant material to cover the at-risk fissures/pits. This is the Department of Pediatric Dentistry's preferred method.

After the material has been placed and cured, excess should be removed, the occlusion checked, and the material polished. For many CCRR's careful attention to removing excess composite prior to curing will avoid the need to adjust occlusion and polish.

MCHB
Maternal and Child Health Bureau

Supported in part by Project #MCJ-379494 from the Maternal and Child Health Bureau (Title V, Social Security Act), Health Resources and Services Administration, Department of Health And Human Services.