Pit and Fissure Sealants: An Overview

A Peer-Reviewed Publication
Written by Heidi Emmerling Muñoz, PhD and Jan Carver Silva, RDH, MSHS

Abstract
The dental profession has long regarded dental sealants as a primary element in the prevention of dental caries. Sealants provide a physical barrier between the spaces created by anatomical pits and fissures of posterior teeth and the cariogenic bacteria, thereby halting incipient lesions and preventing cavitation. Proper techniques must be implemented when placing sealants for optimal retention and patient safety. Patients must understand that sealants are one element for overall preventive dentistry. This article will review the epidemiology and efficacy of sealants; indications for use; the various types and categorization of sealants; characteristics for successful sealants; proper placement procedures for pit and fissure sealants; sealant maintenance; and factors to teach patients.

Educational Objectives:
At the end of this self-instructional educational activity, the participant will be able to:
1. Describe the basic placement of pit and fissure sealants.
2. Discuss the clinician’s role in optimizing best practices and safe use of pit and fissure sealants.
3. Educate patients on the role of dental sealants in an effective caries prevention program.

Author Profile
Heidi Emmerling Muñoz, PhD is a professor of English at Cosumnes River College. Prior to her current role, Dr. Muñoz served as interim director and professor of dental hygiene at Sacramento City College. Dr. Muñoz is a frequent contributor to RDH Magazine and has written articles and columns for a variety of publications. She can be reached at MunozH@crc.losrios.edu

Jan Carver Silva, RDH, MSHS is a professor of dental hygiene at Carrington College California, Sacramento campus. Ms. Carver Silva served as a California Dental Hygienists’ Association delegate and Vice President of the Sacramento Valley Component. She has contributed to RDH Magazine and can be reached at jcarver@carrington.edu

Author Disclosure
Heidi Emmerling Muñoz, PhD and Jan Carver Silva, RDH, MSHS have no commercial ties with the sponsors or providers of the unrestricted educational grant for this course.

Go Green, Go Online to take your course

Publication date: Oct. 2013
Expiration date: Sept. 2016

Supplement to PennWell Publications
PennWell is an ADA CERP-recognized provider
ADA CERP is a service of the American Dental Association to assist dental professionals in identifying quality providers of continuing dental education. ADA CERP does not approve or endorse individual providers or courses; nor does it imply acceptance of credit hours by boards of dentistry.

PennWell Designates this activity for 1 Continuing Educational Credit.

This course was written for dentists, dental hygienists, and assistants.

Earn 1 CE credit
This course was written for dentists, dental hygienists, and assistants.
Educational Objectives
At the end of this self-instructional educational activity, the participant will be able to:
1. Describe the basic placement of pit and fissure sealants.
2. Discuss the clinician’s role in optimizing best practices and safe use of pit and fissure sealants.
3. Educate patients on the role of dental sealants in an effective caries prevention program.

Abstract
The dental profession has long regarded dental sealants as a primary element in the prevention of dental caries. Sealants provide a physical barrier between the spaces created by anatomical pits and fissures of posterior teeth and the cariogenic bacteria, thereby halting incipient lesions and preventing cavitation. Proper techniques must be implemented when placing sealants for optimal retention and patient safety. Patients must understand that sealants are one element for overall preventive dentistry. This article will review the epidemiology and efficacy of sealants; indications for use; the various types and categorization of sealants; characteristics for successful sealants; proper placement procedures for pit and fissure sealants; sealant maintenance; and factors to teach patients.

Epidemiology and Efficacy
Dental caries is a problem for individuals of all ages. 23% of adults between the ages of 20-64, have untreated decay. Additionally, 23% of children ages 2-11 have untreated dental caries. The occlusal surfaces of teeth contain deep pits and small fissures, making these areas difficult to clean. The occlusal surfaces account for up to 90% of all caries in school aged children. The teeth at highest risk for caries are the permanent first and second molars. Dental sealants are a means to prevent caries by painting thin resin coatings on the pits and fissures of the occlusal tooth surfaces. Pit and fissure dental sealants have reduced caries over 70%.

Sealants work by means of simply providing a physical barrier between the susceptible pit and fissures of a tooth and the cariogenic bacteria. If the bacteria cannot penetrate the tooth, bacteria cannot cause decay.

Indications for Use
Candidates for sealants are determined based on caries risk. Risk factors include xerostomia from medications or other etiologies, orthodontics, and presence of incipient enamel lesions. In high risk individuals, all noncavitated posterior permanent teeth should be sealed upon eruption. Evidence shows that placement of pit-and-fissure sealants in teeth with incipient carious lesions significantly reduces the rate of cavitation progression. The fears that dental practitioners have that “sealing in” bacteria within an incipient lesion will result in rapid cavitation are unfounded. A systematic review by Griffin et al. found that sealing of non-cavitated caries in permanent teeth resulted in a ten percent annual reduction in caries progression over unsealed teeth.

Contraindications for pit and fissure sealant placement include radiographic evidence of proximal dental caries, pit and fissures that are well coalesced and self-cleansing, and low caries risk.

Categorization of Pit and Fissure Sealants
Pit and fissure sealants can be categorized by type (glass ionomer versus resin), polymerization (auto or self-cure versus photo or light cure polymerization) and filler. Self-cure sealants come in 2 parts. When they are mixed, they polymerize (harden). The advantage of self-cure sealants is that no special equipment is required. The disadvantages are that mixing is required, and working time is limited because polymerization begins when the material is mixed. The light cured sealants harden when exposed to a curing light. The advantages are that no mixing is required and there is increased working time due to control over the start of polymerization. The disadvantages of light cure sealants are the extra costs and disinfection time required for the curing light, protective shields, and/or glasses.

Pit and fissure sealants can be filled, unfilled, or can have a color. Filled sealants contain particles made of glass or quartz to increase the strength and resistance to wear, including occlusal forces. Sealants with fillers tend to be more viscous and therefore the flow is affected. Unfilled sealants are clear and do not contain the glass or quartz particles, therefore, they are less resistant to wear. Unfilled sealants may not require occlusal adjustment when placed, so this is an advantage during school and community health programs where sealants are placed. Sealants can be clear, tinted, or opaque. The purpose of a colored sealant is quick identification for evaluation during maintenance assessment. Colored sealants do not differ in retention.

Characteristics of Successful Pit and Fissure Sealants
The ideal sealant material is effective, easy to use, long-lasting, and safe. A majority of sealants in clinical use are made of BPA (bisphenol A-glycidyl methylacrylate). There is some controversy about the presence of BPA because it replicates estrogen, which may lead to hormonal reactions in the patient. Though small amounts of BPA have been found in the saliva of some patients immediately after sealant placement containing BPA, there have been no findings of systemic BPA or increased estrogen production as a result of the low levels of BPA found in dental sealants. As a precaution, the air-inhibited layer (the oily surface residue on the surface of a newly-placed sealant) should be removed with gauze immediately after curing.

The longer the sealant is retained, the more effective it is at protecting the tooth from decay. Recent research shows no significant difference in sealant retention between glass iono-
mer and resin-based sealants. Likewise, there is no significant difference in retention between autopolymerized and light-polymerized resin-based sealants. All current sealant materials appear to be equally retentive if applied correctly. The use of a primer and bonding layer prior to placement of the sealant has shown inconsistent results regarding sealant retention.

**Application Techniques**

Good application technique is essential for increasing retention of sealants. It is generally recommended to treat each quadrant separately, to use four-handed technique with an assistant, and to follow the manufacturer’s recommendations. The techniques of application vary slightly among available products, but we present the general techniques.

The patient should wear safety glasses to provide protection from the chemicals and curing light. Once the patient is prepared, the surface of the tooth must be cleaned. Cleaning the tooth surface permits maximum contact of the etch and the sealant with the enamel surface. Cleaning by toothbrushing alone has been shown to be as effective as handpiece prophylaxis in promoting sealant retention, which can reduce the cost of materials needed for the procedure.

The use of air abrasion followed by acid etching, as opposed to acid etching alone, has been shown to increase sealant retention.

Next, the tooth is etched with phosphoric acid according to the manufacturer’s directions. The acid can be in liquid (good flow but hard to control), gel (increased visibility but difficult to rinse), or semi-gel form (tinted with good visibility, control and rinses well) with a concentration of 15%-50% depending on the manufacturer. The purpose of the etching is to create microscopic pores into which the sealant material can flow, increasing retention. Etching time varies from 15-60 seconds, depending on the product.

When using a liquid etch, a small brush, sponge, or cotton pellet is used to apply the etchant. It is important to apply continuously throughout this step and to keep the surface moist. It is also important to dab or pat the etchant on the tooth rather than rubbing the etchant. The action of rubbing rather than dabbing the acid etchant can damage the enamel rods.

When using a gel or semi-gel, the etchant is applied with a manufacturer-supplied syringe or cannula. Care must be taken when etching the tooth so as not to spill or touch the phosphoric acid on the patient’s soft tissue. Acid burns can result if care is not taken.

After acid etching, the tooth must be rinsed and dried thoroughly for 15-20 seconds. A properly etched and dried tooth will have a chalky appearance. If it does not, then the etching should be repeated. Resin-based sealants require an absolutely dry surface until polymerization is complete. Proper isolation through the use of a rubber dam or an absorbent cellulose triangle and cotton rolls placed over the Stensen’s duct is essential to avoid salivary contamination of the sealant site. Salivary contamination during placement is the most common reason for sealant failure.

Glass ionomer sealants have the advantage of not needing a dry field to be effective. In fact, the application procedure for glass ionomers can involve pressing a saliva-moistened finger onto the occlusal surface to push the sealant material into the pits and fissures.

The sealant material is then carefully placed into the prepared pits and fissures. It is important not to over-manipulate the product as this can result in bubbles. Disposable instruments are supplied by the manufacturer. All areas should be covered without overfilling to minimize occlusal adjustment. After placement, the material is left in place for 10 seconds prior to curing to allow optimum penetration into the pores.

Curing time is usually 20-30 seconds, depending on the manufacturer. Longer curing time is related to increased retention. Glass ionomer sealants do not require light curing, however they will set faster with usage of a curing light.

After the sealant is placed, the occlusion should be checked and adjusted as necessary. Unfilled sealants often adjust on their own to the patient’s bite, however filled sealants are harder and more resistant to the patient’s natural occlusion and should be adjusted at the time of placement.

A new entry into the sealant market is giomer, a resin that contains glass ionomer fillers. While all sealant materials release fluoride initially, only giomer has the advantage of being able to continuously recharge and release fluoride over its life. This enables remineralization to occur.

In addition, giomer is able to buffer acid to neutral, providing another defense against decay. Giomer has the further advantage of requiring fewer steps to apply than most other materials. After cleaning and isolating, the self-etching primer is applied using a microbrush and gently air dried after 5 seconds; no rinsing is required. Next the sealant is applied with a syringe and light-cured.

**Sealant Maintenance**

Sealants should be re-examined every appointment and at least every six months for defects. Sealants can last years, depending on the product and placement. If a sealant needs to be replaced, it is essential to re-etch. Maintenance of existing sealants includes avoiding use of an air-powder polisher on intact existing sealants during maintenance appointments, as sealant wear increases with time of exposure to air-powder polisher abrasion.

**Factors to Teach the Patient**

Although pit and fissure sealants are extremely effective at preventing decay, the clinician should emphasize that sealants are one piece of the entire preventive program. The other parts of the caries preventive program that patients should be aware of include a low sugar diet, use of fluoride, and biofilm control. Patients should also be educated as to how pit and fissure sealants prevent dental caries, the need for examination
of the sealant at frequent, scheduled appointments, and need for replacement when indicated.

Conclusion
Caries is a problem for patients of all ages. Along with proper diet, fluoride, and biofilm control, pit and fissure sealants should be considered as part of an overall preventive program rather than an isolated procedure. The dental sealants bond to the etched enamel and seal the pits and fissures, preventing bacteria from initiating the decay process. Ideally, high-risk patients should have sealants placed on all posterior permanent teeth upon eruption. Proximal caries or self-cleansing pits and fissures are contraindications for dental sealants. The dental practitioner should be familiar with the various categories of sealants and the specific application methods for each product. Meticulous care should be used when placing sealants, especially limiting saliva contamination and using a four-handed technique with an assistant. With proper placement and maintenance, sealants can last years.

References

Author Profile
Heidi Emmerling Muñoz, PhD is a professor of English at Cosumnes River College. Prior to her current role, Dr. Muñoz served as interim director and professor of dental hygiene at Sacramento City College. Dr. Muñoz is a frequent contributor to RDH Magazine and has written articles and columns for a variety of publications. She can be reached at MunozH@crc.losrios.edu

Jan Carver Silva, RDH, MSHS is a professor of dental hygiene at Carrington College California, Sacramento campus. Ms. Carver Silva served as a California Dental Hygienists’ Association delegate and Vice President of the Sacramento Valley Component. She has contributed to RDH Magazine and can be reached at jcarver@carrington.edu

Author Disclosure
Heidi Emmerling Muñoz, PhD and Jan Carver Silva, RDH, MSHS have no commercial ties with the sponsors or providers of the unrestricted educational grant for this course.
### Questions

1. Dental caries is a problem for patients in which age group?
   - a. Children under age 10
   - b. Children and young adults aged 11-20
   - c. Adults over 20
   - d. All of the above

2. The teeth at highest risk for caries are:
   - a. Permanent first molars
   - b. Permanent second molars
   - c. a and b
   - d. None of the above

3. All of the following are characteristics of ideal sealant material EXCEPT:
   - a. Effective
   - b. BPA-free
   - c. Easy to use
   - d. Long lasting

4. Recent research shows which type of sealant has the highest retention?
   - a. Glass ionomer
   - b. Resin
   - c. Light polymerized
   - d. None of the above; they are all equal

5. Which of the following is a concern among some people specific to BPA in sealants?
   - a. Fluoride toxicity
   - b. Lack of retention
   - c. Adverse hormonal reactions
   - d. Sealing in bacteria

6. Sealant retention can be enhanced by:
   - a. Use of four-handed technique when placing sealants
   - b. A licensed dentist widening the fissures with a bur
   - c. Administration of local anesthetic
   - d. Removal of the air-inhibiting layer after placement

7. Which of the following can be used to clean the tooth prior to acid etching?
   - a. A toothbrush
   - b. A handpiece
   - c. An air polisher
   - d. All of the above can be used

8. The most common reason for resin-based sealant failure is:
   - a. Placement on an incipient lesion
   - b. Lack of occlusal adjustment
   - c. Salivary contamination
   - d. None of the above

9. How are sealants categorized?
   - a. Composition
   - b. Polymerization
   - c. Filler
   - d. All of the above

10. What types of filler are used in sealants?
    - a. Color
    - b. Quartz
    - c. Nothing
    - d. All of the above

11. After cleansing the tooth, prior to placing the sealant, the tooth is carefully etched with:
    - a. Hydrochloric acid
    - b. Phosphoric Acid
    - c. Hydrogen peroxide
    - d. Fluoride

12. What is the concentration of the etchant?
    - a. 10%
    - b. 75%
    - c. 83%
    - d. 15%-50% depending on the manufacturer

13. The proper sequence for placing resin-based sealants is:
    - a. Etch, dry, place, clean, rinse, occlusal adjustment
    - b. Rinse, etch, dry, place, occlusal adjustment, clean
    - c. Clean, dry, rinse, place, etch, occlusal adjustment
    - d. Clean, etch, rinse, dry, place, occlusal adjustment

14. Contraindications for pit and fissure sealants include:
    - a. Radiographic evidence of proximal caries
    - b. Incipient decay
    - c. Self-cleansing pits and fissures
    - d. a and c

15. Sealants should be re-examined:
    - a. Annually
    - b. At every appointment, or every 6 months
    - c. Every 3 months
    - d. It is unnecessary if placed properly
The cost for courses ranges from $20.00 to $110.00. PennWell is a California Provider. The California Provider number is 4527. Please contact PennWell for current term of acceptance. Participants are urged to contact their state dental boards for confirmation of passing by receipt of a verification form. Verification of Participation forms will be mailed within two weeks after taking an examination.

We encourage participant feedback pertaining to all courses. Please be sure to complete the survey included with the course. If you have any questions, please call Customer Service 216.398.7822.

EDUCATIONAL OBJECTIVES

1. Describe the basic placement of pit and fissure sealants.
2. Discuss the clinician’s role in optimizing best practices and the safe use of pit and fissure sealants.
3. Educate patients on the role of dental sealants in an effective caries prevention program.

COURSE EVALUATION

1. Were the individual course objectives met? Yes No
   Objective #1: Yes No
   Objective #3: Yes No

Please evaluate this course by responding to the following statements, using a scale of Excellent = 5 to Poor = 0.

2. To what extent were the course objectives accomplished overall? 5 4 3 2 1
3. Please rate your personal mastery of the course objectives. 5 4 3 2 1
4. How would you rate the objectives and educational methods? 5 4 3 2 1
5. How do you rate the author’s grasp of the topic? 5 4 3 2 1
6. Please rate the instructor’s effectiveness. 5 4 3 2 1
7. Was the overall administration of the course effective? 5 4 3 2 1
8. Please rate the usefulness and clinical applicability of this course. 5 4 3 2 1
9. Please rate the usefulness of the supplemental webliography. 5 4 3 2 1
10. Do you feel that the references were adequate? Yes No
11. Would you participate in a similar program on a different topic? Yes No
12. If any of the continuing education questions were unclear or ambiguous, please list them.

13. Was there any subject matter you found confusing? Please describe.
14. How long did it take you to complete this course?
15. What additional continuing dental education topics would you like to see?

PLEASE PHOTOCOPY ANSWER SHEET FOR ADDITIONAL PARTICIPANTS.