

PIT and Fissure Sealants – A Narrative Review

Dr. Henna Mir, Dr. Shivalingesh KK, Dr. Divya Srivastava, Dr. Adeeba Saleem, Dr. Swati Pathak, Dr. Waseem Ashraf.

Institute of Dental Sciences, Bareilly, U.P.

Corresponding Author: Dr. Henna Mir, Institute of Dental Sciences, Bareilly, U.P.

Citation of this Article: Dr. Henna Mir, Dr. Shivalingesh KK, Dr. Divya Srivastava, Dr. Adeeba Saleem, Dr. Swati Pathak, Dr. Waseem Ashraf. , “PIT and Fissure Sealants – A Narrative Review”, IJDSIR- February - 2020, Vol. – 3, Issue -1, P. No. 125 – 130.

Copyright: © 2020, Dr. Henna Mir, et al. This is an open access journal and article distributed under the terms of the creative commons attribution noncommercial License. Which allows others to remix, tweak, and build upon the work non commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Type of Publication: Review Article

Conflicts of Interest: Nil

Abstract

This article reviews the effectiveness of pit and fissure sealants in preventing caries, and different sealant material that are used for sealing pit and fissures. This article also reviews the indication, contraindication, application and the technique for the evaluation of sealants.

Keywords: Sealants, caries, pit and fissure.

Introduction

Dental caries is one of the most prevalent oral disease in the history of human affliction.¹ According to the National Center for Health Statistics in the United States, the prevalence of dental caries increases with age, from 21% (6-11 years of age) to 67% in adolescents (16-19 years of age) with 90% of carious lesions found in molar occlusal surfaces in children and young adults.² It is recognized that pit and fissures are highly susceptible to caries.³ Factors responsible for the high incidence of occlusal caries can be lack of salivary exposure to fissures (due to surface tension) and morphology of the pit and fissure. Approaches include primary prevention,

described as measures designed to prevent caries from developing, and secondary prevention, defined as strategies to prevent early caries from progressing to cavitation. Pit and fissure sealants can be used effectively on an individual basis as part of a comprehensive approach to caries prevention or as a public health measure for populations at risk. Sealants are applied to avoid the initiation and the development of caries by providing a physical barrier that prevents the aggregation of micro-organisms and food particles in pits and fissures.⁴

Background of Pit and Fissure Sealants Wilson claimed in 1895 that dental cement was placed in pits and fissures to prevent caries. In 1929, Bodecker proposed that deep fissures could be expanded with a wide round bur to improve self-cleaning of the occlusal surfaces, a procedure called enameloplasty. However, enameloplasty is accompanied by two major disadvantages. First of all, it needs a dentist that reduces its use immediately and secondly more sound tooth structure often needs to be removed. Hyatt advocated early insertion of small

restorations into deep pits and fissures in 1923 and again in 1936 before the development of carious lesions. He called this odontotomy prophylactic procedure. Such operation is more of a cure than a preventive approach, as it involves a dentist for the tooth structure cutting.⁵Buonocore in 1955 identified the acid etching technique using 85% phosphoric acid for 30 s as a method to improve the adhesion. The first sealant material, methyl cyanoacrylate, was developed by Cueto in the mid-1960s Buonocore made further progress and successful use of BIS-GMA resin in 1970 using ultraviolet light. Another option for using pit-and-fissure sealants became available in the late 1960s and early 1970s in which a liquid resin is flowed over the occlusal surface of the.⁶

Which Is The Best Sealant Material To Use?

1. Resin Based Sealants:

- Resin-based sealant materials (RBSs) are divided into four generations by the polymerization process:
 - a) The first generation of RBS, though no longer used but was polymerized by the action of ultraviolet rays on the initiators in the material that initiate polymerization.
 - b) Auto-polymerizing resin sealants (ARBS) or chemical sealants were the second generation; this reaction creates free radicals that initiate the resin sealant material polymerization.
 - c) The third generation consists of visible resin-based light-polymerizing sealants (LRBS). The visible light activates photoinitiators which are sensitive to visible light. By eliminating the mixing step, the sealant application incorporates fewer air bubbles.
 - d) The fourth generation is the fluoride-releasing resin-based sealants (FRBS). Addition of fluoride attempts to inhibit caries.

Polyacid-Modified Resin Based Sealants As a fissure sealant, polyacid-modified, resin-based composite

material, also known as a compomer, has been used. It combines the advantages of a visible light polymerized resin-based sealant with the GI sealant's fluoride releasing property.

2. Glass ionomer materials as sealants:

- It binds chemically to enamel and dentin through an acid-based reaction between a water-based solution of polyacrylic acid and fluoroaluminosilicate of glass powder. Low and high viscosity are the two types of GI sealants. Two concepts of the ART are ART sealant and ART restoration where ART sealant is a preventive component. The main advantage of a glass ionomer cement-based sealant is the continuous release of fluoride.⁶

3. Fluoride-Containing Sealant:

- In an assessment of the cumulative use of fluoride and dental sealants for 4 years, the total proportion of sealants preserved after an average of 2 years on occlusal surfaces of first molars was 92%. This study suggests that sealants for pit and fissure confer additional caries-preventive benefits over and above those of fluoride therapy alone.⁷

4. Filled Vs. Unfilled:

Unfilled resin will penetrate deeper into the fissures and may therefore be retained better.

Besides this unfilled sealant, if left in occlusion with an opposing cusp tip, it will abrade easily, perhaps within 24 to 48 hours. Nonetheless, filled sealant may require adjustment included as a standard part of the application process, which not only increases the time and cost of the operation, but may also not allow the occlusal adjustment to be carried out by all auxiliaries who can administer sealant.

5. Colored Vs Clear

The first colored colored sealant (3 M's Concise White Sealant) was introduced to the American market in March

1977. Colour, as long as it is esthetically suitable, has clear advantages. During application it is easier to see the sealant and the retention of a white sealing agent is much easier to assess than with a clear sealing agent in later times. In addition, documenting retention over long periods with a colored sealant is much easier.⁷

6. Sealant vs. Fluoride Varnish

Several publications compared the efficacy of pit and fissure sealants in the prevention of caries on occlusal surfaces to that of fluoride varnish. A recent update of the Cochrane review found that there is little evidence that pit and fissure sealants have superior results in the prevention of occlusal caries in contrast with the fluoride varnish application.

7. Sealant vs. No Sealant

Fissure sealants are well known in the literature in the prevention of caries. The quality of evidence also indicates that sealants reduce the incidence of caries on sound occlusal surfaces by 76% relative to the non-use of sealants over two to three years.⁶

Indications

- The chosen fossa for sealants is well isolated with a restoration from another fossa.
- The selected area is limited to a fully erupted fossa although the distal fossa cannot be sealed due to insufficient eruption.
- Sealant is placed on an intact occlusal surface where the carious or restored tooth surface is present in the contralateral arch; this is because teeth on the opposite sides of the mouth are usually equally prone to caries.
- The pit and fissure with an incipient lesion.
- Sealant material can be flowed into the rest of pit and fissures over a conservative composite class I restoration, to enhance marginal integrity.⁸
- Primary molars can also be sometimes sealed when significantly deep grooves or pits are present.

- Slightly white or stained pit and fissure, especially in high caries-related patients.
- Buccal and lingual grooves of fully erupted teeth which are sufficiently free of gingiva or operculum.
- Lingual pits of incisors.⁹

Contraindications

- Synthetic porcelain restorations
- Veneers
- Amalgam restorations
- Gold foil restorations, inlays, onlays or crown
- Frank occlusal or interproximal surface caries
- Teeth which cannot be isolated enough
- Sealing margins of existing nonresin restorations
- Vital dentin, which is more sensitive than enamel and has a much poorer retention rate
- In children who are too young to cooperate during the procedure.⁹

Application of sealant:

Waggoner and Siegal provided a detailed description of the current thinking on sealant application techniques. The steps are as follows:

1. Pit and fissure surface cleaning

Prophy cup or brush with or without pumice, an explorer and efficient rinsing with water, a toothbrush and toothpaste, or air abrasion can be used to clean surfaces.

2. Isolation of the tooth

Rubber dam or cotton roll isolation is equally effective and results in similar retention rates. Sealants should not be applied on teeth until the occlusal surface is completely free of gingival tissue in most circumstances.

3. Etching the enamel surface

Usually liquid gel of orthophosphoric acid is used (35 per cent and 37 per cent) for 15 seconds.

4. Rinsing and drying the tooth

Rinsing and drying times should be sufficient to ensure the complete removal of all etching material from the tooth surface.

5. Applying the sealant

All the fissures and pits should be sealed.

6. Polymerization

- To avoid contamination, it is generally recommended that light cured sealants be polymerized immediately after application.

7. Evaluation of the sealant

- In order to ensure complete coverage of the occlusal surface and the occlusion interferences, the sealant should be inspected.¹⁴

8. Follow-Up (Recall-and-Repair)

- The average loss of sealant from permanent molars ranges from 5 to 10 per cent per year.

9. Esterogenicity

- Bisphenol-A (BPA) is the precursor chemical component of bisphenol-a dimethacrylate (Bis-DMA) and bisphenol-a glycidyl dimethacrylate (Bis-GMA), which are the most common monomers used in resin composite restorations and resin-based sealants.
- It is known for its estrogenic ability, with potential human reproductive and developmental toxicity.⁶

Bonding Agents For Sealants

- Feigal et al. in 1993 put forward the idea of using a bonding agent under the sealant when they used hydrophilic bonding materials to aid the bond strength in moist environment.
- The adhesive components can improve penetration into porosities of enamel and thus increase the strength of the bond.⁶

Criteria for Sealant Evaluation

- (A) Occlusal Sealants
- Rating Evaluation of:

Marginal Integrity

- Restorative material adjacent to the tooth and not detectable with an explorer
- Margin detectable with the explorer
- Crevice along the margin of visible width and depth
- Crevice formation with exposure of central fissure

Marginal Discoloration

- No color change at the tooth-sealant interface
- Discoloration noted along the margin in one area
- Discoloration noted along the margin in multiple areas
- Severe discoloration with evidence of penetration and leakage

Anatomical Form

- Harmonious and continuous with occlusal form and structure
- Change in anatomical form but all pits and fissures covered
- Loss of sealant from one or two pits or accessory grooves (partial loss), but no need to repair or replace sealant
- Loss of sealant from pits or accessory grooves (partial loss), with a need for replacement or repair of the sealant
- Loss of sealant from all pits (total loss)
- Partial loss due to occlusion
- Bubble (not connected with the margins)

(B) Buccal/Lingual Sealants Rating Evaluation of:

Marginal Integrity

- Restorative material adjacent to the tooth and not detectable with an explorer
- Margin detectable at the gingival surface due to continued eruption
- Margin detectable with the explorer
- Crevice along the margin of visible width and depth
- Crevice formation with exposure of groove

Marginal Discoloration

- No color change at the tooth-sealant interface
- Discoloration noted along the margin in one area
- Discoloration noted along the margin in multiple areas
- Severe discoloration with evidence of penetration and leakage

Anatomical Form

- Harmonious and continuous with occlusal form and structure
- Change in anatomical form due to excess of material
- Incomplete sealant due to continued eruption, additional groove observable
- Loss of sealant from part of the groove or pit (partial loss), but no need to repair or replace the sealant
- Loss of sealant from part of the groove or pit (partial loss), with a need to repair or replace the sealant
- Total loss of sealant
- Bubble (not connected with the margins)¹¹

Conclusion

As part of a comprehensive approach to caries prevention, Pit-and-fissure sealants can be used effectively. Although sealants were used for the prevention of primary caries, current evidence shows that sealants are also an important secondary preventive strategy when applied on early noncavitated carious lesions. Caries risk assessment is an important component of the decision-making process, and regular reassessment of a patient's caries risk status is necessary.⁴

References

1. Amid I, Tellez M, Pitts BN, Ekstrand RK, Ricketts D, Longbottom C, et al. Caries management pathways preserve dental tissues and promote oral health. *Community Dentistry and Oral Epidemiology* 2013;41:e12-e40.
2. Oulis JC, Berdouses DE, Homata ME, Polychronopoulou A. Prevalence of sealants in relation to dental caries on the permanent molars of 12 and 15-year-old Greek adolescents. A national pathfinder survey. *BioMed Central Public Health* 2011;11(2):100-7.
3. Chaitra TR, Reddy S, Devarasa GM, Ravishankar TL. Flowable resin used as a sealant in molars using conventional, enameloplasty and fissurotomy techniques: an in vitro study. *Journal Of Indian Society Of Pedodontics And Preventive Dentistry* 2010;28(3):145-50.
4. Beauchamp J, Caufield PW, Crall JJ, Donly K, Feigal R, Gooch B, et al. American Dental Association Council on Scientific Affairs. Evidence-based clinical recommendations for the use of pit-and-fissure sealants: a report of the American Dental Association Council on Scientific Affairs. *The Journal of the American Dental Association* 2008;139(3):257-68.
5. Khetani P, Sharma P, Singh S, Augustine V, Baruah K, Thumpala KV, et al. History and Selection of Pit and Fissure Sealants – A Review. *Journal of Medical and Dental Science Research* 2017;4(5):5-12.
6. Reem Naaman R, Housseiny A, Alamoudi N. The Use of Pit and Fissure Sealants—A Literature Review. *Journal of Dentistry* 2018;34(5):3-19.
7. Simonsen JR. Pit and fissure sealant: review of the literature. *Journal Of Pediatric Dentistry* 2002;24(5):393-414.
8. Harris N. *Primary Preventive Dentistry*. Ed 6th. San Antonio, Texas: Julie Levin Alexander, 2004.10: Pit and Fissure Sealants;286-300.
9. Mathew R, Narayan A, Babu E, Oommen V, Ibrahim H, Fatima S. Pit and Fissure Sealants: A Recent Advancement. *International Journal Of Oral Care And Research* 2016;4(4):284-7.

10. Locker D, Jokovic A, Kay JE. Prevention. Part 8: The use of pit and fissure sealants in preventing caries in the permanent dentition of children. *British Dental Journal* Volume 2003;195(7):375-8.
11. Feigal RJ, Musherure P, Gillespie B, et al. Improved sealant retention with bonding agents: A clinical study of two-bottle and single- bottle Systems. *Journal of Dental Research* 2000;79(11):1850-6.