

Pit and Fissure Sealant: A Review

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Abstract

In recent times, carious infection of the tooth is considered as a major worldwide concern, significantly impacting the health, safety and quality of life of the patients affected by it. The required routine oral hygiene procedure along with fluoride use ensures prevention against dental caries. Apart from these, another important prophylactic measure can be followed against the caries by sealing the pit and fissures of a tooth that is more prone to caries occurrence. The main purpose of this article is to present a general overview of the sealing of pits and fissures, materials typically used to seal the occlusal surfaces along with the implications and side effects. This article also presents a detailed review of safe, effective use and cost-effectiveness of pit and fissure sealants as a preventive measure for caries. The finding drawn from this is that primary, as well as permanent teeth, sealed pit and fissures are an efficient and appropriate approach for preventing and arresting dental caries. But conducting a proper regular dental check-up is necessary to ensure that there is no advanced tooth decay caused due to any leakage in the sealing.

Keywords: *Dental caries; Pit and Fissure sealants; Prophylactic therapy; Regular checkups.*

Introduction

A change in the composition of the bacterial biofilm causes dental caries which is a multifactorial infection. This change leads to an imbalance between the demineralization and remineralization process which gradually becomes the cause for the formation of a carious lesion in primary and permanent dentition. The instances of dental caries expanded the most in the nineteenth and twentieth century because of more and simple accessibility of sugar for the populace.¹ The availability and use of sugar became popular among the population of developed countries mainly. There has been a long and creative part of the dental battle against pit and fissure caries which includes innovations in the preventive measures like early physical blocking of pit and fissures with the help of zinc phosphate cement, eradication of fissures mechanically and chemically treated with silver nitrate. These preventive measures continued with the testing of new materials, methodology and technologies each year. Soon the technique of acid etch bonding to the surface of enamel came to limelight and a major step in its use was to prevent pit and fissure decays. Therefore the prevention for dental caries then focused on pit and fissure caries because tooth with pit and fissures is more prone and vulnerable to caries occurrence. These sights

are most convenient for the early occurrence of dental caries. In a recent study, the caries in the smooth surface showed a very notable decrease in the occurrence which might be an outcome due to the expanded utilization of fluoride.²

Fluoride is not as effective in the pit and fissures as on a smooth surface because the fluoride must follow up on the nearby level which isn't mechanically convenient with pit and fissure of the tooth. After all, the dental plaque develops without any disturbance in the pit and fissure of a tooth due to which the enamel gets dissolved by the repeated acid attacks.³ In children, the natural cleansing mechanism of oral cavity by lips, cheeks, and majorly by the tongue during biting of food and gulping is missing for which the occlusal surfaces of developing tooth is mainly affected due to absence of cleaning. In result to that, the bacteria and residual food products gather up in the pit and fissure that forms a plaque and then gradually results in demineralization and caries ultimately. Therefore a recent study showed that the use of sealants can be utilized in the pits along with fissures as a method of preventive intervention for dental caries in children during tooth eruption.⁴

Pit and Fissure Sealant Material: The terminology of pit and fissure sealants are mainly used to depict a material that forms a micromechanical bond, protective layer against the caries-producing bacteria when brought

into the occlusal pit as well as fissures of caries prone tooth. Pit and fissure sealants are divided into 3 sealant material.⁵

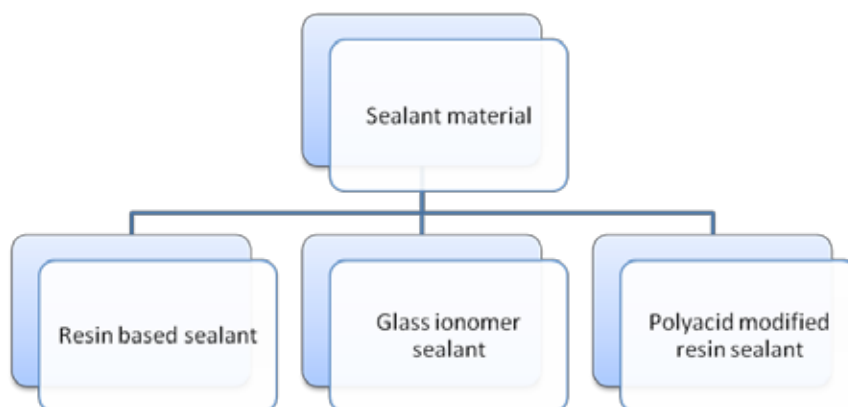


Figure 1. Classification of sealant material

The three major types of sealants are described as below:

1. Resin-based sealants (RBSs)

Determined by the method of polymerization, Resin-based sealants are classified into

- **1st gen:** The initiators in the materials that initiate polymerization are polymerized by the activity of UV rays. This sort is not, at this point being used. An example of 1st gen Resin-based sealants is Nuva-seal which was first introduced sealant to the market.
- **2nd gen:** They are known as the auto polymerizing resin-based sealants. Also sometimes called as chemically cured sealants. However this autopolymerizing resin-based sealants have now been supplanted by the 3rd era of RBSs.
- **3rd gen:** This sort involves visible light polymerizing resin-based sealants. Here, the visible light activates the photoinitiator which is available in the material of the sealant. This is very responsive to visible light in the frequency of about 470nm (blue area).⁶

Resin-based sealants can likewise be grouped by their consistency as (1) filled (2) unfilled. The addition of filler particle on sealants has fewer changes in clinical results. The filled type of sealant usually has high wear resistance but their capacity to enter into the pits and fissures is less. Whereas, unfilled type of sealant has low

viscosity but provide proper penetration into pits and fissures resulting in better retention. Based on translucency, sealant materials can also be divided as opaque and transparent. Opaque are white or tooth-colored sealants whereas transparent sealants are seen as clear, pink or amber. White opaque pit and fissure sealants have better visibility during application and to recognize clinically during routine checkups and follow up as compared to clear sealants.⁷

2. **GI sealant material:** Traditional glass ionomer materials are utilized as pit and fissure sealants. Through an acid-base response in between an aqueous-based polyacrylic acid solution and fluoroaluminosilicate glass powder, it forms a chemical bonding to enamel and dentin. This type of sealant is further grouped as (1) low viscosity type (2) high viscosity type. There is also a variety called resin-modified glass ionomer (RMGIC) which has been utilized as pit and fissure sealants. It is formed when the resin is mixed with glass ionomer cement. Continuous fluoride release is the main asset of GI cement-based sealant. Its preventive impact may also last after the noticeable loss of the material of the sealant. This material has an easy application method and is moisture friendly. Glass ionomer based sealants are mainly indicated in deep fissure primary molar which is hard to isolate because of the uncontrollable behavior of a child.⁸

Polyacid modified resin-based sealant: Otherwise called compomer, polyacid modified resin-based sealants is used as a material for sealing pit and fissures which joins the profitable properties of the visible light polymerized resin-based sealant which includes better adhesion property to enamel and dentin with the fluoride discharging property of the glass ionomer based sealants.⁹

Clinical Technique of Sealant Placement:

- 1. Cleaning and preparation of tooth:** There have been many studies discussing various techniques of enamel surface preparation preceding the acid etching and sealant use. The early application method for pit and fissure sealant includes cleaning of the tooth surface that is treated with pumice and water slurry with a rotating brush which can be pointed or flat ended. Before carrying out the procedure it is mandatory to remove plaque and debris from the enamel and the pits and fissures. Interference with etching technique and sealant penetration into the pits and fissures will occur if the debris is not removed properly from the enamel surface. The polishing of the tooth surface can be done by using the prophylaxis cup and pumice.
- 2. Isolation and drying of the tooth surface:** Prevention of salivary contamination during sealant application is considered to be the most significant and critical step in sealant application. The surface enamel that is etched can be contaminated if it is exposed to salivary proteins even for a split second. Hence a proper isolation of the tooth is necessary. The utilization of a barrier that is a rubber dam is considered to be the best method to accomplish isolation.¹⁰
- 3. Acid etching:** Acid etching is the procedure in which the monomer penetrates the micropores which are formed by etching. It also removes organic materials and debris from the surface. The degree of etching depends on mainly the concentration of acid and duration of exposure. Orthophosphoric acid is normally used in liquid form using a hairbrush for about 30-60 seconds.
- 4. Rinsing, drying, and isolating the tooth:** 30 seconds of rinsing along with 15 seconds for drying the tooth is convenient to remove all the acid etchants which help in achieving the result of characteristics chalky white frosty appearance. Isolation is mandatory in this stage because salivary

contamination at the stage is the major common cause of failure of sealant application.

- 5. Application of material:** After following the above steps and drying the tooth thoroughly, the particular sealant material is then placed on the tooth and is polymerized. Proper care should be taken for the prevention of air bubbles in the material while applying it to the tooth.
- 6. Sealant evaluation:** After polymerizing and before the removal of the rubber dam, the sealant should be examined properly by the operator for any deformity like voids, bubbles, or deficiencies in the material. The retention of the sealant ought to likewise be evaluated by the help of an explorer in a trial to dislodge it. Excess of sealant should be removed over the distal margin that may result in the formation of the ledge. Occlusal high points are also checked and if present is corrected.¹¹
- 7. Periodic maintenance:** Re-evaluation of the sealants is mandatory at recall visits. If any loss in the sealant material seen, a new fresh material can be applied over the old sealant.

Sealing of Primary Tooth: The primary teeth are more prone to carious activity to anatomy and lack of natural cleansing factor. Therefore primary teeth benefit the most from sealant application. If the tooth has deep fissures along with signs of decalcification, pit and fissure sealants are indicated. In the case of caries or restoration of adjacent teeth, sealants are also indicated. Children with medical, physical, and psychological impairments are advised to go for sealant application. For simplification of the clinical procedure to make it progressively worthy to small kids, the etching time is shortened to lessen the opportunity of moisture contact. The procedure time can also be shortened by using a self-etching bonding agent as an option in contrast to the regular acid etching method.¹²

Follow Up: There is a chance of loss of sealant from the molar tooth. Therefore regular maintenance of sealant is necessary to boost the efficiency, maintenance of peripheral integrity, and to provide the necessary protection. By visual method, tactile method and radiographically, the retention and durability of the sealants can be checked.¹³⁻¹⁵

Cost-Effectiveness of Dental Sealants: The most effective intervention which is also cost-effective is sealant application. Application of sealants on primary

or permanent tooth especially the molars lessens the much higher expense by the prevention of increasingly costly treatment. The sealants are mainly indicated and seem to be more cost-effective when utilized in children with a higher risk of caries on teeth that are more prone to bacterial invasion. Therefore it is highly prescribed that sealants ought to be applied specifically relying upon the caries risk of a youngster along with anatomy of the fissure. The cost-effectiveness of the sealants can be more enhanced by using trained dental professionals for sealant application, use of sealant material in which the rate of retention is higher and application of a sealant on the tooth specifically which are more prone to caries.¹⁶

New Developments: From this review, it is proven that sealants are safe and effective preventive material for caries. However, certain improvements can be made to the material and technique of application. Mechanical preparation of the fissure surface can be beneficial for better retention and microleakage. Shorter etching time is found to be equally effective for longer times. Similarly, the use of a sodium bicarbonate air polishing system in the cleaning method helps in higher retention of sealant.^{17,18}

Conclusion

A powerful way to prevent pit as well as fissure caries in primary and permanent tooth is the use of pit and fissure sealants. Therefore, in patients with higher risk of caries, dental professionals ought to be urged to use pit and fissure sealants alongside other prophylactic measures. The tooth with early non cavitated carious lesion additionally gets benefit from utilization of sealant which prevents any progression of caries. The sealant application is a technique sensitive method which requires a moisture-controlled environment. The material for the sealant is selected based on the age of the patient, behavior of the child, and the tooth eruption time. Lastly, maintenance is essential to boost the adequacy of the treatment.

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References

1. Naaman R, El-Housseiny AA, Alamoudi N. The Use of Pit and Fissure Sealants-A Literature Review. *Dent J (Basel)*. 2017;5(4):34.
2. Cvikl B, Moritz A, Bekes K. Pit and Fissure Sealants-A Comprehensive Review. *Dent J (Basel)*. 2018;6(2):18
3. Feigal RJ, Donly KJ. The use of pit and fissure sealants. *Pediatr Dent*. 2006;28(2):143–198.
4. Simonsen RJ. Pit and fissure sealant: review of the literature. *Pediatr Dent*. 2002;24(5):393–414
5. Shobha Tandon. Textbook of pedodontics. 2nd ed. Paras medical publisher; 2008. pp. 257-64.
6. Soben Peter. Essentials of Preventive and Community Dentistry. 5th edition. New Delhi: Arya Medi Publishing House Pvt., Ltd; 2006
7. Dean J.A., Avery D.R., McDonald R.E., editors. McDonald and Avery's Dentistry for the Child and Adolescent. ninth ed. Mosby; Maryland Heights, Mo: 2011. pp. 261–264.
8. Nikhil Marwah. Textbook of paediatric dentistry. 4th edition, 2018
9. Cameron AC, Richard P. Widmer. Handbook of paediatric dentistry. Elsevier; Mobsy 2013.
10. Damle SG. 1st ed. New Delhi: Arya Medi Publishing House; 2000. Pediatric Dentistry; p. 34.
11. Rugg-Gunn A. Dental caries: strategies to control this preventable disease. *Acta Med Acad*. 2013;42(2):117–130.
12. Bagramian RA, Garcia-Godoy F, Volpe AR. The global increase in dental caries. A pending public health crisis. *Am J Dent*. 2009;22(1):3–8.
13. Wright JT, Crall JJ, Fontana M, et al. Evidence-based clinical practice guideline for the use of pit-and-fissure sealants: A report of the American Dental Association and the American Academy of Pediatric Dentistry. *J Am Dent Assoc*. 2016;147(8):672–682.e12.
14. Kitchens DH. The economics of pit and fissure sealants in preventive dentistry: a review. *J Contemp Dent Pract*. 2005;6(3):95–103.
15. Reddy VR, Chowdhary N, Mukunda KS, Kiran NK, Kavyarani BS, Pradeep MC. Retention of resin-based filled and unfilled pit and fissure sealants: A comparative clinical study. *Contemp Clin Dent*. 2015;6(Suppl 1): S18–S23.
16. Ahovuo-Saloranta A, Forss H, Hiiri A, Nordblad A, Mäkelä M. Pit and fissure sealants versus fluoride varnishes for preventing dental decay in the permanent teeth of children and adolescents. *Cochrane Database Syst Rev*. 2016;(1):CD003067.

17. Sidhu SK, Nicholson JW. A Review of Glass-Ionomer Cements for Clinical Dentistry. *J Funct Biomater.* 2016;7(3):16. Mejàre I, Axelsson S, Dahlén G, et al. Caries risk assessment. A systematic review. *Acta Odontol Scand.* 2014;72(2):81–91.
18. Akinlotan M, Chen B, Fontanilla TM, Chen A, Fan VY. Economic evaluation of dental sealants: A systematic literature review. *Community Dent Oral Epidemiol.* 2018;46(1):38–46.