ECRONICON OPEN ACCESS

EC DENTAL SCIENCE
Review Article

Pit and Fissure Sealants in Pediatric Dentistry

Amal Saleem Safar Alharthi[1] and Ahmed Mohamed Elmarakby[2]*

[1]*General Practitioner Dentist, Saudi Arabia*

[2]*Assistant Professor in the Department of Restorative Dental Sciences, Al-Farabi Colleges for Dentistry and Nursing, Riyadh, Saudi Arabia and Lecturer in Operative Dentistry Department, Faculty of Dental Medicine, Al-Azhar University, Assiute Branch, Egypt*

***Corresponding Author:** Ahmed Mohamed Elmarakby, Assistant Professor in the Department of Restorative Dental Sciences, Al-Farabi Colleges for Dentistry and Nursing, Riyadh, Saudi Arabia.

Received: March 15, 2019; **Published:** April 22, 2019

Abstract

Background: Tooth decay is usually treated by operating and non- operating way. However; the non-operative process is deem as better as it is least invasive thus least mediating dentistry came into first. The theory of repeated cycles of restoration that attributed to Elderton attempts to combine the two methods i.e. non-surgical process going to union with restorative method for hygienic practical life. Application of fissure sealant and fluoride have been shown to play an important role in reducing tooth decay. This can be explained through converting the caries susceptible areas like pits and fissures into glazed surface which prohibit bacterial (microorganism) colonization and makes the tooth easy to clean.

Materials and Methods: In this review, online research has been used to get articles to current subject using scientific website such as PubMed, google scholar and dental medical books (with English language) at the last 50 years (1968-2018). For a literature review search keywords were used: pit and fissure sealant, fluoride protection, caries risk assessment, and evidence based recommendation for pit and fissure application.

Results: The study identified 450 articles from initial search cri¬teria. After study and examine summary the search get rid of essay not connected to the insertion standard. Finally, 62 studies were included.

Conclusion: Sealant materials have the ability to be retained in the occlusal surfaces of teeth of children and adolescents, showing a potential effectiveness for caries prevention, their application having deep effects on the dental caries of all tooth surfaces.

Keywords: *Fissure Sealant; Tooth Prevention; Fluoride; Tooth Re-Mineralization*

Introduction

There have been persistent attempts at past decades by dentists to try to prevent tooth decay, especially among children. Methods used to achieve that goal involve such as prophylactic cooperation as early physical blockage of fissure with zinc phosphate cement, mechanical fissure enucleate, innovation odontotomy and chemical treatment with silver nitrate. These method are reviewed periodically by specialists in the field of preventive dentistry to determine the effectiveness of these method in prevention of tooth decay, especially in primary teeth [1-4].

When did fissure sealant method born?

Buonocore study was the first attempt to describe enamel bonding by acid etch in 1955 then bonding became modern technology and logical step in pit and fissure sealant to prohibit caries [5]. Thus, resin sealant methods were born [6] and remains as one of the most effective method to prevent one of wide-spread disease that affect humankind. Dental caries is the one mutual inveterate childhood illness.

Decay starts in children shortly after growing of milky teeth and uninterrupted raise at salient rate in their school age.

When to make application to pit and fissure sealant?

The food tends to stay and difficult to be reached by tooth brush bristles in routine teeth-brushing especially in deep pits and fissures. It supplies a suitable circumstances for oral microorganism to develop and transform carbohydrate to acid that lead to mineral loos of enamel [7]. The effective method to prohibit decay for pit and fissure can be achieved by efficient covering (sealing) of fissure that called fissure sealant. Sealant has been characterized as a flowable material that applied into pits and fissures of teeth that liable to decay and can bond in a micromechanical way to the occlusal surface of the tooth so that stopping entrance of bacteria responsible of caries to reach their nutritional supply [8]. When comparing the percentage of pit and fissure cavitation, it can be showed that in primary posterior teeth it represented 44% and in permanent posterior teeth it represented 80-90% [9,10]. Decay in pit and fissure that are liable to caries can be minimized through using the sealant. It have been shown that an improving incidence of 86% after 1year and 58% after 4years in a reduction (minimize) of caries activity when implementation the fissure sealant [11,12]. Prior to application of fissure sealant on tooth, it should define and recognize the expected risk of primary and permanent teeth then evaluate the expected good outcomes after fluoride implementation [13]. This can be achieved by professional practitioner that using different methods for indicating morphology of the tooth, diagnosis of clinical situation, history of decay, history of fluoride application and the hygiene condition of oral cavity. When tooth have highest risk caries liability, the implementation of sealant will give greatest good outcome. Rapid treatment using sealant material should take place especially with tooth of high caries susceptibility. On the other hand, there is no need for using sealant material in case of tooth of low risk to decay [13].

Why fissure sealant act as preventive measure for deciduous teeth?

Increasing of caries risk may take place due to abnormal patient habits, oral flora changing and in case of patient with abnormal medical or physical conditions. Teeth that have not previously been sealed will be the most beneficiary from application of sealant material [13,14]. With proper case diagnosis and evaluation, fissure sealant material can be applied on teeth revealed initial decay at area of pits and fissures [14]. Some clinical studies have concluded that decay become arrested and caries causative organisms were reduced after period from sealant application and also under sealed margins restorations [15-17]. Cross-sectional studies and questionnaires have revealed that dentists in pediatric field often preferred enameloplasty technique prior to the sealant application [18]. *In vitro* researches revealed that enameloplasty technique may improve sealant retention [19-22]. On the other hand, some *in vivo* researches concluded that enameloplasty technique has no effect regarding retention if applied prior placement of sealant material [23,24]. There are different varieties between primary and permanent teeth regarding enamel morphological design, physiological state, mineral content and crystal composition [25-28]. Primary teeth characterized by small enamel thickness and large prismatic layer thickness [26,27]. Also, deciduous teeth considered less resistance to tooth decay and more influenced by chemical effects like erosion. Biocompatibility and general behavior of deciduous teeth toward dental materials are quite different when compared to permanent teeth [29,30]. The most primary teeth affected by dental decay in age between six months to three years are the posterior teeth that represented 81.5% [31]. Due to fear from dentist, most children do not go to dental clinic. Only the pain from dental decay or other reasons may make the children visit to dental clinic compulsory. It has been proven unequivocally that primary teeth decay is closely related to caries that will takes place later to permanent teeth [32]. One clinical study concluded that occlusal surface of posterior teeth in children between age 2 and 3 years was porn to teeth decay by 74.5%. This was explained by roughness nature of occlusal surface which was a major reason of food adhesion and found a good shelter for bacteria causing carious lesion [33]. The most advantage of sealant material is that it prevents food collection and adhesion to occlusal surface and also prevents the formation of environment that is favorable for growth of bacteria [34].

Application of fissure sealant and their bonding mechanism on the tooth

Controlling prevention of saliva from reaching water-sensitive dental material may be so difficult when dealing with children. Saliva contamination during application of sealant material in children is frequently expected. Consequently, the result will be undesirable if such a problem is not controlled. Sealants are hydrophilic in its nature so it is water-attractive material. The amount of water in tooth substrate play an important role during sealant material application [35-38]. It was approved that there are varieties in the amount of water presented in both deciduous and permanent teeth that would affect bond strength of sealant material after application [39,40]. A study of Lemos LV., *et al.* on occlusal surface of posterior primary teeth has shown better bond strength of OptiBond FL than pit and fissure seal-

ant material of normal hydrophilic nature after 24h application [41]. Other studies have clarified the importance of using non-traditional sealant material that compatible with the nature of occlusal surfaces composition of primary teeth [36,37]. But that does not mean there are other few studies believe that some kinds of sealant that give similar positive results when applied for both deciduous and permanent teeth. This has been explained by the fact that this is due to the strong bond formed between sealant and enamel in both primary and permanent teeth [42]. The aim of this study of Feldens EG., *et al.* was to assessment of micro-tensile bond strength (MTBS) of fissure sealant that applied on the enamel surface of both deciduous and permanent teeth. Comparing time was after sealant application with 24 hours and after 6 months. It was concluded that there was not statistical significant difference observed within the period of comparison [34]. The application of pit and fissure sealants is a non-invasive technique that plays a fundamental role in the prevention of occlusal caries in both primary and permanent teeth. Occlusal caries are often associated with the pit and fissure morphology [43]. Retention of food on occlusal surfaces, lack of saliva flow to the fissures and in-sufficient intake of fluoride are the culprit for the high incidence of occlusal caries [44,45]. The application of pit and fissure sealants is a widely accepted preventive technique. This conservative technique caring with tackling pit and fissure caries is a minimal invasive approach that is even acceptable to most children [46].

Factors affecting clinical success of pit and fissure sealant

The clinical success of fissure sealants is highly related to their appropriate application [47]. It is very important to say that to obtain the highest bond strength between sealant material and enamel substrate, it is necessary to maintain the proper drying of enamel surface prior to application of fissure sealant. Any contamination means only increasing of failure rate and de-bonding [48]. Adhesive agents have been used as mediating agents between the enamel surface and the filling. Adhesive systems can be classified into two groups in terms of clinical procedures: etch and rinse and self-etch adhesives. The first system includes phosphoric acid etching and primer/adhesive resin in one bottle, and the second system includes etching and priming solution in one bottle and an adhesive resin or an etch-prime-adhesive as an all-in-one procedure [49]. The published literature indicates that the use of dentin bonding agents before sealant application can be helpful for reducing micro-leakage and increasing the bond strength [48]. In contrast, some papers clarify that administration of a bonding agent before the application of pit and fissure sealants did not increase the bond strength [50]. An easy, rapid and realistic method of evaluating these applications is necessary. Similar results obtained under *in vivo* conditions by simulating the oral cavity conditions (thermal changes and chewing forces) in a laboratory environment to mimic the natural aging process. Studies investigating the use of adhesive systems prior to fissure sealant placement are still few in the literature, and the existing works have shown controversial results [51-55].

Effect of pit and fissure sealant on tooth and retention on primary and permanent tooth

Pit and fissure sealants have been considered an effective caries prevention material. Most studies regarding sealants type have described their effectiveness on the permanent dentition in the primary dentition [3,15]. Children aged 5 to 9 years are estimated to average 5.3 decayed or refilled surfaces (dfs) and 2.5k, decayed or filled teeth (dfi). With children aged 5 having an average of 4.0 decayed or filled surfaces and 2.2 decayed or filled teeth [56]. This suggests that the majority of tooth decay occurs shortly after eruption. There is no enough information on the status of caries prevalence of the primary dentition of children younger than 5 years. Thus, data for caries susceptibility of the primary occlusal surfaces are not available for children with recently erupted primary molars. However, the 1979-80 National Institute for Dental Research (NIDR) survey showed that 54% of caries in the permanent dentition occurred on the occlusal surfaces and 29% occurred on bucco-lingual surfaces [56]. The National Preventive Dentistry Demonstration Program [57] showed that 54% of permanent teeth caries occurred on the occlusal surfaces and 35% occurred on bucco-lingual surfaces. Based on these data, 83% to 89% of caries in the permanent dentition of children aged 5 to 17 years occurs in tooth surfaces with pits and fissures. Although corresponding data for the primary dentition are not available, it may be inferred that the prevalence of caries by tooth surface for primary teeth with occlusal morphological structure similar to that of the permanent dentition approximates that of permanent teeth. If this inference is correct, then pit and fissure surfaces are at greater caries risk than smooth surfaces for both permanent and primary teeth. As sealants are primarily used to prevent tooth decay in pits and fissures, it can be assumed that they are most effective in populations in which smooth surface tooth decay is under control. Because the majority of tooth decay occurs on the occlusal surfaces, sealants are one of the most important measures available in the prevention of tooth decay. When sealant application is coupled with the various methods of fluoride delivery, tooth decay can be almost eradicated in a target population. A recent study [32] showed that early caries can be arrested by the application of sealant over affected tooth surfaces. Thus, the placement of sealant over existing incipient carious lesions is not a

technique to be avoided but may be considered an appropriate procedure for treating small lesions as well as a caries-preventive technique. Some studies [58,59] investigated the effectiveness of chemically cured and ultraviolet light-cured sealants. Sealants that are polymerized by exposure to intense visible light have been introduced commercially, and reports [52] indicate that 60% to 75% of sealants marketed are visible-light cured. A sealant that is esthetically acceptable and easily detectable is desirable for both patient satisfaction and operator convenience. A detectable sealant enhances the application procedure and the ease of identification at recall examinations. Optimal benefits from sealants can be expected if the application is completed soon after the eruption of the tooth surface.

Conclusion

Pit and fissure surfaces are at greater caries risk than smooth surfaces for both permanent and primary teeth. As sealants are primarily used to prevent tooth decay in pits and fissures, it can be assumed that they are most effective in populations in which smooth surface tooth decay is under control. Because the majority of tooth decay occurs on the occlusal surfaces, sealants are one of the most important measures available in the prevention of tooth decay.

Bibliography

1. Wilson IP. "Preventive dentistry". *Dental Digest* 1 (1895): 70-72.
2. Bödecker CF. "Eradication of enamel fissures". *Dental Items* 51 (1929): 859-866.
3. Hyatt T. "Prophylactic odontotomy: The cutting into the tooth for the prevention of disease". *Dental Cosmos* 65 (1923): 234-241.
4. Kline H and Knutson JW. "Studies on dental caries XIII. Effect of ammoniacal silver nitrate on caries in the first permanent molar". *Journal of the American Dental Association* 29.11 (1942): 1420-1426.
5. Buonocore MG. "A simple method of increasing the adhesion of acrylic filling materials to enamel surfaces". *Journal of Dental Research* 34.6 (1955): 849-853.
6. Cueto EI and Buonocore MG. "Adhesives and caries prevention: a preliminary report". *British Dental Journal* 119 (1965): 77-80.
7. Muthu MS and Sivakumar N. "Pediatric dentistry. Principles and Practice". 1st edition. New Delhi: Elsevier (2009).
8. Simonsen RJ. "Pit and fissure sealants". In: Clinical Applications of the Acid Etch Technique. Chicago, Ill: Quintessence Publishing Co, Inc (1978): 19-42.
9. Brown LJ., *et al*. "Dental caries and sealant usage in US children, 1988-1991: Selected findings from the third National Health and Nutrition Examination Survey". *Journal of the American Dental Association* 127.3 (1996): 335-343.
10. National Center for Health Statistics, CDC. National Health and Nutrition Examination Surveys 1999-2004 (2008).
11. Llodra JC., *et al*. "Factors influencing the effectiveness of sealants: A meta-analysis". *Community Dentistry and Oral Epidemiology* 21.5 (1993): 261-268.
12. Ahovuo-Saloranta A., *et al*. "Pit and fissure sealants for preventing dental decay in the permanent teeth of children and adolescents". *Cochrane Database of Systematic Reviews* 3 (2004): CD001830.
13. Feigal RJ. "The use of pit and fissure sealants". *Pediatric Dentistry* 24.5 (2002): 415-422.
14. Handelman SL., *et al*. "A preliminary report on the effect of fissure sealant on bacteria in dental caries". *Journal of Prosthetic Dentistry* 27.4 (1972): 390-392.
15. Handelman SL., *et al*. "Two-year report of sealant effect on bacteria in dental caries". *Journal of the American Dental Association* 93.5 (1976): 967-970.
16. Going RE., *et al*. "The viability of microorganisms in caries lesions five years after covering with a fissure sealant". *Journal of the American Dental Association* 97.3 (1978): 4554-62.

17. Mertz-Fairhurst EJ., *et al*. "Cariostatic and ultraconservative sealed restorations: Nine-year results among children and adults". *ASDC Journal of Dentistry for Children* 62.2 (1995): 97-107.

18. Primosch RE and Barr ES. "Sealant use and placement techniques among pediatric dentists". *Journal of the American Dental Association* 132.10 (2001): 1442-1451.

19. Wright GZ., *et al*. "The safety and efficacy of treatment with air abrasion technology". *International Journal of Paediatric Dentistry* 9.2 (1999): 133-140.

20. Chan DC., *et al*. "Evaluation of different methods for cleaning and preparing occlusal fissures". *Operative Dentistry* 24.6 (1999): 331-336.

21. Geiger SB., *et al*. "Improving fissure sealant quality: Mechanical preparation and filling level". *Journal of Dentistry* 28.6 (2000): 407-412.

22. Zervou C., *et al*. "Enameloplasty effects on microleakage of pit-and fissure sealants under load: An in vitro study". *Journal of Clinical Pediatric Dentistry* 24.4 (2000): 279-285.

23. Le Bell Y and Forsten L. "Sealing of preventively enlarged fissures". *Acta Odontologica Scandinavica* 38.2 (1980): 101-104.

24. Shapira J and Eidelman E. "Six-year clinical evaluation of fissure sealants placed after mechanical preparation: A matched pair study". *Pediatric Dentistry* 8.3 (1986): 204-205.

25. Gwinnett AJ and Garcia-Godoy F. "Effect of etching time and acid concentration on resin shear bond strength to primary tooth enamel". *American Journal of Dentistry* 5.5 (1992): 237-239.

26. Mortimer KV. "The relationship of deciduous enamel structure of dental disease". *Caries Research* 4.3 (1970): 206-223.

27. Fava M., *et al*. "Prismless enamel in human non erupted deciduous molar teeth: A scanning electron microscopic study". *Revista de Odontologia da Universidade de São Paulo* 11.4 (1997): 239-243.

28. Sonju Clasen AB and Ruyter IE. "Quantitative determination of type A and type B carbonate in human deciduous and permanent enamel by means of Fourier transform infrared spectrometry". *Advances in Dental Research* 11.4 (1997): 523-527.

29. Marquezan M., *et al*. "Microtensile bond strength of contemporary adhesives to primary enamel and dentin". *Journal of Clinical Pediatric Dentistry* 32.2 (2008): 127-132.

30. Wang L., *et al*. "Effect of adhesive systems associated with resin-modified glass ionomer cements". *Journal of Oral Rehabilitation* 33.2 (2006): 110-116.

31. Mattos-Graner RO., *et al*. "Caries prevalence in 6-36-month-old Brazilian children". *Community Dental Health Journal* 13.2 (1996): 96-98.

32. Amaral RC., *et al*. "Dental caries trends among preschool children in Indaiatuba, SP, Brazil". *Brazilian Journal of Oral Sciences* 13.1 (2014): 1-5.

33. Hicks MJ and Flaitz CM. "Caries formation in vitro around a fluoride-releasing pit and fissure sealant in primary teeth". *ASDC Journal of Dentistry for Children* 65.3 (1998): 161-168.

34. Feldens EG., *et al*. "Invasive technique of pit and fissure sealants in primary molars: a SEM study". *Journal of Clinical Pediatric Dentistry* 18.3 (1994): 187-190.

35. Grande RHM., *et al*. "Clinical evaluation of an adhesive used as a fissure sealant". *American Journal of Dentistry* 13.4 (2000): 167-170.

36. Ramires-Romito AC., *et al*. "Micro-tensile bond strength of adhesive systems applied on occlusal primary enamel". *Journal of Clinical Pediatric Dentistry* 28.4 (2004): 333-338.

37. Ramires-Romito AC., *et al*. "Microtensile bond strength of sealant and adhesive systems applied to occlusal primary enamel". *American Journal of Dentistry* 20.2 (2007): 114-120.

38. Vargas CM., *et al*. "Oral health trends in Maryland". *Journal of Public Health Dentistry* 72.1 (2012): S18-S22.

39. Kanehira M., *et al*. "Rationale behind the design and comparative evaluation of an all-in-one self-etch model adhesive". *Journal of Dentistry* 37 (2009): 432-439.

40. Gomes GB., *et al*. "Influence of water concentration on the etching aggressiveness of self-etch primers to ground primary enamel". *Pediatric Dentistry* 34.3 (2012): 226-230.

41. Lemos LVFM., *et al*. "Bond strength and morphology of resin materials applied to the occlusal surface of primary molars". *International Journal of Paediatric Dentistry* 22.6 (2012): 435-441.

42. Simonsen RJ. "Pit and fissure sealant: review of the literature". *Pediatric Dentistry* 24.5 (2002): 393-414.

43. Duangthip D and Lussi A. "Effects of fissure cleaning methods, drying agents, and fissure morphology on microleakage and penetration ability of sealants in vitro". *Pediatric Dentistry* 25.6 (2003): 527-533.

44. Salama FS and Al-Hammad NS. "Marginal seal of sealant and compomer materials with and without enameloplasty". *International Journal of Paediatric Dentistry* 12.1 (2002): 39-46.

45. El-Housseiny AA and Sharaf AA. "Evaluation of fissure sealant applied to topical fluoride treated teeth". *Journal of Clinical Pediatric Dentistry* 29.3 (2005): 215-219.

46. Gordon PH and Nunn JH. "Fissure sealants". In: Murray JJ, ed. The Prevention of Oral Disease. 3rd edition. New York: Oxford University Press (1996): 78-94.

47. Barroso JM., *et al*. "Shear bond strength of pit-and-fissure sealants to saliva-contaminated and noncontaminated enamel". *Journal of Dentistry for Children* 72.3 (2005): 95-99.

48. Tulunoglu O., *et al*. "The effect of bonding agents on the microleakage and bond strength of sealant in primary teeth". *Journal of Oral Rehabilitation* 26.5 (1999): 436-441.

49. Van Meerbeek B., *et al*. "Microtensile bond strengths of an etch & rinse and self-etch adhesive to enamel and dentin as a function of surface treatment". *Operative Dentistry* 28.5 (2003): 647-660.

50. Jones EF. "A 2-year clinical evaluation of two pit and fissure sealants placed with and without the use of a bonding agent". *Quintessence International* 24.2 (1993): 131-133.

51. Cehreli ZC and Gungor HC. "Quantitative microleakage evaluation of fissure sealants applied with or without a bonding agent: results after four year water storage in vitro". *Journal of Adhesive Dentistry* 10.5 (2008): 379-384.

52. Gomes-Silva JM., *et al*. "Bond strength of a pit-and-fissure sealant associated to etch-and-rinse and self-etching adhesive systems to saliva-contaminated enamel: individual vs. simultaneous light curing". *Brazilian Dental Journal* 19.4 (2008): 341-347.

53. Feigal RJ and Quelhas I. "Clinical trial of a self-etching adhesive for sealant application: success at 24 months with Prompt L-Pop". *American Journal of Dentistry* 16.4 (2003): 249-251.

54. Venker DJ., *et al*. "Twelve-month sealant re-tention in a school-based program using a self-etching primer/adhesive". *Journal of Public Health Dentistry* 64.4 (2004): 191-197.

55. Perdigao J., *et al*. "Clinical performance of a self-etching adhesive at 18 months". *American Journal of Dentistry* 18.2 (2005): 135-140.

56. National Caries Program, NID R. The prevalence of dental caries in United States children, 1979-1980. T h e national dental caries prevalence survey. US Department of Health and Human Services, NIH pub no. 82-2245 (1981).

57. Bell RM., *et al*. "Results of base line dental exams in the national preventive dentistry demonstration program". R-2862-RW J. Santa Monica, CA, R and Corp, (1982).

58. Cueto EI and Buonocore MG. "Sealing of pits and fissures with an adhesive resin: its use in caries prevention". *Journal of the American Dental Association* 75.1 (1967): 121-128.

59. Buonocore MG. "Caries prevention in pits and fissures sealed with adhesive resin polymerized by ultraviolet light: a two-year study of a single adhesive application". *Journal of the American Dental Association* 82.5 (1971): 1090-1093.

Volume 18 Issue 5 May 2019