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REVIEW ARTICLE

Pit and Fissure Sealants: A Recent Advancement

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ABSTRACT

Tooth surfaces with pits and fissures are particularly vulnerable to caries development. With the permanent dentition, caries involving the occlusal surfaces account for almost 60% of total caries in children and adolescents, although occlusal surfaces account for only 12.5% of total tooth surface. Dental sealants are preventive dental treatment where pit and fissure of primary or permanent molar and premolar are filled with plastic material. Fissure sealants (FSs) prevent the early intervention of dental caries before it reaches to end-stage called as cavitations. Mainly, the pit and fissure sealants (PFS) are to prevent developing caries, which is achieved by blocking the surface, and prevents bacteria from getting stuck to it.

Keywords: Cost-effectiveness, Occlusal surfaces, Pit and fissure sealants, Preventive dentistry.

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INTRODUCTION

The term pit and fissure sealant (PFS) is used to describe a material, i.e., introduced into the occlusal pits and fissures of caries-susceptible teeth, thus forming a micromechanically bonded, protective layer cutting access of caries producing bacteria from their source of nutrients.[1]

Buonocore's classic study of 1955 marked the start of a major revolution in the clinical practice of dentistry. The first clinical benefit from Buonocore's work was the introduction of the first dental PFS, Nuva-Seal (LD Caulk) in February 1971, along with its curing initiator, and ultraviolet light source, the Caulk Nuva Lite. However, it took several more years before the sealant technique, and other clinical innovations that have resulted from Buonocore's work, began to be adopted in clinical dentistry to any significant degree. Still, more than 30 years after the introduction of PFS to the dental market place, the profession has not embraced the procedure to the extent that available scientific data would expect.[2]

While levels of tooth decay (dental caries) in children and adolescents have declined in many parts of the world in recent decades, caries remains a public health problem in many countries.[3,4]

The molar teeth account for most of the decay experience in the primary[5] and permanent teeth[6] of children and adolescents. The molar teeth have many grooves (fissures) and pits on the chewing (occlusal) surface and on the buccal and palatal surfaces, which can be very difficult to keep clean. These are the sites most susceptible to developing decay.[7] Pit and fissure sealants (PFS) are materials that are applied to the pits and fissure surfaces of teeth to create a thin barrier that protects the sealed surface from decay.[8-10]

TYPES OF PFS

Resins

Resin-based fissure sealants (FSs) are bonded to the underlying enamel by the use of the acid etch technique. Their caries preventive property is based on the establishment of a tight seal, which prevents leakage of nutrients to the microflora in the deeper parts of the fissure. The resin sealants may be either pure resin, composites, or compomers, and their polymerization may be initiated chemically or by light.[11]

Pit and Fissure Sealants

These are available as clear, opaque, or tinted. No product has demonstrated a superior retention rate but the tinted and opaque FSs have the advantage of more accurate evaluation by the dentist at recall.[12]

Glass Ionomer Cements

One of the main clinical advantages of glass ionomer cement (GIC) is their ability to bond chemically to dentin and enamel without the use of the acid-etch technique, which makes them less vulnerable to moisture. This, in conjunction with active F release into the surrounding

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enamel, has led to the development and evaluation of GIC as an alternative FS system, particularly in cases where moisture control is difficult to achieve.[13]

Compomers

Compomers are currently being investigated widely in both *in vitro* and *in vivo* studies. The amount of F released in distilled water is considerably less than GIC.[14]

Fluoride-containing Sealants

The durability of F containing FS would now appear to be comparable to conventional resin FS. However, further long-term clinical trials are necessary to determine that the clinical longevity of FS retention is not adversely affected by the presence of incorporated F. Also, the clinical importance of the F ion in F containing FS in terms of caries prevention remains to be shown.[11]

CLINICAL INDICATIONS FOR PFS

Indications

- The occlusal surfaces of permanent teeth having well-defined pit and fissures and/or deep fossae. Occasionally, primary molars with significantly deep grooves or pits may be sealed
- Stained or slightly white pit and fissure, especially in patients with high caries incidence
- Buccal and lingual grooves when only the appropriate teeth have erupted sufficiently to be free of gingival and operculuctum contact
- Incisors with lingual pits.

Contraindications

- Synthetic porcelain restorations
- Veneers
- Amalgam restorations
- Gold foil restorations, inlays, onlays, or crown
- Evidence of caries on occlusal or interproximal surfaces
- Teeth that cannot be sufficiently isolated
- 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.

RETENTION AND EFFECTIVENESS OF SEALANT APPLICATION

The primary factor associated with the efficacy of sealants is their ability to remain bonded to the occlusal surface. A report published in JADA to coincide with National Children Dental Health Month concluded that sealants are highly effective in the prevention of tooth decay on the occlusal surfaces of teeth. The report found that 92 to 96% dental sealants placed on occlusal surfaces of teeth remain intact 1 year later and up to 82% are retained after 5 years.

Tooth caries can be prevented as long as the sealant adheres to the tooth surface and, for this reason, the success of sealant is measured by the length of time the sealant remains in the tooth. Salivary contamination during sealing placement is the commonest reason for sealant failure.[15]

After checking the occlusion with articulating paper to evaluate any potential occlusal interference, or whether tooth has occlusion in areas where sealant placement and retention is desired, fissurotomy is recommended to create additional space for thickness of sealant and thus increase retention. Sealant should be applied for covering the cusp ridges to a thickness of at least 0.3 mm.[16]

NEW ADVANCEMENTS IN PFS

Moist-tolerant PFS: There has been a significant advancement in resin-based sealants with the development of moisture-tolerant chemistry. Traditional sealants were hydrophobic, where a completely dry field is required. Recently, a new advanced resin-based sealant with the development of moisture control chemistry, i.e., a hydrophilic moisture-tolerant resin-based sealant named Embrace Wet Bond has been developed. A study by Joseph P. O'Donnell in 2008 shows the moisture-tolerant Embrace Wet Bond sealant had a 95% success after 2 years, which is comparable to other sealant studies where teeth that were difficult to isolate were excluded.[17]

Fluoride releasing PFS: Fillers are added to resin sealants which contain fluoride. In a clinical evaluation of 2 years, Helioseal-F is applied in school children at risk of caries. Out of 431 FSs, complete retention was found on 77%, while 22% were partially lost and 1% were completely lost.[16]

Cost-effectiveness

The cost-effectiveness of the sealant placement has been generally ignored. However, the cost of preventing tooth decay by placing dental sealants is much less than treating oral disease once it has developed. When the sealants are applied by a dentist, the cost appears likely to exceed the potential cost of restoration saved, but this could be altered if the procedure was carried out by auxiliaries.

The issue of cost-effectiveness of sealants has not been addressed by many studies. At the 10-year point of a 15-year study, it was found that it is 1.6 times as costly to restore the carious lesions in the first permanent

molars in an unsealed group of 5- to 10-year-old children living in a fluoridated area than it is to prevent, with a single application of PFS, the greater number of lesions observed if pit and fissure sealant is not utilized.[18] Of course, in areas of low caries rates, the cost-effectiveness of applying pit and fissure sealant *en masse* is questionable. The benefit of preventing a lesion rather than having a restoration placed and then continually replaced as necessary. However, the level of dental caries in any population should be monitored closely because a successful program of prevention, and thus a substantial decline in caries prevalence, could diminish the economic argument for sealants. Burt noted that cost-effectiveness of sealants would be enhanced by:

- Using trained auxiliaries to apply sealant to the fullest extent allowed by law,
- Applying the most recently developed sealants in which retention rates appear to be most favorable, and
- Their application in areas where proximal caries is low.[19]

Sealants and Safety

In a time of increased patient litigiousness and OSHA concern for the safety of employees, it is imperative to discuss safety concern associated with sealant application. Safety concern includes systemic toxicity, eye safety, local hard, and soft tissue effects.

Follow-up and Review

All sealed surfaces should be regularly monitored clinically and radiographically. Bitewing radiographs should be taken at a frequency consistent with the patient's risk status, especially where there has been doubt as to the caries status of the surface prior to sealant placement. The exact intervals between radiographic reviews will depend not only on risk factors, which may change over time, but also on monitoring of other susceptible sites, e.g., proximal surfaces.[20]

RECOMMENDATIONS

- Apply sealants to the permanent molar teeth of children and youth who are identified at risk by a caries risk assessment.
- Place sealants on teeth as soon as possible after eruption; however, the length of time after eruption should not be a barrier to placement of sealants.
- Use resin-based sealant materials to seal teeth, for increased retention of dental sealants.
- Disseminate the review findings to peel dentists, dental hygienists, level II dental assistants, and other health care providers to promote the use of PFS.
- Share relevant evidence with parents of children and youth in the community in order to promote discussions about and requests for PFS from their practitioners.
- Collect and analyze the cost of PFS application for various providers in different settings throughout Peel, to aid in assessing cost-effectiveness of sealant application throughout the region.

CONCLUSION

Most of the carious lesions that occur in the mouth occur on the occlusal surfaces. Which teeth will become carious cannot be predicted; however, if the surface is sealed with a pit and fissure sealant, no caries will develop as long as the sealant remains in place. Sealants are easy to apply, but the application of sealants is an extremely sensitive technique. So only trained staff should be allowed to place the sealants.

REFERENCES

1. Simonsen RJ. Pit and fissure sealants. In: Clinical applications of the acid etch technique. 1st ed. Chicago (IL): Quintessence Publishing; 1978. p. 19-42.
2. Buonocore MG. A simple method of increasing the adhesion of acrylic filling materials to enamel surfaces. J Dent Res 1955 Dec;34(6):849-853.
3. Petersen PE. The World Oral Health Report 2003: continuous improvement of oral health in the 21st century – the approach of the WHO Global Oral Health Programme; 2003.
4. Whelton H, Crowley E, O'Mullane D, Harding M, Guiney H, Cronin M, Flannery E, Kelleher V. North South survey of children's oral health in Ireland 2002. Dublin: Brunswick Press; 2006.
5. Elfrink ME, Veerkamp JS, Kalsbeek H. Caries pattern in primary molars in Dutch 5-year-old children. Eur Arch Paediatr Dent 2006 Dec;7(4):236-240.
6. Batchelor PA, Sheiham A. Grouping of tooth surfaces by susceptibility to caries: a study in 5–16 year-old children. BMC Oral Health 2004 Oct 28;4(1):2-4.
7. Slade GD, Spencer AJ, Davies MJ, Burrow D. Intra-oral distribution and impact of caries experience among South Australian School Children. Aust Dent J 1996 Oct;41(5): 343-350.
8. Dukic W, Dukic OL, Milardovic S, Vindakijevic Z. Clinical comparison of flowable composite to other fissure sealing materials – a 12 months study. Coll Antropol 2007 Dec;31(4):1019-1024.
9. Pardi V, Pereira AC, Ambrosano GM, Meneghim MD. Clinical evaluation of three different materials used as pit and fissure sealant: 24-months results. J Clin Pediatr Dent 2005;29(2): 133-137.
10. Yengopal V, Mickenautsch S, Bezerra A, Leal S. Caries-preventive effect of glass ionomer and resin-based fissure sealants on permanent teeth: a meta analysis. J Oral Sci 2009 Sep;51(3):373-382.
11. Welbury R, Raadal M, Lygidakis NA. EAPD guidelines for the use of pit and fissure sealants. Eur J Paediatr Dent 2004 Sep;5(3):179-184.

12. Waggoner WF, Siegal M. Pit and fissure sealant application: updating the technique. J Am Dent Assoc 1996 Mar;127(3): 351-361.
13. Komatsu H, Ikeda T, Ohshima K. Enamel fluoride uptake from glass ionomer cement designed for sealant. J Dent Res 1986;65(Spec Issue):778.
14. Meyer JM, Cattani-Lorente MA, Dupuis V. Compomers: between glass-ionomer cements and composites. Biomaterials 1998 Mar;19(6):529-539.
15. Locker D, Jokovic A, Kay EJ. Prevention. Part 8: The use of pit and fissure sealants in preventing caries in the permanent dentition of children. Br Dent J 2003 Oct 11;195(7): 375-378.
16. Godhane A, Ukey A, Tote JV, Das G, Naphde M, Patil P. Use of pit and fissure sealant in prevention of dental caries in pediatric dentistry and recent advancement: a review. Int J Dent Med Res 2015;1(6):220-223.
17. Murnseer C, Rosentritt M, Handel G. Three body wear of fissure sealants. J Dent Res 2007;86:417.
18. Simonsen RJ. Cost effectiveness of pit and fissure sealant at 10 years. Quintessence Int 1989 Feb;20(2):75-82.
19. Burt BA. Fissure sealants: clinical and economic factors. J Dent Educ 1984 Feb;48(2 Suppl):96-102.
20. Rushton VE, Horner K, Worthington HV. Factors influencing the frequency of bitewing radiography in general dental practice. Community Dent Oral Epidemiol 1996 Aug;24(4):272-276.