

Use of Pit and Fissure Sealant in Prevention of Dental Caries in Pediatric Dentistry and Recent Advancement: A Review

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ABSTRACT

This review article about pit and fissure sealants aims to address the use of pit and fissure sealants in the prevention of dental caries. It starts with the brief history of sealants followed by its indication and contraindications, types, effectiveness, and longevity. The newest material advancement is reviewed to establish the next step in sealant improvement for the young patient. This review concludes that sealants prevent bacteria growth which causes caries.

KEYWORDS: Pit and Fissure Sealants, Paediatric Dentistry, Preventive Dentistry

INTRODUCTION

Since last few decades dentistry has experienced outstanding scientific advances in restorative material and technique. These have permitted more effective oral health management.^{1,2}

Dental sealants are preventive dental treatment where pit and fissure of primary or permanent molar and premolar are filled with plastic material.³

Anatomy of molar teeth makes it more susceptible to dental caries. Dental caries is a disease process describe as gain or loss of minerals from the tooth. Saliva and Fluoride present in the tooth surface provide minerals whereas bacteria present in the mouth ferment food and produce acid that are responsible for loss of minerals.⁴ And when this get misbalanced due to any of the reasons like poor oral hygiene, intake of carbohydrate, lack of fluoride consumption, there is continuous loss of minerals for long time which causes decay.⁵

Fissure sealant is a preventive treatment which prevents the early intervention of dental caries before it reaches to end-stage called as 'hole' or cavitation.⁷ Aim of pit and fissure sealant is to prevent developing caries which is achieved by blocking the surface and prevents bacteria from getting stuck to it.⁶

HISTORY

Many attempts have been made to prevent the development of caries.^{7,8} The creator of modern dentistry, G.V BLACK, stated that 40% of caries occurs in pit and fissure of permanent teeth due to being able to retain food

and plaque.⁹ In 1905. Willoughby D. Miller made one of the first attempts to prevent occlusal caries by applying silver nitrate to tooth surface, chemically treating the biofilm with its antibacterial functions against both streptococcus.¹⁰ Bunonocore in 1970 developed a viscous resin bisphenol glycidyl dimethacrylate /BIS-GMA which was used as basis for many resin based sealant material development.¹¹ In 1974, J.W McLean and A.D Wilson introduced GIC, which bond both to enamel and dentin. Another advantage of GIC is that they contain fluoride and are less moisture sensitive.¹²

INDICATION

- Deep retentive pit and fissure.
- Stained pit and fissure
- Caries free pit and fissure
- No radiographic or clinical evidence of proximal caries.
- Poor plaque control.
- Orthodontic appliance.¹³

CONTRAINDICATION

- A balanced diet low in sugar
- Exceptional oral hygiene
- Teeth with shallow pit and fissures
- Partially erupted teeth without adequate moisture control.[16]
- Isolation not possible.

TYPES

Pit and fissure sealants are classified into various ways,

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but the commonest classification is on the basis of composition. There are two basic sealant type: Resin and glass ionomer type.¹⁷

Resin based sealants can be classified into different types typically polymerization method, filled/unfilled colored/clear and color changing upon polymerization. In filled and unfilled, unfilled sealants perform better than filled sealants.¹⁸⁻¹⁹ sealants that change color during polymerization has also been introduced. Ex Helioclear clear chroma, which after polymerization changes to green which is beneficial during sealant placement? Manufacturers in some cases introduced fillers in sealants which contain fluoride (Helioclear-F, Delton plus).

As described earlier, resin based moisture tolerant sealant seems to provide needed physical and chemical properties to increase sealant success.

MORPHOLOGY

A clinician using dental mirror and explorer observe that there are pit and fissure and grooves on teeth surface.²⁰⁻²¹ The concept of using sharp explorer for detection of pit and fissure caries has been discarded in favor of the visual appearance of enamel.²⁰

Nango described three variations in pit and fissure namely- v type, u-type and I-type which explains high susceptibility of pit and fissure to dental caries.²² Buonocore and coworkers in 1960s investigated use of adhesives to seal caries susceptible pit and fissure.^{23,24} By late 1970s and early 1980s clinical data on sealants was very positive.²⁴

A basic concept of 5-10% of sealant loss per year had been seen when one review published sealant data.²⁵ A negative aspect of sealant in dentistry can be the failure of clinician and reapply when lost or failing.

CONSIDERATION FOR PREMATURE SEALANT FACTOR

Partially erupted tooth, poor isolation, occlusal parafunctional habits, patient behavioral problems, age of the patient, enamel structural defects.

EFFECTIVENESS

For prevention of caries, sealants are accepted as the more effective method. Tooth caries can be prevented as long as the sealant adhere 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.²⁶ Salivary contamination during sealing placement is the commonest reason for sealant failure.²⁶

After checking the occlusion with articulating ribbon to evaluate any potential occlusal interference. If 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.^{27,28}

Sealant should be applied for covering the cusp ridges to

a thickness of at least 0.3mm.²⁷⁻²⁹

FACTORS ENHANCING RETENTION

- Isolation of teeth from saliva.
- Good operator technique.
- Not placing sealants on partially erupted teeth.
- Preparing fissure by cleaning out plaque and debris.³⁰

Longevity: The retention rate between GIC and Resin is different. Resin shows a better retention property. In a clinical trial of 2 years comparing GIC and resin for fissure sealants demonstrated the total loss of GIC is 31.78% in contrast to the resin which is 5.96%.³¹ A study did acknowledge that GIC has therapeutic advantages of releasing fluoride. They can exert a cariostatic effect and for this reason GIC is more of a fluoride vehicle rather than traditional fissure sealant.³²

NEW ADVANCEMENTS IN PIT AND FISSURE SEALANTS

- Moist tolerant pit and fissure sealants- 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, a hydrophilic moisture tolerant resin based sealant named Embrace WetBond has been developed. A study by Joseph P.O Donnell in 2008 shows the moisture-tolerant Embrace WetBond sealant had a 95% success after 2 years which is comparable to other sealant studies where teeth that were difficult to isolate were excluded.^{33,34}
- Fluoride releasing pit and fissure sealants- fillers are added to resin sealants which contain fluoride. In a clinical evaluation of 2 years, Helioclear-F is applied in school children at risk of caries. Out of 431 fissure sealants complete retention found on 77% while 22% were partially lost, and 1% were completely lost.

DISCUSSION

Teeth can be classified as sound or at risk based on the basis of clinical studies. Heller and colleagues evaluated the sound and at risk teeth by comparing sealed and unsealed teeth in the same mouth.³⁵ Teeth which were initially sound had caries rate 13% at 5 years when unsealed and 8% when sealed. Teeth that were classified at risk had caries rate 52% at 5 years when unsealed and 11% when sealed. There no doubt that sealing teeth at risk has substantial benefit.

Pit, fissure, and grooves can be observed using a dental mirror and explorer. The concept of detection of pit and fissure caries using sharp explorer has been discarded in favor of the visual appearance of enamel. Even with newer technologies of caries detection It is difficult to chart the disease progression

Pit and can be classified according to their cross-sectional appearance, namely-V-type, U-type, and I-type.³⁷ It is impossible to clean the shape of the pit and fissure in most of the cases. Bacteria and food are compacted into occlusal surface explaining the high susceptibility of pit and fissure caries.

The earliest sealants-resins were placed with an acid etched technique that sealed carious susceptible pit and fissure.^{38,39} In a 4 year clinical evaluation of sealant retention comparing sealed with non-sealed teeth demonstrated a decrease of 43% in prevalence of caries. A later 7 year study by Mertz – Fairhurtz reported 66% complete retention and 14% partial retention.⁴⁰

CONCLUSION

Use of sealants has proved to have good results. For prevention of dental caries in pit and fissure, sealants were introduced. There is evidence suggesting effectiveness of sealants when compared with no sealants. Sealants prevent bacteria growth which causes caries. Biomaterials to seal pit and fissure should present with the simple application method, biocompatibility, low viscosity and good surface retention and low solubility.[40]

And to improve this biomaterial, more laboratory should be developed.

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