



Pit and Fissure Sealants in Primary and Secondary Prevention of Dental Caries

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Abstract-

Dental caries, a chronic disease is unique among humans and is one of the most common and important global oral health concern in the world today. Amongst all the teeth, molars and premolars pose greater susceptibility to caries. Their susceptibility to caries is probably related to their occlusal morphology.

Routine oral hygiene can be maintained with use of fluoride along with pit and fissure sealants as a prophylactic measure would help prevent dental caries. This review article provides a general overview of pit and fissure sealants, the materials used for sealing occlusal surfaces, as well as indications and contraindications. The conclusion is that sealing pit and fissures of primary and permanent teeth is an effective method for preventing and arresting caries and to ensure that there is no advanced tooth decay caused by sealing leakage, a regular dental check-up is necessary.

Keywords -

Pit and fissure, caries, sealants, oral health problem, occlusal surface

Introduction -

In human history, tooth decay has been among the most prevalent diseases. It is one of the most prevalent chronic conditions in children.

When a child's teeth first sprout, caries begins to form, and it continues to advance quickly throughout the formative years. Pits and fissures are where food retention typically occurs, and regular brushing makes it difficult to remove food from these places.

These difficult-to-reach places offer oral bacteria a heaven where they can thrive and convert carbohydrates into acids, demineralizing the enamel in the process.[1]

The most effective way to prevent dental caries is use of pit and fissure sealants or the dental sealants.

This is the substance that is introduced on the occlusal surface of the tooth that is subjected to the formation of cavities, thereby creating a shield that cuts off nutrients source for bacteria initiating caries.

Definition-

Pit and Fissure Sealant

A definition of pit and fissure sealant was proposed by Simonsen in 1978. He defined it as "a material that is introduced into the occlusal pits and fissures of caries susceptible teeth, thus forming a micro-mechanically bonded, protective layer cutting access of caries-producing bacteria from their source of nutrients." [2]

Types of fissures-

Nagano (1960), described four principal types of fissures, based on the alphabetical description of shape:

V type

U type

I type

K type [2]

Fissures with shallow and wide 'V' or 'U' shapes are self-cleaning and have a limited susceptibility to caries, whereas fissures with 'I' or 'K' shapes are very susceptible to caries.

Requisites of an efficient sealant-

- This paste's viscosity allows for penetration into crevices as deep as the maxillary teeth.
- Ample time for working.
- Cure Fast
- Good and long-lasting adhesion to enamel.
- Low solubility and sorption.
- Decreases wear and tear
- Tissue inflammation is reduced.
- Has cariostatic properties [3]

Classification of pit and fissure sealants-

Based on filler content

Depending on the presence / absence of fillers, sealants are classified into filled and unfilled resin systems.

Most of the self-cured resins are unfilled, these resins are colour less or tinted transparent materials.

Filled resins are also available as opaque, tooth-coloured or white-shades. [4]

Based on the colour of the sealants

In March 1977, the first coloured sealant (3M TM ESPE TM Concise TM White Sealant) was introduced to the US market.

Coloured sealant is clearly visible to the child, it is beneficial to encourage the child to periodically check for any sealant loss. This also helps in the encouraging aspects of the prevention program.[5]

Resin based sealant materials

Resin based sealants are classified into four generations based on the method of polymerization.

First generation sealants

The first sealant that used the acid etch process was introduced in the mid-1960s and it was cyanoacrylate (CA).

Nuva Seal® became the first commercially successful brand in 1972.

CAs were not suitable as sealants due to the bacterial degradation of sealant in the oral cavity over time.

The conquests of these CAs were replaced by second-generation sealant materials, which were found to be resistant to degradation and produced a strong bond with etched enamel.[6]

Second generation sealants

Second-generation sealants are dimethacrylates, representing the BIS-GMA reaction product, which is considered its founder as a hybrid between methacrylate and epoxy resin.

This generation sealants include auto polymerizing sealants which are set with a chemical catalyst- accelerator system.[7]

They are generally "self-cured" or "chemical cured" without the need for an external ultraviolet source.

Commercial products available today are BIS-GMA-based products or urethane dimethacrylates products.

Auto polymerizing resins generally performed better than the early ultraviolet light-initiated resin sealants.[8]

Third generation sealants

Third-generation sealants are synthetic compounds that contain initiator such as Camphor quinone and a reducing agent such as a tertiary amine to initiate polymerization.

Visible light source is used with eye protection.

Visual light activated sealants are more retentive [9]

Fourth generation sealants

In order to increase the duration of fluoride exposure to enamel for improved prevention of dental caries, fluoride-releasing materials have been developed.

Addition of fluoride to a sealant, or perhaps on its surface before applying the sealant, may have the potential benefit of additional protection against caries.[10]

Other material that can also be used

Glass ionomer sealant material, Low viscosity & high viscosity type.[11]

Polyacid-modified resin-based sealants, this polyacid-modified resin sealant has a better adhesion to enamel and dentin and is also less soluble in water, compared to GI sealant materials,[12] and less sensitive to techniques, compared to resin-based sealants. [13,14]

Clinical indications and contraindications for PFS-

Indications: -

The occlusal surface of a permanent tooth having clearly defined fissures and/or deep fossae.

- Patients with a high incidence of caries
- Gingival and operculum grooves that are free of gingival and operculum contact when only the appropriate teeth have erupted.
- Incisors with pits and fissures on the tongue.
- Sealants should be applied to primary teeth in children who have fissures and pits that are deep or discoloured or who have caries in the main molar on the opposite side.[15]
- Sealing is particularly important for kids and teenagers with physical, medical, and other limitations.[16]

Contraindications: -

- Restorations made of porcelain with synthetic materials
- Cavities on occlusal, interproximal areas of teeth;
- insufficient isolation of teeth;
- previously restored non-resin areas that need sealing;
- restorations containing amalgam;
- restorations onlays, inlays, or crowns in gold foil;
- its retention rate is significantly lower than enamel and it is more sensitive;
- extremely young children who do not cooperate with treatment

Technique-

Isolation of the Tooth

Moisture control is the most crucial aspect of the pit and fissure sealant placement, and therefore absolute isolation using a rubber dam is preferred.

Inadequate isolation leads to decrease in retention of the material.

In cases where absolute isolation is not possible, or it is not practical, like in the case of newly erupted teeth due to the need for local anaesthesia to place the clamp. In such cases, a dry field can be achieved by cotton rolls and isolation shields, and clever use of the evacuation tip. The application of glass ionomer may be considered as a temporary measure.

Acid Etching

Most frequently used: 37% orthophosphoric acid (gel)

Etch for 15 seconds for permanent molars, 15 to 30 seconds for primary teeth. Teeth with dental fluorosis require additional etching time.

Rinse well with air-water spray.

Dry the tooth with uncontaminated compressed air until a frosty white opaque appearance is seen

If cotton roll isolation has been used, replace cotton rolls.

If this appearance is not seen, repeat acid etching.

If the surface becomes contaminated, re-etching must be done.[17]

Sealant Placement and Curing

Many sealant kits have their own dispensers and instructions that must be followed.

Apply sealant, allow to flow into pits and fissures

In mandibular teeth, apply the sealant from the distal aspect, allow flowing mesially.

In maxillary teeth, apply the sealant from the mesial aspect, allowing to flow distally.

Use a fine brush, mini sponge, and carry sealant material up to the cuspal inclines

Air bubbles should not be incorporated

Visible Light Cured Sealant

10 to 20 seconds: exposure to visible light

The tip of curing light should be held 3 mm to 5 mm from the surface of the sealant

After the sealant has set, wipe the surface with a wet cotton pellet

Evaluate the Sealant

Visually and tactically

Evaluate the Occlusion of Scaled Tooth Surfaces

Check the occlusion with articulating paper – round finishing bur

Annual recall: 5% to 10% of sealants require repair or replacement annually [18]

Follow-Up Treatment

To ensure success in the application of pits and fissure sealants either as a primary or secondary prevention aid, regular check-up is mandatory. The failure for the sealants lies mainly primarily in the leaching of the material, hence, interrupting the mechanical barrier of Sealant and enamel.[19]

The window at the sealant-enamel interface would act as a potential way for food particles as well as saliva. This would promote the growth of bacteria leading to the initiation of dental caries beneath the sealant.[20]

Studies have even looked at potential side effects in addition to the disadvantages, if the sealant leaches out. Though no negative results have been reported in the individuals participated in the clinical trials. [21,22,23] However, there have been reports regarding resin-based products containing bisphenol A, such as bis-GMA or bis-DMA, having oestrogen-like effects. Patients treated via resin-based cements; bisphenol A was found in their saliva for at least up to 3 hours. However, research has found that with the use of pit and fissure sealants, patients are not at risk for oestrogen-like side effects. [24-26] Therefore, it is mandatory for the patients as well as parents to comply with a follow up stated by the concerned dentists. [27,28]

Recent advances in pit and fissure sealants

Fluoride releasing pits and fissure sealants

In comparison to conventional pits and fissure sealants, the application of these sealants over permanent molars have proved to be effective and efficacious aid in controlling the caries progression, especially in young children.

The clinical evaluation has also shown significant reduction in caries in individuals treated with fluoride releasing flowable resins.[29]

Nanocomposites as pit and fissure sealants

Due to its property of penetration into narrow and deep fissures, they can certainly be used as sealants, especially in managing juvenile patients. The disadvantage is the micro leakage.[30]

Color changing sealants

To ease the follow up, color changing sealants have come into practice. They are easily visible in comparison to clean sealants.

The first color changing sealant that has been launched in an arena of dentistry is the 3M's Concise White Sealant in March 1977.

A white color in the sealant makes it easily visible while applying and even during patient's follow up [31].

Hydrophobic and hydrophilic pit and fissure sealants

In individuals with hypersalivation, differently abled, highly uncooperative, with half erupted molars, hydrophilic pits and fissure sealants are easier to work with and provide the same efficacy in preventing caries. These potentialities would make it ideal to be used while providing community services.[32]

Cost-effectiveness of dental sealants

There is no doubt that dental sealants are a cost-effective procedure. By preventing the need for more intrusive and expensive restorative treatments, sealing permanent molars lowers the overall cost. When used on high-risk children and on surfaces susceptible to decay, sealants are considered more cost-effective. So, it is advised that sealants can be used on the basis of child's fissures anatomy and caries risk. [33,34]

Narrow, deep I-shaped fissures are somewhat more susceptible to caries in comparison to V-shaped fissures which are shallow and wide.[35] Permanent first molars that have just emerged should likewise be considered decay-prone. These teeth should be protected from caries and sealed at the earliest opportunity. Buccal pits and lingual grooves are also vulnerable to caries whose sealing is difficult.[36]

In high-risk caries patients' application of sealant should be a part of caries management protocol.[37] Fluoridated toothpaste, fluoride supplements, and expert topical fluoride treatment are all recommended and diet counselling, evaluating to what extent other preventive approaches are important.[38] several indicators are used to assess caries risk, including low socioeconomic status, past caries experience, sugar intake between meals, and active white spot lesion.

Conclusion

Carious lesions most commonly occur on the occlusal surfaces. It is impossible to foresee which teeth will become carious but if the surface is sealed with a pit and fissure sealer, no caries will form as long as the sealant is kept in place.

Along with proper diet, fluoride, and biofilm control, sealing pits and fissures should be considered as part of overall preventive program against caries rather than a separate procedure. Ideally, high-risk patients should apply sealants to all of their posterior teeth after eruption. Self-cleansing pits and fissures and proximal caries are contraindicated for sealant application. The dentist should be familiar with the different types of sealants and specific application methods for each product. With proper placement and maintenance, sealants can last for years.

clinical recommendations for the use of pit and fissure sealants are beneficial.

The main recommendations are that sealing pit and fissures of primary and permanent teeth is safe and effective both in preventing and in arresting caries. However, the long-term success is dependent on regular check-ups and the renewal of the sealing if required.

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