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Review Article

Indications, techniques, and outcomes of pit and fissure sealants in pediatric dentistry

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ABSTRACT

Pit and fissure sealants are safe and effective preventive measures for reducing the risk of tooth decay in pediatric patients. The procedure for applying sealants is a relatively quick and non-invasive process that typically involves preparation, isolation, and etchant application. They are typically used on the occlusal surfaces of molars and premolars, which have deep grooves and fissures that are difficult to clean. Sealants are mostly applied to the permanent molars in children, as they are the most susceptible to decay due to their deep grooves and pits sealants are non-invasive, cost-effective, easy to apply, and long-lasting. However, sealants cannot be used on teeth with existing decay, and they may need to be reapplied periodically to ensure continued protection. Sealants are not a substitute for good oral hygiene habits, regular dental check-ups, and cleanings. The necessity of the preventive dental procedure is based on the child's individual needs and the condition of their teeth.

Keywords: Pit and fissure sealant, Preventive dentistry, Pediatric dentistry

INTRODUCTION

Pit and fissure sealants are a preventive treatment used in pediatric dentistry to protect the children's teeth from the decay. These sealants are applied to the occlusal surfaces of the posterior teeth, which have natural grooves as well as the pits that can be difficult to clean with the toothbrush.[1]

The procedure for applying sealants is a relatively quick and non-invasive process that typically involves preparation, isolation, and etchant application and sealant application respectively.[2] The tooth is cleaned and prepared by removing any debris or plaque from the surface. This is followed by isolation with cotton rolls or other devices to keep it dry and free from saliva. After isolation, etching is done with a mild acidic solution. The etchant typically contains phosphoric acid, which helps to

create a rough surface on the tooth enamel that allows the sealant to bond more effectively. The etching solution is then rinsed off, and the tooth is dried. The sealant material is then applied to the tooth surface and carefully manipulated to fill in the deep grooves and fissures. The material is then photocured to harden and bond it to the tooth surface. If necessary, additional material is added to ensure complete coverage.[2]

Sealants are mostly applied to the permanent molars in children, as they are the most susceptible to decay due to their deep grooves and pits.[3] However, they can also be applied to deciduous teeth in some cases. The American Dental association recommends that children receive sealants as soon as their permanent molars come in, which is typically around the age of six or seven.[4] Sealants can last for several years before they need to be reapplied, and they are a cost-effective way to prevent tooth decay in children.

There are several types of pit and fissure sealants available for use in pediatric dentistry.[5] Resin-based sealants are the most common type of sealant and are made of a resin material that is applied to the tooth surface.[6] They can be either filled or unfilled, with filled sealants containing small particles of silica or glass that make them stronger and more wear resistant. Glass ionomer sealants are made of a material that releases fluoride over time, helping to prevent tooth decay.[7] They are less wear-resistant than resin-based sealants, so they may need to be reapplied more often. Compomer sealants are a combination of composite resin and glass ionomer materials, providing both the strength of resin-based sealants and the fluoride release of glass ionomer sealants.[8]

METHODS

This study is based on a comprehensive literature search conducted on April 19, 2023, in the Medline and Cochrane databases, utilizing the medical topic headings (MeSH) and a combination of all available related terms, according to the database. To prevent missing any possible research, a manual search for publications was conducted through Google Scholar, using the reference lists of the previously listed papers as a starting point. We looked for valuable information in papers that discussed the indications, techniques, and outcomes of pit and fissure sealants in pediatric dentistry. There were no restrictions on the date, language, participant age, or type of publication.

DISCUSSION

Pit and fissure sealants are indicated for children who are at a higher risk of developing tooth decay. There are several advantages to using pit and fissure sealants in pediatric patients to prevent tooth decay. Some of the main advantages include the following:

Effective prevention of tooth decay: Pit and fissure sealants have been shown to be effective at preventing tooth decay in children, particularly on the occlusal surfaces of the molars and premolars.[5]

Non-invasive: Applying sealants is a non-invasive procedure that does not require drilling or removing any tooth structure.[9] This can be particularly beneficial for children who are anxious about dental procedures.

Cost-effective: Sealants are a cost-effective way to prevent tooth decay in children, as they can help reduce the need for more invasive and costly dental treatments such as fillings and root canals.[10]

Easy application: Applying sealants is a relatively quick and easy procedure that can be done in a single dental visit.[11] This can be particularly convenient for busy parents and children with busy schedules.

***Long-lasting*:** While the long-term effectiveness of sealants varies depending on factors such as the type of sealant used and the child's oral hygiene habits, some sealants can remain effective for up to ten years or more.[12]

Indications

Common indications for the use of pit and fissure sealants in children include deep grooves and fissures, a history of cavities, newly erupted permanent molars, and problems with oral hygiene maintenance and orthodontic treatment.

Deep grooves and fissures: Some children have deeper grooves and fissures in their teeth that can make them more susceptible to tooth decay. Sealants can help fill in these areas and prevent food particles and bacteria from getting trapped in them.[13]

History of cavities: Children who have a history of cavities or who are at a higher risk of developing cavities may benefit from sealants as a preventive measure.[14]

Newly erupted permanent molars: When children's permanent molars first erupt, the enamel is still developing and may not be as strong as it will be later on. Applying sealants to these teeth can help protect them during this vulnerable period.[15]

Difficulty with oral hygiene: Children who have difficulty brushing and flossing may be more likely to develop tooth decay, particularly in the deep grooves and fissures of the molars.[16] Sealants can help provide an additional layer of protection in these areas.

Orthodontic treatment: Children who are undergoing orthodontic treatment may have difficulty cleaning their teeth properly, particularly around brackets and wires.[14] Sealants can help protect the teeth from decay during this time.

Techniques

There are several techniques used for applying pit and fissure sealants in pediatric dentistry. Some common techniques include the following.

Etch and rinse technique: This technique involves etching the tooth surface with an acidic solution to create a rough surface for the sealant to adhere to.[17] The etching solution is rinsed off, and the tooth is dried before the sealant material is applied.

Self-etching technique: In this technique, the sealant material contains an acidic component that etches the tooth surface as the sealant is applied.[18] This technique can be faster and more convenient than the etch and rinse technique.

Glass ionomer base technique: This technique involves applying a glass ionomer material to the deep grooves and fissures of the tooth before applying the sealant.[19] The glass ionomer material releases fluoride over time, helping to prevent decay.

Selective etching technique: This technique involves selectively etching only the deep grooves and fissures of the tooth, rather than the entire surface.[20] This can help preserve more of the tooth structure and reduce the risk of post-operative sensitivity.

Sealant placement using a flowable composite: In this technique, a flowable composite resin material is used instead of a traditional sealant material.[21] The flowable composite is easier to manipulate and can flow into even the smallest crevices, providing a more thorough seal.

Outcomes

Pit and fissure sealants have been shown to be effective preventive measures for reducing the incidence of tooth decay in pediatric patients. Here are some of the outcomes associated with the use of pit and fissure sealants:

Reduction in tooth decay: Multiple studies have found that pit and fissure sealants can significantly reduce the incidence of tooth decay in children.[22] One study found that sealants reduced the incidence of decay in permanent molars by up to 80% over four years.

Cost-effectiveness: Sealants are a cost-effective way to prevent tooth decay in children. One study found that the use of sealants was associated with a significant reduction in the need for fillings and other restorative procedures, resulting in cost savings for both patients and dental insurance providers.[23]

Long-term effectiveness: While the long-term effectiveness of sealants varies depending on factors such as the type of sealant used and the child's oral hygiene habits, some studies have found that sealants can remain effective for up to 10 years or more.[24]

No adverse effects: Research has found that pit and fissure sealants are safe for use in children and do not pose any significant health risks.[3]

While pit and fissure sealants are a safe and effective preventive measure for reducing the risk of tooth decay in pediatric patients, several considerations should be considered when using sealants in children. Here are some key considerations:

Tooth preparation: Before applying sealants, the tooth surface must be cleaned and prepared to ensure the best possible adhesion.[25] This can be a challenging process for pediatric patients, particularly those who are very young or have difficulty sitting still. The dentist will need to take care to ensure that the tooth is completely dry and free of debris before applying the sealant material.

Age of the patient: Pit and fissure sealants are most commonly used in children aged 6-14 when their permanent molars are erupting.[26] However, they may also be used in younger children if they have deep grooves or fissures that put them at a higher risk of decay.

Type of sealant: There are several types of sealant materials available, each with its own advantages and disadvantages. The dentist should select the most appropriate type of sealant for the child based on their individual needs and the condition of their teeth.[27]

Long-term maintenance: While sealants can be effective for several years, they may need to be reapplied periodically to ensure continued protection.[28] Parents should ensure that their child receives regular dental check-ups and cleanings to monitor the condition of their sealants and prevent decay.

Overall, pit and fissure sealants are a safe and effective preventive measure for reducing the risk of tooth decay in pediatric patients.

The recent developments in pit and fissure sealants are promising and may offer additional benefits for pediatric patients in the future. These include the following.

Fluoride-releasing sealants: Some newer sealant materials contain fluoride, which can help strengthen the tooth and prevent decay.[29] These fluoride-releasing sealants have been shown to be more effective at preventing decay than traditional sealants.

Resin infiltration: This is a newer technique that involves infiltrating resin material into the early stages of decay in the grooves and fissures of the tooth.[30] This can help stop the decay from progressing and may be used in conjunction with sealants for additional protection.

Nanotechnology: Some researchers are exploring the use of nanotechnology in developing new sealant materials.[31] These materials are designed to be more durable and long-lasting than traditional sealants, while still providing effective protection against decay.

Automated sealant application: Some dental offices are now using automated systems for applying sealants, which can make the process faster and more efficient.[32] These systems use lasers or other technology to ensure precise placement of the sealant material.

Digital sealant monitoring: Some dental offices are now using digital technology to monitor the condition of sealants over time. This can help identify any areas of wear or damage that may require reapplication of the sealant material.[33]

While pit and fissure sealants are a safe and effective preventive measure for reducing the risk of tooth decay in pediatric patients, there are some limitations and contraindications to their use in dentistry. A few of these are mentioned below.

Cannot be used on teeth with existing decay: Sealants are only effective for preventing new decay from forming on the tooth surface. They cannot be used to treat existing decay or cavities.

May need to be reapplied: While some sealants can remain effective for up to ten years or more, they may need to be reapplied periodically to ensure continued protection. This can be inconvenient for some patients and may add to the cost of dental care.[34]

Difficulties with application: Applying sealants can be challenging in some cases, particularly in pediatric patients who have difficulty sitting still or maintaining good oral hygiene.[35]

Not a substitute for good oral hygiene: While sealants can be an effective preventive measure, they are not a substitute for good oral hygiene habits such as brushing twice a day and flossing daily.[36] Regular dental check-ups and cleanings are also important for maintaining good oral health.

Not suitable for all teeth: Sealants are typically used on the occlusal surfaces of molars and premolars, which have deep grooves and fissures that are difficult to clean. They may not be suitable for other teeth that do not have these features.[36] Regular dental check-ups and cleanings are also important for maintaining good oral health.

CONCLUSION

Pit and fissure sealants are a valuable tool in preventive dentistry for pediatric patients. They are effective at reducing the risk of tooth decay in the occlusal surfaces of molars and premolars, and they offer several advantages such as being non-invasive, cost-effective, easy to apply, and long-lasting. However, sealants have some limitations and are not a substitute for good oral hygiene habits and regular dental check-ups and cleanings.

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