

Preparation before acid etching in fissure sealant therapy: yes or no?

A systematic review and meta-analysis

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Dental sealants were introduced in the 1960s to protect occlusal pits and fissures from dental caries.¹ Pit-and-fissure sealant application is a procedure that involves the placement of a sealant material into the pits and fissures of teeth that are susceptible to caries, mainly on the occlusal tooth surfaces.² The sealant forms a micromechanically bonded protective layer that acts as a barrier and prevents the accumulation of bacteria that can cause caries. The application of pit-and-fissure sealant to posterior teeth is the most effective method of preventing pit-and-fissure caries.³

A review and meta-analysis of the literature show that the pit-and-fissure sealant is effective in preventing the initiation of caries in sound, susceptible pits and fissures in children and adolescents, particularly when used with an adhesive system.^{3,4} Investigators in ongoing studies are assessing the retention and effectiveness of sealants after the application technique of the sealant has been modified. Investigators in these studies focus on the effectiveness of using a preparation method before conventional fissure sealant application to improve the chance of better etching of enamel rods and improving the penetration of the enamel sealant material into the depths of the pits and fissures, thereby improving sealant retention. Adhesion is defined as a state in which 2 surfaces are held together by interfacial forces, and mechanical adhesion is the main mechanism of adhesion in fissure sealant therapy.⁴ Polymerization shrinkage of resin-based sealant materials has a deleterious effect on sealant adhesion and can induce gaps in adhesion. Investigators have proposed chemical and mechanical

ABSTRACT

Background. The authors of this systematic review and meta-analysis had 2 aims: to evaluate fissure sealant retention with and without the use of a preparation method and to compare fissure sealant retention using the preparation-only method before sealant placement with the conventional acid-etching procedure.

Types of Studies Reviewed. The authors conducted a literature search (from database inception through June 2, 2016) to identify studies for inclusion in this systematic review. The authors assessed the quality of the evidence with the modified Jadad scale and performed the meta-analysis by using a random-effects model.

Results. The authors considered 12 studies (8 for the first part and 4 for the second part) that met the inclusion criteria for the systematic review and meta-analysis. In the analysis of the first part of the systematic review, the authors found that the preparation method before acid etching had a significant positive effect on fissure sealant retention (odds ratio, 3.262; 95% confidence interval, 1.782-5.971; $P = .001$). In the analysis of the second part of the systematic review, the authors found that there were no significant differences between the preparation-only method and the conventional acid-etching method in terms of fissure sealant retention (odds ratio, 1.241; 95% confidence interval, 0.534-2.888; $P = .616$).

Conclusions and Practical Implications. The use of a preparation method before fissure sealant application can increase sealant retention. However, preparation alone cannot substitute the conventional acid-etching method before sealant placement.

Key Words. Pit-and-fissure sealants; preparation; systematic review; meta-analysis.

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preparations of tooth surfaces such as acid etching alone or in combination with cleaning, bur enameloplasty, air abrasion, or laser treatment to improve the adhesion of sealant materials.⁵⁻¹⁰

The cleaning procedure to remove debris and deposits by using a bristle brush or rubber cup with or without a slurry of pumice is an easy and widely available method that Hegde and Coutinho⁹ used with good sealant retention results in their study. Enameloplasty with burs (fissurotomy STF and NF burs, small one-quarter round burs), with a high- or slow-speed handpiece, has been demonstrated in several *in vivo* and *in vitro* studies as a simple, cost-effective, and easily accessible method resulting in acceptable sealant retention and reduced microleakage.^{5,11-15} The air abrasion system uses a propelled stream of aluminum oxide particles generated from compressed air and bottled carbon dioxide or nitrogen gas to abrade the tooth structure. For fissure surface cleansing before sealant application, a brief exposure at 40 pounds per square inch with a small tip size is sufficient. Enamel roughening, opening of questionable fissures, removing suspected caries, and cleaning pits and fissures are the main mechanisms of this technique. Investigators have achieved conflicting results with this treatment in several studies.^{8,14,16-20}

Investigators have suggested the use of lasers as a pretreatment method to roughen enamel before fissure sealant application. The main advantage of the laser-etched surface is the acid resistance induced by recrystallization of the enamel. As the calcium:phosphorus ratio changes with the laser application, the enamel becomes more resistant to caries.²¹ Repetitively pulsed lasers can produce etching patterns similar to those obtained with orthophosphoric acid.²² In addition, laser treatment can promote the sterilization of fissures because of its action on the dental plaque. Investigators have achieved conflicting results with this treatment in several clinical and laboratory studies.^{7,23-25} The acid-etch technique is a well-accepted method for the preparation of pits and fissures before sealant application. However, the pellicle and remaining debris might not be removed from the base of the fissures with the conventional etching procedure.²⁶ Therefore, it is questionable whether pit-and-fissure preparation before the conventional etching procedure is needed or whether it could be used as an alternative to the procedure.

Our primary objective in this systematic review was to compare the fissure sealant retention in studies in which the investigators used a preparation method with that in studies in which the investigators did not use a preparation method before conventional acid etching. Our second objective was to compare fissure sealant retention in studies in which the investigators used other preparation methods before sealant placement instead of the conventional acid-etching procedure.

METHODS

Search strategy and inclusion criteria. To identify studies for inclusion in this systematic review, we conducted searches by using PubMed, Scopus, Embase, the Cochrane Database of Systematic Reviews (via Wiley Online Library), Ovid (Cochrane Central Register of Controlled Trials, Cochrane Methodology Register, Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effects, MEDLINE), and the Institute for Scientific Information Web of Knowledge (all databases, including the Web of Science Core Collection, Biological Abstracts, Biosis Citation Index, Current Contents Connect, Data Citation Index, Derwent Innovation Index, Food Science and Technology Abstracts, Inspec, Korean Journal Database, MEDLINE, SciELO Citation Index, and Zoological Record). These sources commonly are used for developing search strategies within the field of dentistry and other medical disciplines.^{4,27-29} We applied no language exclusion or date limit to the search. If necessary, we contacted the authors for clarification.

We limited the free search terms as follows: ((fissure sealant) AND preparation) OR ((air abrasion) OR laser OR bur OR pumice OR brush OR fissurotomy OR prophylaxis OR (air polishing) OR toothbrush* OR enameloplasty OR enameloplasty). In addition, we hand searched the reference lists and the cited references from all the relevant studies (from Scopus and Google Scholar) for any possible missing articles, and we performed the final search on June 2, 2016.

For the systematic review, we included clinical articles in which the authors described randomized or quasi-randomized studies that incorporated a follow-up duration of at least 6 months and reported the sample size of each group accurately. In addition to these criteria, for the first part of the study, we determined that both the experimental and control groups in the included studies had involved the use of a phosphoric acid pre-etching stage and that the experimental group had involved the use of a preparation method before acid etching. However, for the second part of the study, the experimental group had to have involved a preparation method without acid etching and the control group had to have involved only acid etching as preparation. Furthermore, we excluded the following articles: nonclinical studies, nonrandomized or noncontrolled trials, or studies with inadequate amounts of data for analysis.

Two associate professors in the field of pediatric dentistry (A.B., A.S.S.) independently evaluated the articles in a masked manner and selected the relevant articles on the basis of the inclusion criteria. We debated

ABBREVIATION KEY. N: No. NM: Not mentioned. Y: Yes.

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