A moisture tolerant, resin-based pit and fissure sealant

By Ira Hoffman, DDS, BSc

Pit and fissure sealants have been shown to be highly effective in preventing caries, and there is considerable research documenting sealant success over extended periods.[1–4]

The primary measure of sealant efficacy is retention. If the sealant material stays bonded to the tooth and provides a good seal, then it is reasonable to expect that caries incidence can be decreased.

The practitioner must overcome certain challenges to achieve the desired high degree of success. The decision to place sealant is based on caries risk analysis. The first and second permanent molars are at the greatest risk of developing caries, and the optimal time to seal them is during the early eruption.

Unfortunately, there are anatomical considerations that make the placement of sealants less reliable at that time.

During the eruption process, permanent molars break through the gingival tissues leaving excess tissue, an operculum, over the distal surfaces that can interfere with the success of a sealant.

Furthermore, isolation is mandatory for traditional sealants, but is extremely difficult, if not impossible, with erupting teeth.

Because moisture contamination is a contra-indication for traditional pit and fissure sealants, which require a clean, dry, etched enamel surface for success, some clinicians prefer to wait for the teeth to fully erupt so that isolation can be achieved.

By this time, however, caries has often invaded the at-risk pits and fissures and, as a result, a more invasive treatment and restoration is required.

In recent years, we have seen the development of new materials that behave favorably in the moist oral environment, taking advantage of the moisture that is ever-present in the mouth.

An advanced, resin-based sealant technology has been developed that incorporates a moisture-tolerant resin chemistry that is placed on the slightly moist tooth, allowing placement during early eruption (Embrace WetBond Pit and Fissure Sealant, Pulpdent Corporation, Watertown, Mass.).

Traditional pit and fissure sealants are hydrophobic. They repel water and cannot be applied where there is moisture. These materials are based on bis-GMA and other monomers that are primarily hydrophobic in nature and require a dry field.

Many manufacturers recommend their use with hydrophilic bonding agents as a way to overcome the dry field requirement; however, the bonding agents add considerable time and cost to the procedure, and the procedure becomes more technique sensitive.

Embrace WetBond is based on a unique chemistry that incorporates di-, tri- and multi-functional acidic acrylate monomers in a proprietary formula with a carefully designed hydrophilic-hydrophobic balance. The result is a resin-based material that is moisture tolerant and behaves favorably in the moist oral environment.

In fact, Embrace is activated by moisture. Embrace WetBond contains no bis-GMA and no bisphenol A, and is unlike hydrophobic monomers typically used in traditional sealants.

The moisture tolerant Embrace sealant does not require a bonding agent. Enamel is etched, rinsed and lightly dried. The tooth is left slightly moist and glossy but without any drops or pooling of water. Embrace is water miscible.

When placed on the tooth surface in the presence of moisture, the sealant spreads over the enamel surface and integrates with the tooth in a unique way. It has been noted that margins are smooth and virtually undetectable with an explorer.[5]

This tooth-integrating phenomenon can be seen with scanning electron microscopy, which shows the intimate association between the sealant and the tooth that provides an exceptional seal against microleakage and protection against caries.

After light curing, however, Embrace sealant has physical properties similar to other commercially available sealants.[6–8]

A longitudinal clinical study using Embrace WetBond Pit and Fissure Sealant was begun in May 2002. The study was conducted in a suburban pediatric practice. There was no prescreening of patients. Even difficult patients and children with poor oral hygiene and dietary habits were included in the study.

In this practice-based study, 334 sealed teeth were followed at recall visits for four to six years and evaluated by a pediatric dentist. Of these, 299 sealants were intact and clinically acceptable. Of the remaining teeth, 32 required resealing with no evidence of occlusal caries, and only three teeth, or less than 1 percent, developed occlusal caries.[9]

As a basic concept, 5–10 percent of sealant loss per year has been seen when one reviews published sealant data.[10] This data reveals the importance of periodic reevaluation of sealed teeth and reapplication of sealant if necessary. This reevaluation of sealants should be standard care. When a sealant needs to be repaired or reapplied, the tooth should be treated as if an initial sealant is being placed.[11]


Fig. 1


Fig. 2


Fig. 3


Fig. 4

Clinical technique

Embrace WetBond requires a small change from the traditional clinical protocol because the etched enamel surfaces of the teeth should be slightly moist during sealant placement. Following these directions will ensure clinical success.

1. Examine and evaluate the occlusal surfaces, and isolate the teeth to be sealed with rubber dam or cotton rolls (Fig.1).
2. Clean the tooth surfaces using an oil-free, water–pumice paste with a disposable prophylaxis angle in a slow-speed handpiece. Other methods for cleaning teeth before sealant placement include using a non-fluoride, pumice prophylaxis paste and an air abrasion device (Fig.2).
3. Rinse thoroughly with an air-water spray, removing all residual paste from pits and fissures, and dry (Fig. 3).
4. Prepare questionable enamel and small lesions in the usual manner. Rinse and dry with oil-free compressed air.
5. Apply Pulpdent 35–40 percent phosphoric acid etching gel to the clean tooth surface for 15 seconds (Fig.4). Rinse well with an air-water spray (Fig. 5). Do not disturb this surface.
6. Lightly dry and remove excess water with a cotton pellet or clean compressed air (Fig. 6). Leave tooth surfaces slightly moist. Slightly moist tooth surfaces should appear shiny or glossy, but there should be no visible pooling or drops of water on the tooth surfaces. With Embrace WetBond, the typical dull, frosted appearance of the etched surface is not desired. Embrace bonds to surfaces slightly moist from saliva; however, it is best to avoid bacterial contamination.
7. Place an applicator tip on the syringe and apply the Embrace WetBond sealant to the occlusal surface. After dispensing, use a microbrush applicator to place the sealant, covering all pits and fissures and extending onto the cusp ridges. The final sealant thickness upon application should be at least 0.3 mm (Fig. 7).
8. After application, light-cure the sealant holding the light-curing probe at right angles and as close as possible to the occlusal surface. Embrace cures with all lights (Fig. 8). Curing time for a halogen light with a minimum of 300 mW/cm^2 is 20 seconds. More powerful lights will cure faster.
9. Evaluate the sealant for coverage, retention and occlusion (Fig. 9). The tooth is sealed and ready for function (Fig. 10).

Although the most common practice is to apply the pit-and-fissure sealant directly to the etched enamel, various studies have evaluated the efficacy of using a bonding agent before sealant placement.

The use of a bonding agent has the potential to increase sealant retention with traditional sealants,[12,13] but the disadvantage is that it increases the number of steps, is more technique sensitive and adds cost in time and materials.

With Embrace WetBond Pit and Fissure Sealant, adhesive bonding agents are not required and, although saliva contamination should be avoided whenever possible, it does not

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affect the bond of Embrace WetBond sealant.

Discussion

Clinically, a moisture-tolerant sealant makes sense. Unless a rubber dam is being used, the clinician is working in the oral cavity with humidity near 100 percent. This ensures that even the driest tooth surfaces contain some moisture.

In addition, because the permanent first molars are the teeth at greatest risk, it is desirable to seal them immediately upon eruption when isolation is the most difficult. Therefore, a moisture-tolerant resin sealant is necessary to ensure the optimal chance for successful retention.

Until now, the only moisture-tolerant sealants were glass ionomers.[14] Their mechanism of adhesion is ionic bonding, not micromechanical retention to an acid-etched enamel surface.

In studies with glass-ionomer sealants it has been reported that the three-year retention rate is only 31 percent.[15] Pardi and co-workers also reported low sealant retention rates with glass ionomers.[16]

The information currently available suggests that the optimal characteristics for a pit-and-fissure sealant are a resin-based material that is moisture tolerant, light-cured and lightly filled with color so that sealant detection and evaluation at recall is easily accomplished.[14]

The introduction of a moisture-tolerant, resin-based sealant (Embrace WetBond) has eliminated the problems seen in the past with traditional, hydrophobic resin-based sealants.

In a dental practice, pit-and-fissure sealants are best applied by trained auxiliaries using an etch-and-rinse, moisture-tolerant sealant. Adherence to the sealant technique described above can lead to success in preventing pit and fissure caries. DT


Fig. 5


Fig. 6


Fig. 7

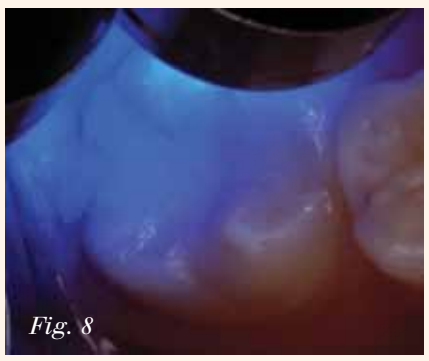
Fig. 8


Fig. 9


Fig. 10

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