

Composite/sealant restoration: 6 1/2-year results

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Abstract

This study was performed to examine the success of a conservative cavity preparation using the principle of "sealing for prevention" rather than "extension for prevention." A total of 332 restorations were placed in 243 permanent molars in 114 children aged 6-14 with a mean age of 8 years. After 80 months, 104 restorations were examined for sealant retention, marginal staining, anatomic wear, marginal adaptation of the composite if the sealant was lost, and dental caries. Twenty restorations sustained partial loss and 16 complete loss of the sealant. Marginal staining was not evident, but 5 restorations showed evidence of wear and 11 marginal caries. These findings indicate that conservative cavity preparation with sealing for prevention is a successful restoration which conserves valuable tooth structure.

In classical restorative dentistry technique, whenever the occlusal surface of a molar is prepared, the preparation usually is extended to include all pits and fissures whether or not these areas are carious (Gilmore 1979). Although these extensions of the preparation are performed to prevent caries, sound tooth structure is removed and a weakened tooth results. The first permanent molar in the adult mouth frequently sustains cusp fracture following placement of a restoration, necessitating extensive restorative or endodontic treatment. This problem might be caused inadvertently when conscientious practitioners use extension for prevention with young patients. Consequently, it would be beneficial to preserve sound tooth structure and employ fissure sealants for prevention. The composite/sealant restoration has been investigated with excellent results (Simonsen and Stallard 1977; Azhdori et al. 1979; Simonsen 1980; Mertz-Fairhurst et al. 1983) and recently it has been advocated for widespread use by general practitioners (Anusavice 1988). This article reports the 6 1/2-

year results of a study which examined the success of a conservative occlusal restoration in which fissure sealant was used rather than cavity extension into pits and fissures for prevention of caries.

Methods

This study was conducted at the New Jersey Dental School in Newark and Hadassah School of Dental Medicine in Jerusalem, Israel. Three hundred thirty-two restorations were placed in 240 teeth of 110 subjects, aged 6-14 years with a mean age of 8 years (Table). The restorations were placed predominantly in the first permanent molars in all 4 quadrants, and in a few second permanent molars. The teeth selected for treatment had incipient, minimal, or moderate occlusal carious lesions. Extensive lesions that involved all of the pits and fissures were excluded because there was no tooth structure to preserve with the sealant.

Table. Subject Characteristics

	Subjects	Teeth	Restorations
Newark	40	81	99
Jerusalem	70	159	233
Total	110	240	332

The treatment procedure was similar to that used for routine amalgam restorations in that both local anesthesia and rubber dam isolation were used (Fig 1, next page). The tooth surface was cleaned with a rubber cup and prophylaxis paste or a slurry of pumice and the cavity was prepared with round or pear-shaped burs at high or low speed (Fig 2, next page). The preparation consisted only of caries removal (Fig 3, next page) and although grossly undermined or soft demineralized enamel was removed, there was no attempt to remove slightly undermined enamel, create any retention, or extend for prevention into sound pits and fissures. Stained but firm fissures with no stickiness or underlying enamel discoloration were left intact to conserve

Figs 1-8 (opposite) reprinted with permission from Quintessence International 16:489-92, 1985.

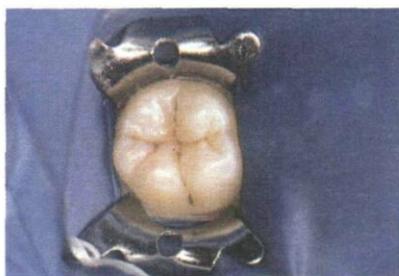


FIG 1. Molar isolated with rubber dam.



FIG 2. Carious lesion removal with pear-shaped bur.

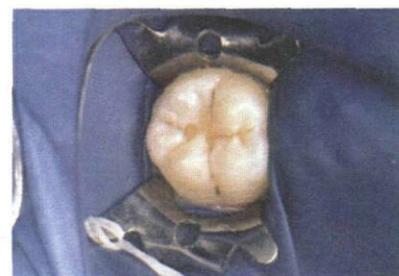


FIG 3. Conservative preparation completed.



FIG 4. Pulp protection placed.

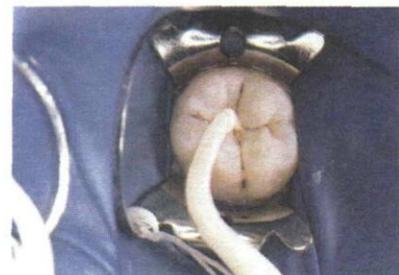


FIG 5. Placing composite resin material with Teflon® instrument.



FIG 6. Composite resin material placed.

sound tooth structure. Preparations with minimal or moderate decay averaged 1.5×2 mm with a depth of approximately 2-2.5 mm. Preparations for incipient lesions were less than 1 mm in cross section.

Following caries removal, the pulp was protected with a layer of calcium hydroxide (Dycal — LD Caulk Co; Milford, DE, Fig 4) and the cavity was restored with an autopolymerized composite (Miradapt — Johnson & Johnson Dental Products Co; East Windsor, NJ) which was applied with a Centrix (Centrix Co; Stratford, CT) syringe to fill the cavity without excess. The use of the syringe prevented voids at the base of the cavity. After application, the material was pushed into the cavity with a plastic instrument (Fig 5). If the restoration was large, a piece of plastic cellophane was placed on the tooth and held firmly with a cotton pellet until the material hardened. After the material had set, any necessary trimming was performed with small white stones at high speed and the occlusal surface then was etched for 60 sec with 37% phosphoric acid, washed, and dried (Fig 6) and Delton (Johnson & Johnson Dental Products Co; East Windsor, NJ) autopolymerized sealant was applied according to the manufacturer's instructions. Tinted sealant was used on approximately half of the teeth and clear sealant was used on the remainder. In the incipient preparations composite was not placed and the sealant served as the restoration. The



FIG 7. Completed restoration, rubber dam removed.



FIG 8. First permanent molar with composite resin sealant restoration in the central pit area 4 years after placement. Other teeth had been covered with tinted fissure sealant.

sealant was not allowed to flow lingually or buccally onto unetched enamel or to contact distally the soft tissue operculum if present. After the sealant was fully set it was tested by attempting to pry it off with a dental explorer. Occasionally, the sealant was dislodged and it was reapplied after re-etching of the tooth surface for 60 sec. Figure 7 illustrates the completed restoration and Figure 8 illustrates a similar conservative restoration in a permanent maxillary first molar at 4 years after placement.

Placement and examination of the restorations in both countries were performed or supervised by one investigator (MH). The restorations were examined at 6, 12, 18, 24, 36, 48, 60, and 80 months and were evaluated according to the following criteria: (1) sealant — no loss, partial loss, complete loss; (2) marginal staining — none, slight, severe; (3) anatomic wear — none, slight, severe;

(4) marginal adaptation of the composite if the sealant was lost — no defect, slight catch, moderate catch, slight crevice, extensive crevice; and (5) dental caries — none, present.

Results

After 6 1/2 years, 104 restorations were available for examination and the findings are summarized in Figure 9. Caries developed in 11 teeth (11%) while sealant wear was observed in 5 of the teeth (5%). Complete loss was noted in 16 restorations (15%) and partial loss occurred in 20 restorations (19%). Complete retention of the sealant was found in 68 restorations (65%). Although there was sealant loss in 32% of the restorations, there were only 2 teeth which sustained loss of the composite restorative material, subsequently resulting in caries.

Discussion

The results obtained in this study are similar to those of other investigations. These results demonstrate that conservative composite restorations can be used successfully to restore moderately involved occlusal carious lesions. The retention of the composite restoration was excellent and retention of the sealant was similar to results of other sealant studies.

Wear was slight because the preparation was confined to areas of the occlusal surface that were not stress bearing. Recurrent caries was minimal and occurred whenever there was partial or complete sealant loss which exposed a susceptible pit or fissure. Because this was a clinical research study, resealing was not instituted. However, it would normally be performed in clinical practice if partial sealant loss was detected on recall examination and this would have led to less dental caries.

In this study an autopolymerized material was used, but a light polymerized material could be used just as successfully. Similarly, in this study etching of the tooth was performed after composite placement and before sealant placement. Etching could be performed before placement of the composite if extreme care is exercised so that the etched enamel surface is not contaminated before sealant placement. If the etched surface is manipulated during placement, then re-etch of the enamel becomes necessary. Although etching prior to placement of the composite and the use of a bonding agent might contribute to retention, in this study only 2 restorations were lost after 6 1/2 years and retention was not considered to be a problem.

If a carious lesion develops on the proximal tooth surface, it should be restored with as little involvement

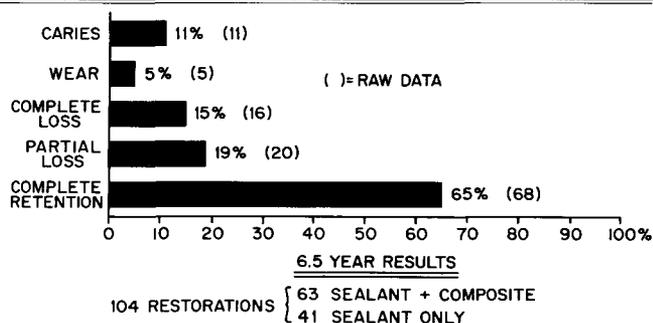


FIG 9. Findings after 6 1/2 years.

of the occlusal surface as possible. Preliminary evidence indicates that there will be little, if any, leakage of an amalgam/sealant interface if amalgam is used to restore the proximal surface and the occlusal sealant is left intact (Fuks and Shey 1983).

Conclusion

The results of this study demonstrate that conservative cavity preparation with sealing for prevention is a successful approach for treating teeth with minimal or moderate carious lesions. It is particularly recommended when carious lesions have not yet involved all pits and fissures and valuable tooth structure can be conserved, resulting in a stronger restored tooth.

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Anusavice KJ: Final report of international symposium: Criteria for placement and replacement of dental restorations. Gainesville: University of Florida, 1987.

Azhdori S, Sveen OB, Buonocore MG: Evaluation of a restorative preventive technique for localized occlusal caries. *J Dent Res* 58:952, 1979.

Fuks AB, Shey Z: In vitro assessment of marginal leakage of combined amalgam sealant restorations on occlusal surfaces of permanent molar teeth. *J Dent Child* 50:425-29, 1983.

Gilmore GW, Lund MR: *Operative Dentistry*. St. Louis; CV Mosby Co, 1973 p 82.

Mertz-Fairhurst EJ, Newcomer AP, Call-Smith KM: Caries arrestment and prevention by sealed conservative filled resin restorations. *J Dent Res* 62:478, 1983.

Simonsen RT, Stallard RE: Sealant restorations utilizing a diluted filled resin: one-year results. *Quintessence Int* 6:77-84, 1977.

Simonsen RT: Preventive resin restorations: three-year results. *J Am Dent Assoc* 100:535-39, 1980.