The preventive resin (composite resin/sealant) restoration: Nine-year results

Milton Houpt* / Anna Fuks** / Eliezer Eidelman***

This study was performed to examine the 9-year success of the composite resin/sealant restoration, which uses "sealing for prevention" of fissure caries rather than "cavity extension for prevention." Three hundred thirty-two Class I restorations were placed in the occlusal surfaces of 240 permanent molar teeth in 114 children aged 6 to 14. Cavity preparations were made in occlusal surfaces, and caries was removed with no attempt to create any additional retention or remove undermined enamel. Exposed dentin was covered with Dycal and the cavity was restored with Radiopaque Adaptic, which was then covered with Delton fissure sealant. Incipient lesions confined to the enamel were restored only with Delton. After 9 years, 79 restorations in 28 subjects were examined for sealant retention, marginal staining, and the presence of dental caries. Forty-three restorations (54%) had completely retained sealants, 20 (25%) had sustained partial loss, and 16 (20%) of the restorations had lost all sealant. Dental caries occurred in 19 (25%) of the restorations that had sealant loss. An additional 16 teeth had proximal caries unrelated to the occlusal restoration. These findings demonstrated that the composite resin/sealant (preventive resin) restoration produced excellent long-term results. (Quintessence Int 1994;25:155–159.)

Introduction

Classic restorative dentistry dictates that an occlusal cavity preparation should extend into all pits and fissures, whether or not they are carious. Although such extension is performed to prevent future caries, sound tooth structure is usually destroyed, thereby weakening the tooth and increasing the perimeter of the restorative material. In adults, permanent first molars frequently have cuspal fracture, and extensive restorative or endodontic treatment often becomes necessary. This problem may be inadvertently caused when conscientious practitioners use cavity "extension for prevention" in young patients. If the margins of the restoration break down and the restoration is replaced, the cavity becomes larger and the tooth becomes weaker until it subsequently fractures. Consequently, it might be beneficial if sound tooth structure could be preserved and another method of prevention were used.

A conservative occlusal preparation without extension for prevention has been advocated, and excellent results have been obtained in various studies of the procedure. This paper reports 9-year results of a study to determine the success of a conservative cavity preparation that uses the principle of "sealing for prevention" rather than that of cavity "extension for prevention."

Method and materials

The present study was conducted at the New Jersey Dental School and at the Hebrew University, Hadassah School of Dental Medicine, Jerusalem. A total of 332 Class I restorations were placed in 240 teeth of 110 sub-
Preventive Dentistry

Fig 1 Maxillary permanent first molar with occlusal pit and fissure caries.

Fig 2 Minimal cavity preparation (outlined) without extension for prevention. Calcium hydroxide pulpal protection has been placed.

jects, aged 6 to 14 (mean age of 8 years). Almost all restorations were placed in permanent first molars, and a few permanent second molars. The restorations were fairly well distributed among all four quadrants. The teeth selected for treatment had incipient, minimal, or moderate occlusal carious lesions (Fig 1). Extensive lesions that involved all of the pits and fissures were excluded, because there was no sound tooth structure to preserve with sealant.

The treatment procedure was similar to that used for routine amalgam restorations in that local anesthesia and rubber dam isolation were used. The tooth surface was cleaned with a rubber cup and prophylaxis paste, and the cavity was prepared with round or pear-shaped burs used at either high or low speed. The preparation consisted only of caries removal. Grossly undermined or soft, demineralized enamel was removed, but there was no attempt to remove slightly undermined enamel, make special retentive areas, or extend for prevention into sound pits and fissures. Fissures that were stained, but firm, and without stickiness or underlying enamel discoloration were left intact to conserve tooth structure. The size of the resulting preparations with minimal or moderate decay averaged $1.5 \times 2.0$ mm with a depth of approximately 2.0 to 2.5 mm. Preparations for incipient lesions were less than 1 mm in cross section.

After removal of caries, calcium hydroxide pulpal protection (Dycal, Caulk) was placed (Fig 2), followed by placement of a composite resin material. In this study an autopolymerized composite resin (Miradapt, Johnson & Johnson Dental) was applied with a syringe (Centrix, Centrix), obturating the cavity but avoiding excess. The syringe was used to prevent voids at the base of the cavity. The material was then pushed into the cavity with a plastic instrument and, 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. Those teeth with incipient lesions had only small preparations and no composite resin was placed. After the material had set, the occasionally small resulting excess was trimmed with small white stones at high speed. Articulation paper was not used because the rubber dam was left in place for the sealant application.

The occlusal surface was then washed, dried, etched for 60 seconds with 37% phosphoric acid, and washed and dried again. A self-polymerizing sealant (Delton, Johnson & Johnson Dental) was then mixed and applied according to the manufacturer’s instructions (Fig 3). Tinted sealant was used on approximately half of the teeth, and clear sealant was used on the remainder. In those minimal preparations that had no composite resin, the sealant served as the restorative material. After the sealant had set, it was tested by attempting to pry it off with an explorer. Occasionally, the sealant was dislodged and was reapplied after re-etching of the tooth surface for 60 seconds.

The placement and subsequent examination of all restorations in both countries was performed or supervised by the principal investigator, whose standardized ratings were reported in previous studies. The restorations were examined at 6 months, 1 year, and $1/2, 2, 3, 4, 5, 6/2,$ and 9 years, and evaluated according to the following criteria: sealant condition (no loss, partial...
loss, or complete loss); marginal staining (none, slight, or severe); anatomic wear (none, slight, or severe); marginal adaptation of the composite resin if the sealant was lost (no defect, slight catch, moderate catch, slight crevice, or extensive crevice); and dental caries development (none or present).

**Results**

After 9 years, 79 restorations in 28 subjects in Israel were available for examination. Forty-three restorations (54%) had sealants that were completely retained, 20 restorations (25%) had partially lost their sealants, and 16 (20%) had lost all sealant (Figs 4 and 5). Dental caries occurred in 19 restorations (25%) in which there was some sealant loss, and an additional 16 teeth had proximal caries that was unrelated to the occlusal restoration. There was no loss of the composite resin restoration and no occlusal caries whenever the sealant was intact. Sealant wear was slight and it occurred in five restorations.

**Discussion**

These restorations were examined annually 7 times in the 9 years since their placement, and the longitudinal data concerning their success are presented in Fig 6. Complete retention of the sealant declined approxi-
In this study etching of the tooth was performed after composite resin placement and before sealant placement. Etching can be performed after placement of the composite resin as long as care is taken not to damage the etched enamel surface before sealant placement. If the etched surface is manipulated during placement or trimming of the composite resin, re-etching of the enamel is necessary. Etching before placement of the composite resin might contribute to retention of that material; however, in this study, after 9 years, retention of the composite resin did not appear to be a problem.

If caries develops subsequently on the proximal tooth surface, it should be treated with as little involvement of the occlusal surface as possible, thereby preserving healthy tooth structure (Fig 7). Preliminary evidence indicates that there will be little, if any, leakage at the amalgam-sealant interface if amalgam is used to restore the proximal lesion and the occlusal composite resin and sealant are left intact.

Glass-ionomer materials have been recommended for this procedure because the material can bond to the dentin, thereby increasing retention of the restoration, and because the fluoride content of the glass-ionomer cement is thought to inhibit recurrent caries at the margin of the restoration. This study, retention of the restoration was not a problem. In addition, the caries occurred predominantly in uncovered, intact pits and fissures rather than at cavosurface margins; consequently, the fluoride of the glass-ionomer material might not have had much influence on the development of caries. The suggested benefit of glass-ionomer materials requires further study.

When the composite resin/sealant restoration was first recommended more than a decade ago, some practitioners were skeptical and did not incorporate the procedure into their practices because of the limited data available in regard to long-term success. This 9-year study demonstrates that the composite resin/sealant restoration can be used successfully to conserve healthy tooth structure when occlusal caries is treated. The technique is particularly recommended when occlusal carious lesions have not yet involved all pits and fissures, and these can be preserved in a stronger tooth.

Summary

A study was performed to determine the success of a conservative cavity preparation using the principle of sealing for prevention rather than that of cavity extension for prevention. A total of 332 restorations were
place in 240 teeth of 110 subjects, aged 6 to 14, with a mean age of 8 years. After 9 years, 79 restorations were examined. Caries appeared in 19 teeth (24% of sample) and sealant wear occurred in 14 restorations (18%). Complete sealant loss was observed in 16 restorations (20%) and partial loss in 20 (25%), leaving 43 restorations (54%) with complete retention of the sealant. These results show that conservative cavity preparation with sealing for prevention is a successful technique that conserves valuable tooth structure.

Acknowledgments

The informed consent of all human subjects who participated in the experimental investigation reported in this manuscript was obtained after the nature of the procedure and possible discomforts and risks had been fully explained.

The authors acknowledge the support of the Johnson & Johnson Dental Products Co, East Windsor, New Jersey. The authors further acknowledge the extensive contributions of Dr Zia Shey, New Jersey Dental School, and Drs Aubrey Chosack and Joseph Shapira of the Hebrew University in the original design and implementation of this study.

References


Rubber Dam in Clinical Practice

J. S. Reid, P. D. Callis, and C. J. W. Patterson

Although the rubber dam was first introduced into dentistry more than 100 years ago, it is still not widely accepted in general dental practice. Yet this technique is basically simple to use once it has been mastered and has many advantages both for the patient and the dentist.

The authors have set out to provide a clear text that explains how and why the technique should be used; this is supplemented by excellent photographs illustrating details of the technique in practice.

All dentists will benefit from having this handbook readily at hand so that they can put this technique to regular use and benefit from its advantages of safety, better working conditions in the mouth, and better patient management.

CALL OR FAX TO ORDER: Tel: (800) 621-0387 or (708) 682-3223; Fax: (708) 682-3288

or fill out the order form and send to:
Quintessence Publishing Co, Inc
551 N. Kimberly Drive
Carol Stream, IL 60188-1881

Send me ________ copies of (214) Rubber Dam in Clinical Practice at US $32/copy.

Name ____________________________
Street ____________________________
City ____________ State ______ Zip ______
Telephone ________________________

I General Practitioner  I Specialist
I Bill me, including shipping & handling
I Charge to my credit card plus shipping & handling
I Visa/MasterCard  I American Express

Card no. ____________ Expires ____________

Signature __________________________

Prices subject to change without notice. All sales are final. Shipping and handling charges will be added to all orders. For Illinois and Canadian residents, sales tax will be added if applicable. Payment must be made in US funds.