RESTORATIVE DENTISTRY

Liners for posterior composite restorations

BACKGROUND

Whether or not to use a liner under direct posterior composite restorations remains a grey area, with most dental schools teaching this technique but little evidence backing it up. With the trend toward using composites as the material of choice for restoring occlusal and occlusoproximal caries lesions in permanent teeth showing no signs of abating, it's important to review the current practices to see how they relate to the available evidence and to determine what should be regarded as the best practice.

CURRENT PRACTICES AND EVIDENCE

Traditionally, in nearly all cases, caries should be removed completely before a restoration is placed. However, substantial evidence indicates that removing all caries in an asymptomatic, vital tooth is not required, particularly when seeking to avoid pulpal exposure. The traditional removal was followed by placing a liner on the floor and, when present, the axial walls of the cavity, except with minimally deep cavities. The liner was considered necessary for a multitude of reasons, such as to protect the pulp against thermal, electric, and chemical insults; to promote the development of reactionary or reparative dentin; to permit remineralization of the softened dentin; and to limit any adverse effects related to leakage. When a hard-setting cement was used as a liner, it was seen as a way to provide a solid base against which restorative materials could be packed and condensed. The evidence supporting this approach is limited at best. The practice relies on teaching that has been handed down from one generation to the next for over 100 years.

Glass-ionomer Cement Liners

A broad consensus indicates that liners should be used for moderately deep and deep cavities, although research tends not to support this approach for all moderately deep cavities. Glass-ionomer cement (GIC) as a lining material was used in the belief that GIC would bond to dentin and hermetically seal off the floor and any axial walls while releasing fluoride to provide antibacterial coverage. Although fluoride ions have anticariogenic properties and inhibit secondary caries formation, the clinical benefit of the fluoride and the length of time it is released remain unclear. A downside to the use of GIC liners is the 20% increase in postoperative sensitivity patients experience after posterior composites are placed with a GIC liner.

Flowable Composites

Flowable composites are bonded to the tooth using a dental adhesive, but suffer from polymerization shrinkage and a high modulus of elasticity, so that the bond can be disrupted, especially if instructions are not followed meticulously. The result is a poor seal of the dentin and the creation of microgaps. These gaps begin a process by allowing bacterial colonization, buildup of bacterial byproducts, pulp irritation, sensitivity, and possible secondary caries development. The benefits of flowable composites must be weighed against these adverse effects.

Resin-modified Glass-ionomer Cement

For resin-modified glass-ionomer cement (RMGIC) liners, microgaps can also occur, causing movement of the dentin tubular fluid and postoperative sensitivity. If the seal becomes lost, bacteria can enter through the microgaps and cause pulpal inflammation. Cracks can also develop between the tooth and the lining and grow if the tooth is subjected to stress, leading to the same negative progression as is seen with flowable composites.

Calcium Hydroxide Cement

A hard-setting calcium hydroxide cement has also been used as a liner under posterior composites. However, these materials are readily soluble, so the lining is likely to be washed out from under the restoration if any gaps in the seal exist. These cements also suffer an inability to bond to dentin, so the contraction of the restoration material on polymerization can disrupt the liner and form microgaps. Calcium hydroxide cement is not recommended as a liner for these reasons.

REASONS FOR USING A LINER

Placement of a liner under posterior composite restorations remains popular for a number of reasons. Some fear the patient will develop sensitivity postoperatively if a liner is not used. Evidence indicates, however, that the dentin-sealing ability of the newer bonding agents provides adequate protection and makes the dentin insensitive, so any chance for postoperative sensitivity developing is slight or none. Generally, studies have identified the cause of postoperative sensitivity in these restored sites to be related to the restorative technique, such as using a suboptimal operative approach or operator error in handling the adhesives and composites.

Some practitioners select liners to avoid the leaching of monomers from posterior composites with soggy bottoms, with its attendant risk for adverse pulpal reactions. Again, the dentin-sealing ability of the current bonding agents virtually eliminates this possibility.

Liners have also been seen as prolonging the longevity of the restoration and avoiding the failure of posterior composite restorations. Studies find that posterior composites placed on top of a GIC lining develop more fractures than those placed using a total-etch technique. Thus placement of a liner may adversely affect the restored tooth unit's biomechanical properties and lead to failure. Other studies have found no advantage to using the liner with respect to the longevity of the restoration. It should be

noted that liners placed in block-out undercuts in preparations for indirect restorations do serve a function, but do not need to restore the cavity to minimum depth.

DETERMINING THE BEST PRACTICE

Several factors should be considered when trying to determine the best practice relative to the use of liners. First, liners and bases are traditionally associated with the use of amalgam, where they were needed to provide thermal insulation between the amalgam and the vital dentin. The use of resin composites provides sufficient insulation, so liners are not needed when these newer materials are used.

Second, liners were used to obtain predictable adhesion to remaining tooth tissues, but the current dentin bonding systems used with resin-based composite restorations are sufficient in this regard. The liner actually limits the surface area available for bonding and reduces the thickness of the resin composite, which has a negative effect on the physical and biomechanical properties of the restoration.

Third, applying a dentin bonding agent seals the restoration and protects the pulp from both stimuli and bacterial ingress. Liners simply aren't needed to perform these functions.

Reliance on the current evidence rather than on tradition when considering issues such as the use of liners for restorations is not yet a widespread phenomenon among dental practitioners. The use of liners should be guided by prioritizing the need being met and is most likely going to be limited to deep cavities that are being restored with a posterior composite.

Clinical Significance

The evidence does not support the placement of a liner under posterior composites except when it will serve a therapeutic pulpal effect in deep cavities. It would be helpful to have current clinically relevant data supporting the indications for liners and to ensure that the information is shared in ways that will influence clinicians' decision-making processes and operative approaches. This includes reaching out to dental schools to ensure that they are presenting liner use in the context of the best available evidence.

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Reprints available from IR Blum, Dept of Restorative Dentistry, King's College Hosp Dental Inst, Bessemer Rd, London, SE5 9RS, United Kingdom; e-mail; igor.blum@nhs.net

Placing and restoring direct restorations

BACKGROUND

The prevalence of caries remains high, even in the light of advances in prevention, oral health education, and oral hygiene practices, along with the availability of improved treatment options. In many countries, most adults have at least 1 restoration and are subject to repeated dental maintenance interventions, including the replacement of the restoration. All restorations eventually suffer deterioration and degradation and will need to be repaired or replaced. A review was done covering studies performed between 1981 and 1998 that reported replacements accounted for 56% of the restorations dentists placed. Because many changes have occurred in the approaches to tooth restorations since then, an update was completed that surveyed the literature since 1998 to determine if the patterns of restoration placement and replacement have changed.

METHODS

The 1981-1998 review included studies in which dentists completed a proforma when any patient came for a new or replacement restoration. It included 12 papers that detailed the placement of 32,697 restorations, of which 44% were initial restorations and 56% were replacements. The post-1998 review covered 25 studies, of which 12 were in the previous review, and documented an additional 54,023 restoration placements, with 41.9% being initial restorations and 58.1% being replacements. The total numbers were 86,720 restorations, with 37,016 being new and 49,704 being replacements. The comparison of the 2 reviews included materials used and reasons for initial or replacement restorations being done.

RESULTS

Materials

Since 1981, 40.9% of the restorations were done using amalgam, 44% composites, 13.4% glass-ionomers/resin-modified glass ionomer/compomers, and 1.7% 'other' materials. Between the 2 reviews, fewer restorations were done in amalgam, a fall from 56.7% of the restorations to 31.2%. Resin composite restorations increased from 36.7% to 48.5% over the same period. Amalgam was the material of choice in the earlier review, followed by composite. In the later review, the 2 were reversed. Amalgam