The tunnel restoration — nine years of clinical experience using capsulated glass ionomer cements. Case report

Geoffrey M. Knight

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Abstract

The clinical potential of the tunnel restoration is restrained by perceived difficulties of access to proximal caries and lack of long-term clinical data.

This paper describes a technique that affords proximal access similar to that of a standard Class II cavity preparation and provides an evaluation of a technique, using capsulated glass ionomer cements. It is supported by more than nine years of clinical experience that confirms the viability of this procedure as an alternative to conventional Class II cavity restorations for initial proximal lesions.

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Introduction

The introduction of glass ionomer cements[1] provided the dental profession with a reliable[2] and predictable material for a number of specific restorative applications.[3-5]

In 1984 the tunnel restoration emerged as a conservative alternative to the conventional Class II preparation for initial carious lesions.[6-8] The continuing integrity of the marginal ridge protects a tooth from inherent restorative problems that include occlusal and proximal instability, open contacts and weakening of associated cusps.[9] Furthermore, the prolonged release and uptake of fluoride from the glass ionomer surface[10,11] provides a continuous fluoride presence that protects the margins of the restoration from caries and possibly the proximal surfaces of adjacent teeth. Marginal ridge fracture after placement is infrequent[6-8] and the management of such is the simple repair of the defect with composite resin.

The technique has since been modified to incorporate a composite overlay on the occlusal surface and this modification is receiving increasing interest in the literature.[12-14] Widespread acceptance of this procedure is currently limited by the lack of long-term clinical information and perceived difficulties with access to proximal caries through a small occlusal preparation.[15] There is emerging evidence indicating that the technique is a viable restorative procedure.[14]

This paper addresses this situation by suggesting modifications to cavity design that improve access to increase clinical predictability and reports on more than nine years clinical experience with the tunnel technique using capsulated glass ionomer cements (Fig. 1, 2).

Cavity design

As first reported, the tunnel preparation utilized a small oval access cavity in the occlusal fossa above the proximal lesion.[6-8] This access was limited and interfered with:

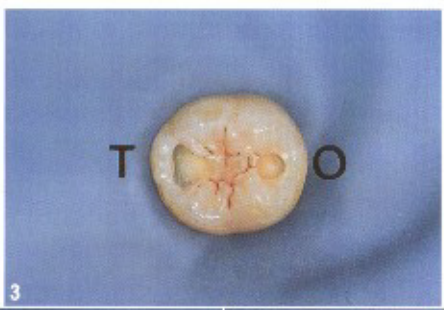
(1) Determination of the extent of caries. Radiographs tended to underestimate the lesion size and were, therefore, clinically unreliable.[17]

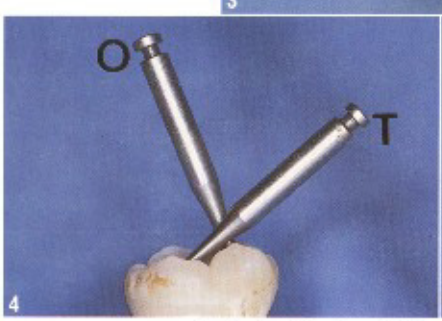
(2) Adequate mechanical preparation.

(3) A practitioner's judgment to ensure that caries had been removed.

Improved access required in both the bucco-lingual and mesio-distal planes may be gained by extending the access cavity from the occlusal fossa bucco-lingually, parallel to the marginal ridge (2 mm in from the margin) and along the central fissure away from the margin to form a 'T' pattern on the occlusal surface (Fig. 3). This improved access over the standard 'tunnel' cavity design in

Fig. 1. – Tunnel preparation in tooth 36.
Fig. 2. – Restoration (Ketac-Fil) at nine years and seven months.





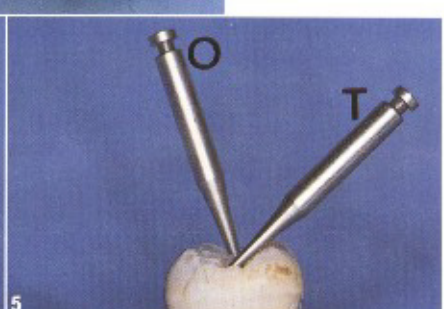


Fig. 3. – The 'T' cavity modification compared with the original 'O' type.
Fig. 4. – 'T' preparation showing substantially better access than the original 'O' type in the mesio-distal plane.
Fig. 5. – Better access with the 'T' preparation in the bucco-lingual plane.

both the mesio-distal plane (Fig. 4) and bucco-lingual plane (Fig. 5) enhances the diagnosis of the carious involvement of the tooth. Removal of an existing occlusal restoration facilitates access, otherwise removal of some healthy tissue may be required to achieve the 'T' configuration.

Modification of the original tunnel access with a 'T' preparation may increase the propensity of the marginal ridge to fail. A bonded composite overlay at the occlusal surface up to the marginal ridge will improve strength and abrasion resistance and should minimize future marginal ridge failure. Further-

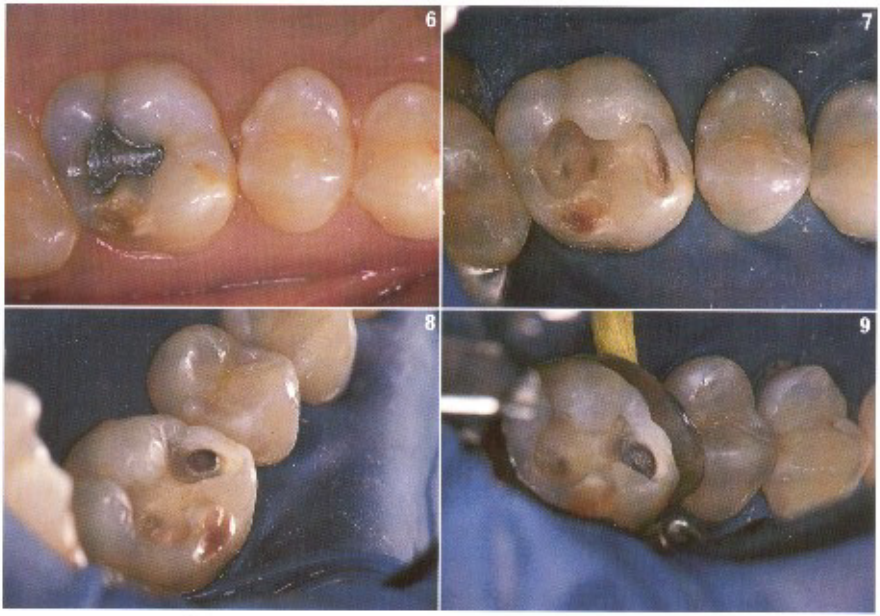


Fig. 6.—Tooth 16 with an initial carious lesion present on the mesial aspect.

Fig. 7.—Rubber dam placed for good moisture control. Existing amalgam restoration removed and caries accessed by a 'T' type preparation on the mesial aspect of the tooth.

Fig. 8.—The 'T' type preparation showing excellent access to diagnose and remove remaining caries.

Fig. 9.—The 'smear layer' removed with a mild acid and matrix band placed and wooden wedge inserted proximally.

more, composite resins have been shown to be a viable occlusal restorative material.[18,19]

The author has used a 'sandwich' technique of overlaying an etched capsulated glass ionomer base with a bonded composite resin in association with the 'T' cavity design for over four years.

A minimum of 40 restorations have been placed during this time without observing a single fractured composite bonded marginal ridge at recall visits.

Operative technique

The operative technique for the modified 'T' tunnel restoration is set out below. The clinical case chosen depicts the restoration of a first permanent molar.

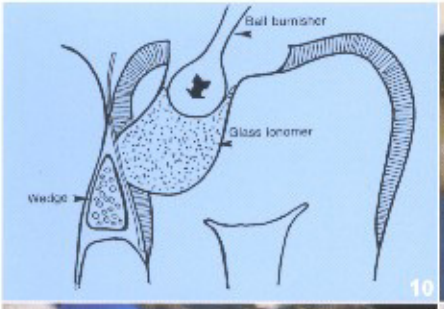
Case report

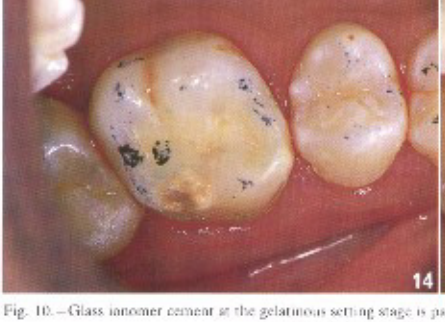
1. A young adult presented with mesial caries on tooth 16. The hypoplasia on the buccal aspect was pigmented but not carious and, as it had been present for over 20 years, it was left intact (Fig. 6).

2. Rubber dam was applied to facilitate moisture control. The broken-down amalgam on the occlusal surface was removed to facilitate access. The cavity was prepared with a cylindrical diamond bur (541) to the width of the marginal ridge, parallel to, and about 2 mm in from the margin. The central fissure was removed, to form the neck of the 'T', to the old amalgam margin and to the full depth of the enamel on the occlusal surface (Fig. 7).

3. Carious dentine was removed with a slow speed round bur (6 round) and small excavators accessing the lesion at each of the 'T' extensions. This preparation affords similar visual and instrumental access to the cavity as a standard Class II cavity preparation (Fig. 8). As caries occurs below the contact area, protection of the proximal enamel surface of the adjoining tooth is seldom needed.

4. After removal of the smear layer with a weak acid solution (Mount[5] currently recommends a 10 per cent solution of polyacrylic acid for 10 seconds), the preparation was washed thoroughly and dried with





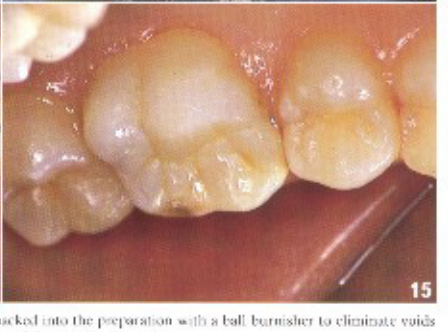


Fig. 10.—Glass ionomer cement at the gelatinous setting stage is packed into the preparation with a ball burnisher to eliminate voids and maximize the integrity of the proximal margin.

Fig. 11.—Set glass ionomer base prepared back to the dentino-enamel margin.

Fig. 12.—The composite resin overlay placed incrementally over the etched glass ionomer base.

Fig. 13.—The occlusal surface developed and continuity of the proximal surface created with finishing strips.

Fig. 14. Dam removed, occlusion adjusted. Note centric stops on mesial and distal marginal ridges.

Fig. 15.—Final contouring and polishing. (*Note:* Patient was recalled for review one week later.)

oil free air. A matrix band was placed and wedged firmly (Fig. 9). Wooden wedges adapt much better to the proximal margin than plastic ones. A small increment of calcium hydroxide lining may be placed at the base of deep cavities.

5. Capsulated Ketac-Bond,* a Type III glass ionomer cement, as classified by Wilson and McLean[10] was used to restore the tooth up to the level of the dentino-enamel junction on the occlusal surface. A powder liquid ratio of 4.2:1 gives capsulated Ketac-Bond similar properties to capsulated Ketac-Fil* but with higher early resistance to water