

THE EFFECT OF ENAMEL ETCHANTS AND A CLEANING AGENT ON CUT DENTINE:
AN IN VITRO STUDY

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It is well established¹ that acid etching of enamel improves the retention and sealing ability of composite resin restorations by creating high energy irregularities in the enamel surface that promote adaptation between the resin and the enamel. A similar etching of dentine² could further improve mechanical retention of the restoration. However, a controversy exists concerning the biocompatibility of the resin restorative material with the tooth pulp³. During normal cavity preparation, a layer of debris known as the smear layer is produced, which effectively blocks the dentinal tubules preventing the movement of irritant resin materials down the tubules towards the pulp. With the advent of the acid etch technique it is apparent that the etchant, no matter how carefully applied, must spill over onto the adjacent dentine, could remove the smear layer to a greater or lesser degree and thereby enhance the pulpal response. This study was undertaken to examine the effects of various commercially available enamel etchants and cleaning agents on smear layer covered dentine.

Cavities 1,25 x 2,00mm were prepared in the cervical dentine of extracted human premolar teeth using a no. 577 tungsten carbide bur. The cavity depth was standardised at 1mm with the aid of a depth gauge fitted to the high speed airturbine. The cavities were hemisected with a low speed, water cooled, diamond disc saw, then cleaned with water and air. Thereafter the following solutions were applied to six cavities each as per manufacturers' instructions: Anhydron; Chemfill (Citric Acid); Enamelbond etchant and Scotchbond etchant gel. Once the cavities had been cleaned and dried, the specimens were prepared for scanning electron microscopy (SEM) and viewed at magnifications of x35, x200 and x2000. Cavity walls and floors were viewed separately and representative areas photographed. Similarly prepared unetched cavities served as a control.

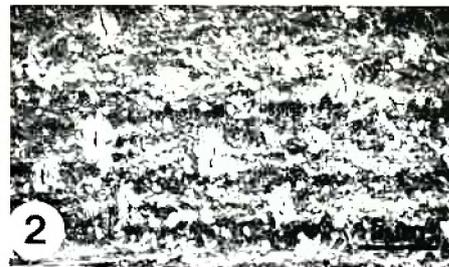
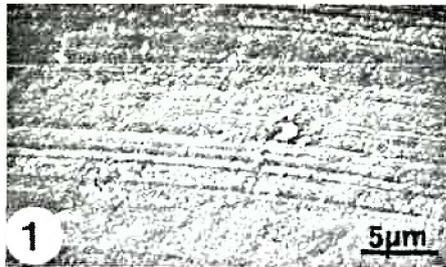
The surfaces of all control specimens were covered with a smear layer which obscured the detail of the underlying dentine (Fig. 1). Anhydron, a cleaning agent which dries and removes loose debris from the cavity surfaces, was unable to remove the smear layer from the walls and floor of the cavity. However, regular cracks in this layer indicated the position of the underlying dentinal tubules (Fig. 2). Both Chemfill (Citric Acid) and Enamelbond etchant proved to be effective smear layer removers. Cavities treated with these two products revealed patent dentinal tubules in both the cavity floor and wall, although some residual debris was present (Fig. 3). Dentine treated with Scotchbond etchant gel had a rough mottled appearance with occluded dentinal tubules apparent in the elevated peritubular areas (Fig. 4). The irregular surface of the Scotchbond treated dentine is ascribed to the prolonged concentrated contact which is maintained between the dentine and the etchant gel. This results in a preferential demineralisation of the less

mineralised inter-tubular dentine as opposed to the peritubular dentine.

Of the four etching and cleaning agents examined, only Scotchbond etchant gel was successful in demineralising the dentine, without removing the smear layer plugs from the dentinal tubules. Both Chemfill (Citric Acid) and Enamelbond etchant effectively removed the smear layer, providing irritant restorative materials direct access to the pulp via the open dentinal tubules. Anhydron was shown to be the least effective smear layer remover, but then it is not regarded as a successful etching agent and as such is not entirely suitable for all cavity preparation. Another advantage of Scotchbond is its high viscosity gel consistency which is less likely to spill onto the adjacent dentine during the etching process, whereas etching with the other liquid solutions make dentine wetting and consequent etching inevitable during this procedure.

References

1. Amsberry, W., von Fraunhofer, J.A., Hoots, J. et al (1984) J. Prosthet. Dent. 52, 647.
2. Gwinnett, J. (1977) J. Dent. Res. 56, 1155.
3. Hey, R.J. (1981) Dent. Clin. North Amer. 25, 257.



- Fig. 1 Normal untreated dentine showing the smear layer.
Fig. 2 Wall of a cavity treated with Anhydron.
Fig. 3 Dentine treated with Chemfill (Citric Acid) and Enamelbond etchant.
Fig. 4 Scotchbond etchant gel treated dentine.