

A comparative study of pumice versus hydrogen peroxide as pretreatments for acid etching for resin bonding

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Introduction

Various methods have been investigated for pretreating the surface of enamel to enhance the effect of etching.¹⁻³ Increasing evidence suggests that the etching pattern is controlled by the organic content of the enamel. Marshall, Olson, and Lee⁴ in 1975 studied acid etching for pit and fissure sealants without precleaning the teeth and found significant advantage in having a clean, debris-free, and uniformly roughened surface for good sealing. They proposed longer etching time. Other studies proposed using other materials to solve this problem of debris. In 1979, Lee and Skobe⁵ suggested using 1.0 N sodium hydroxide to remove the organic matter. In their study, when the organic matter was removed by exposing the enamel to 1.0 N sodium hydroxide, the acid etched the enamel surface uniformly. When the enamel was not pretreated, the acid etchant created a honeycomb pattern with the prism cores dissolving faster than the interprismatic substance. The pattern of etching appeared to be influenced by the distribution of organic matter in the prisms, the rate of dissolution of the organic matter in various reagents, and the relative dissolution of the mineral component. Some doubt remains regarding the need for a preliminary prophylaxis. At least two laboratory studies^{6,7} have shown little difference in the surface pattern of enamel, and two clinical trials^{8,9} have demonstrated favorable sealant retention rates for bonded resins, composites, and glass ionomers when pumice prophylaxis of the tooth surface was omitted.

Main et al.⁷ stated that under laboratory conditions or in vivo, acquired pellicle is completely removed by a standard acid-etching treatment, yet Ripa¹⁰ still concluded that there is insufficient evidence to recommend changes in the currently recommended clinical procedure, which involves a prophylaxis with pumice slurry.

Donnan and Ball's¹¹ recent study found no statistically significant differences in sealant retention rates between two groups: One wherein no prophylaxis preceded acid etching and the other wherein the teeth were cleaned with pumice slurry before etching.

Two most important factors in obtaining a clean enamel surface receptive to the sealant material are the removal of pellicle and surface debris, and the quality of the etched surface.^{12,13} Previous reports suggest that pumicing removes organic material from smooth enamel surfaces.

This does not however, apply to teeth with fissures.^{14,15}

The use of pumice slurry is the technique most widely accepted by practitioners. Today, some have stopped using pumice and are starting to use hydrogen peroxide as a cleansing agent. To date, no in vitro or in vivo studies have been documented using hydrogen peroxide as a cleansing agent. Hydrogen peroxide is an oxidizing agent that releases molecular oxygen with a brief period of antimicrobial action when it contacts tissue. It is believed that the effervescent action of hydrogen peroxide combined with the mechanical action of the brush cleans the enamel surface. The purpose of this study was to evaluate the use of pumice and hydrogen peroxide as pretreatments for acid etching and their effects on composite resin bond strengths.

Methods and materials

Fifty-two noncarious, buccal surfaces of erupted permanent premolar and molar teeth were embedded in epoxy resin, then stored in artificial saliva for seven days to prevent dehydration. Teeth were assigned randomly to one of two groups, one receiving pumice and the other hydrogen peroxide as pretreatments for acid etching.

Pumice slurry was applied with a rubber cup while hydrogen peroxide was applied with a fine-tipped soft bristle brush. Teeth then were washed for 20 sec, dried with oil-free air for 10 sec, and etched for 1 min using 37% phosphoric acid gel applied with a brush. After the etching period, teeth were washed for 30 sec and dried with oil-free air. Scotchbond bonding agent then was applied according to the manufacturer's instructions. A composite rod (Concise, 3M Company, Minneapolis, MN) 4.4 mm in diameter was attached via autopolymerization to the treated surfaces using a clear gelatin capsule as matrix. All teeth were stored for seven days in artificial saliva. Shear strength of the adhesive resin bond to the teeth was done with an Instron® Universal testing machine (Instron Engineering Corp., Canton, MA) by applying the force parallel to the enamel surface (i.e., perpendicular to the composite cylinder) using a cross-head speed of 0.02 in./min.

Because the distribution of the variables is skewed, a nonparametric test was chosen to compare the two groups. The Mann-Whitney U test was used to compare the two groups.

Table. Mean shear bond strength (kg/cm²)

Group	Number	Mean	SD	Range
Pumice pretreatment	26	52.3	19.7	26–108
Hydrogen peroxide pretreatment	26	61.4	23.0	26–101

Results

The average shear bond strengths in kg/cm² are given in the Table. The Mann-Whitney U test demonstrated no statistically significant difference in shear bond strength between groups one and two ($P > 0.05$).

Discussion

This experiment found no statistically significant difference in shear bond strengths between pumice or hydrogen peroxide as pretreatments for acid etching.

The mean shear bond strength values obtained in our study were similar to mean values reported by other investigators for shear strengths of dentin bonding agents to permanent dentin.¹⁶ These values give us a baseline from which to evaluate dentin bonding agents in vitro. A clinical situation will determine the true success or failure.

Bond strength measurement has been evaluated as to shear bond strength (force parallel to tooth/resin interface). Testing bond strength by the shear method places the maximum force at the tooth/resin interface with a more reproducible interfacial fracture observed. This results in far fewer cohesive failures.^{17, 18}

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