Bonded orthodontic brackets demonstrate similar retention on microabraded and nonmicroabraded tooth surfaces

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The technique of cementing orthodontic bands to teeth was first introduced by Magil[1] in 1871 and remained the treatment of choice for more than 85 years. Direct bonding has replaced anterior teeth banding and offers significant advantages such as improved esthetics, ease of placement, patient comfort, decreased soft tissue irritation, enhanced ability to detect interproximal decay, and less decalcification.[2]

Mechanical pretreatment procedures have been studied to determine whether there is a significant effect on the etching pattern. Khadry[3] indicated that pretreatment by grinding or removing the surface enamel prior to etching produces a more favorable etch pattern; however, Brannstrom[4] found little change in etch pattern in teeth subjected to grinding with a diamond point or aluminum oxide disc prior to etching. Gerbo et al.[5] compared the tensile bond strength of orthodontic brackets when the enamel was cleaned with an air abrasion polisher versus the rubber cup and pumice prior to acid etching and found no statistical difference. Opinya[6] tested the tensile bond strength of fluorosed and nonfluorosed teeth and found an increase in bond strength in fluorosed teeth treated with a green stone and pumice prior to etching.

Enamel surfaces disturbed during amelogenesis may result in enamel hypoplasias. These hypoplastic areas result in brown, white, or yellow stains and may be caused by local infection, trauma, excessive fluoride consumption, or any combination of these factors. Various techniques have been described in the literature to remove these superficial enamel stains. In 1916, Walter Kane first used muriatic acid and heat to eliminate brown fluorotic stains.[7] In 1984, McCloskey[7] described a method using 18% hydrochloric acid and pumice. In 1989, Croll[8] began using the term "enamel microabrasion" and further refined the technique with a gel-like microabrasive material (PREMA,™ Premier Products, Norristown, PA) that contains hydrochloric acid and a fine grit silicon carbide abrasive in a water-soluble gel. The treatment results in a uniform mechanical and chemical removal of 50–150μ of enamel. Little is known about the bond strength of orthodontic brackets to teeth that have been previously microabraded with the PREMA compound. Croll has suggested that teeth that have been microabraded with PREMA or any hydrochloric acid and pumice solution show a suboptimal etching pattern and may require an additional 15- to 30-sec etch prior to orthodontic bracket placement.[8] The purpose of this study was to determine if microabrasion affects the tensile bond strength of the enamel to which orthodontic brackets have been bonded.

Methods and materials

Sixty extracted noncarious human premolar teeth were collected and divided randomly into three groups. The crowns were sectioned from the roots, embedded in acrylic, and stored in distilled water.

Group 1 was cleaned with a slurry of nonfluoridated flour of pumice for 30 sec then rinsed and dried with oil-free compressed air. Following cleaning, a 37% phosphoric acid etchant was placed on the buccal surfaces for 30 sec, thoroughly rinsed, and dried. A layer of primer was applied to the etched surface, and precoated adhesive metal brackets (3M Unitek Co. Monrovia, CA) were placed on the midbuccal surface of the crown. The precoated brackets have a predetermined amount of adhesive and were selected to standardize the bonding procedure. Firm seating pressure was applied until bracket-to-tooth contact was achieved. Any excess material around the bracket base was removed with an explorer prior to curing. The specimens were light-cured with an Ortholux™ (3M Unitek Co. Monrovia, CA) visible light-curing unit for 60 sec. The teeth were then immersed in distilled water and stored in an incubator at 37°C for 14 days and thermocycled for 2500 cycles 5–45°C to simulate the oral cavity.[9] The Instron™ Testing Machine (Instron Corp, Canton, MA) with a stress breaking apparatus was used to determine the tensile bond strength.

Group 2 was prepared for bonding in a similar manner to group 1; however, PREMA compound was applied to treat the enamel surface prior to acid etching. PREMA was applied using a slow-speed handpiece with a 10:1 gear reduction contra angle. Ten applications of a 20-sec duration with a 20-sec rinse were con-

TABLE. MEAN TENSILE BOND STRENGTH

Group	Number	Mean Bond Strength (Kg/Mm^2)	Standard Deviation
1. Control	20	11.78*	3.08
2. PREMA	20	12.39*	2.74
3. PREMA+ 6 wks.	20	11.79*	5.11

* No statistical difference using $P > 0.05$. One way analysis of variance.

ducted as recommended by the manufacturer. To control for consistency, all specimens were microabraded by a single operation, then treated as group 1, starting with the 37% phosphoric acid etch.

Group 3 was treated the same as group 2. However, after the application of the PREMA compound and prior to etching, the specimens were stored in distilled water at 37°C for 6 weeks to determine if time would affect the tensile bond strength.

Results

The three groups were compared for differences in tensile bond strength using a one-way analysis of variance (ANOVA), and results are shown in Table 1. There was no statistical difference between the three groups. However, group 2, which was microabraded prior to etching and bonding, did show a slightly greater bond strength.

Discussion

Several techniques have been used to remove intrinsic fluorosis stains, including sandpaper disks, hydrochloric acid abrasion, 12 fluted bur mechanical treatment, PREMA compound abrasion, and hydrogen peroxide treatment.

The effects of microabrasion have been evaluated in the literature using scanning electron microscopy. The treated enamel is removed by chemical erosion and mechanical abrasion. Uniform enamel removal is in the range of 50–150μ. Microabrasion creates a smooth, polished layer by deposition and compaction of calcium and phosphate breakdown products that result from the simultaneous erosive and abrasive action of the microabrasion compound.[10] The results of this study indicate that teeth etched in the usual manner using 37% phosphoric acid (group 1), those with PREMA microabrasion immediately prior to bonding (group 2), and those microabraded and stored for 6 weeks prior to bonding (group 3) showed no significant difference in tensile bond strength. The site of bond failure, determined by visual examination with the aid of a light microscope, was found to be at the bracket–resin interface with a substantial amount of adhesive left on the enamel surface in all three groups. Based on the results of this study, it may not be necessary to increase the etching time when bracketing teeth that have been microabraded with PREMA compound as Croll has suggested.[8, 10]

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