

# Clinical Comparison of Bond Failures Using Different Enamel Preparations of Severely Fluorotic Teeth

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The purpose of this study was to compare the failure rates of brackets bonded to severely fluorotic teeth using three different methods of enamel preparation.

## Materials and Methods

Seventeen consecutive patients (seven male and 10 female, ranging in age from 22 to 34) were selected from the Department of Orthodontics, Qindu Stomatological College, if they met the following criteria:

- Dental fluorosis diagnosed, according to Dean's Fluorosis Index, as "moderately severe" or "severe".<sup>1</sup> The major sign of this classification is discrete or confluent pitting. Brown stains are widespread, and the teeth often appear corroded. All enamel surfaces are affected, and hypoplasia is so marked that the overall form of the teeth may be altered.
- Patient and parents gave informed consent to the trial.

A total of 324 severely fluorotic teeth were included in the study. These were randomly divided into three groups according to the method of enamel preparation (Table 1):

*Group A.* Each surface to be bonded was brushed clean with plain, non-fluoridated pumice and water.

*Group B.* After the surface to be bonded was cleaned as in Group A, it was polished by evenly removing .1-.2mm of enamel with a carbide drill.

*Group C.* Each surface to be bonded was cleaned and polished as in Group B. Next, a tooth-colored, .2-.3mm layer of Transbond Plus Self-Etching Primer\* was affixed to the surface, according to the manufacturer's instructions, to form a veneer.

In each group, .022" × .028" standard edge-wise brackets\*\* were bonded directly with

TABLE 1  
SAMPLE CHARACTERISTICS

	Group A	Group B	Group C
No. patients	5	6	6
No. males	2	3	3
No. females	3	3	3
Mean age (yrs.,mos.)	27,3	28,0	27,8
Age range (yrs.,mos.)	22,8-32,7	23,5-34,2	22,1-33,4
No. bonded teeth	96	112	116

Transbond Plus Self-Etching Primer. After the brackets were properly positioned, excess adhesive was removed.

Each patient returned four, eight, and 12 weeks after bonding to be checked for bond failure, which was defined as a loose or missing bracket. Whenever a bracket failed, it was replaced with a new one.

Statistical analysis was performed with the Statistical Package for the Social Sciences,\*\*\* version 11.0 for Windows. Chi-square tests were used to compare the three groups.

## Results

Bond failure rates after 12 weeks were 74.0% for Group A, 25.9% for Group B, and 1.7% for Group C (Table 2). The differences among the three groups were statistically significant at the .01 level.

\*Trademark of 3M Unitek, 2724 S. Peck Road, Monrovia, CA 91016.

\*\*Tomy International Inc., 818, Shinmachi, Ohkuma-machi, Futaba-gun, Fukushima, Japan.

\*\*\*SPSS Inc., 233 S. Wacker Drive, Chicago, IL.

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**TABLE 2  
COMPARISON OF BRACKET FAILURE RATES**

Group	No. Pts.	No. Brackets	4 Weeks		8 Weeks		12 Weeks		Total	Failure Rate
			Anterior	Premolar	Anterior	Premolar	Anterior	Premolar		
A	5	96	15	26	9	15	5	1	71	74.0%
B	6	112	2	8	3	10	2	4	29	25.9%*
C	6	116	1	0	0	0	1	0	2	1.7%**

\*Difference between Group B and Group A is statistically significant at or below the .01 level.

\*\*Difference between Group C and Group B is statistically significant at or below the .01 level.

## Discussion

Direct bonding of brackets is generally conceded to be easier, faster, and less expensive than other adhesion methods.<sup>2</sup> Because the success of direct bonding depends on the mechanical locking of an adhesive between the bracket base and irregularities in the enamel surface, however, it requires careful attention to all three components of the system: the tooth surface and its preparation, the design of the attachment base, and the bonding material.<sup>3</sup>

Enamel fluorosis occurs when excessive amounts of fluoride are ingested during tooth development, generally between the ages of 1 and 8. It is characterized by increased porosity (or hypomineralization) of the subsurface enamel and the well-mineralized surface layer of enamel. As the severity of dental fluorosis increases, the depth of enamel involvement and the degree of porosity also increase. Severely fluorosed enamel is pitted, discolored, and prone to fracture and wear because the well-mineralized zone is highly susceptible to mechanical stress.<sup>4-6</sup> In the most extreme cases, the outer layer of enamel chips off immediately after tooth eruption.<sup>7</sup>

Compared to normal teeth, fluorosed teeth have more fluoride and less calcium.<sup>8-10</sup> Hypo-

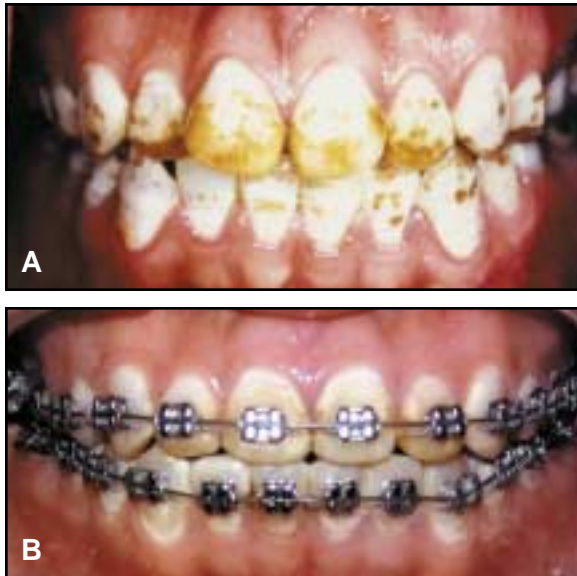
mineralization and irregular prism patterns, including cracks and fissures, can be observed microscopically in fluorosed enamel.<sup>11,12</sup> These abnormalities result in a marked decrease in microhardness, which adversely affects the mechanical locking of an adhesive to the enamel surface.

To reduce the likelihood of bond failure, fluorotic teeth have traditionally been custom-fitted with bands welded to brackets. This time-consuming method is unesthetic, however, especially in the anterior segments. Today, fluorotic teeth are often covered with light-cured composite veneers (Fig. 1). The present study indicates that such esthetic treatment can also enhance the bond strength of the brackets.

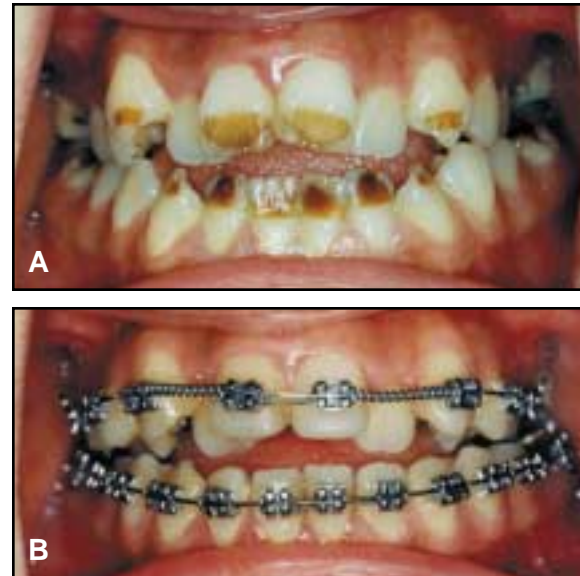
When the fragile outer layer of enamel is removed, the microhardness of the enamel is improved, so that the retentive tags within the enamel can endure greater mechanical force. This explains the difference in bond failure rates between Groups A and B. Failures are further reduced by augmenting the adhesive surface with a light-cured veneer, as in Group C, because bond strength is directly proportional to the surface area.

Light-cured composite veneers can also be used in patients with other enamel defects, such

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**Fig. 1 A.** Patient with severely fluorotic teeth before orthodontic treatment. **B.** Brackets bonded to light-cured composite veneers on fluorotic teeth.



**Fig. 2 A.** Patient with enamel aplasia before orthodontic treatment. **B.** Brackets bonded to light-cured composite veneers on teeth with enamel aplasia.

as aplasia (Fig. 2). The veneers can be preserved after orthodontic treatment in patients who cannot afford or elect not to have crown restorations.

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