

Original article:

### Marginal Integrity of Adhesive Fracture Restorations: Chamfer Versus Bevel

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Table 1 Comparison of Marginal Leakage of Preparations

Test Group	Material	Number of Teeth	% No Leakage
I. Bevel Preparation	Conventional Composite	15	67
II. Bevel Preparation	Microfill Composite	30	60
III. Chamfer Preparation	Conventional Composite	15	87
IV. Chamfer Preparation	Microfill Composite	30	54

#### Introduction

Utilization of adhesive or acid etch composite restorative techniques to repair fractured permanent incisors is widely accepted.<sup>2,4</sup> The advantages of this technique are its atraumatic nature, excellent esthetics, and reasonable period of retention. These characteristics make this the restoration of choice for anterior fractures occurring in children and adolescents.

Debate continues as to the advisability of mechanically preparing the tooth prior to the adhesive reconstruction. Questions also remain concerning which preparations achieve optimum durability and esthetics. The advent of microfill resins introduce a new parameter to the use of adhesive techniques. The purpose of this research is to compare the marginal integrity of fractured anterior teeth when prepared with the bevel versus the chamfer preparation and restored with a conventional adhesive composite versus a microfill composite resin system.

#### Materials and Methods

Ninety permanent central or lateral incisors extracted for periodontal reasons comprised the four experimental groups:

Group I – Bevel preparation of enamel – conventional composite A – 15 teeth

Group II – Bevel preparation of enamel – microfill resin BC – 30 teeth

Group III – Chamfer preparation of enamel – conventional composite A – 15 teeth

Group IV – Chamfer preparation of enamel – microfill resin BC – 30 teeth

The teeth restored with microfill resins were divided into two sub-groups, where different microfill resins were used.

The restoration protocol was standard for adhesive fracture repair, including an

- A – Nuvaséal-Nuafil (L. D. Caulk Company, Milford, Delaware)
- B – Finesse (L. D. Caulk Company, Milford, Delaware)
- C – Silar (3M Company, St. Paul, Minnesota)

unfilled resin interface with the sixty-second etched and fifteen-second washed enamel. The only difference in technique was that no external unfilled resin “glaze” was applied to the teeth.

The teeth were stored in sterile water with fuchsin dye (1 g dye / L of water) for seven days and then cycled 160 times in the dye solution from a 0°C bath to a 70°C bath. The teeth remained at each temperature for 60 seconds and were then rinsed thoroughly and placed in sterile water in individually encoded plastic containers. The marginal integrity was evaluated by an examiner unaware of which preparation was being evaluated. Serial sectioning in approximately ¼ mm increments via a high speed diamond bur was performed on several areas of the labial and proximal margins of each restoration. A visual examination was used to evaluate gross dye penetration or deterioration of the margins. Marginal leakage or deterioration was recorded as Present or Not Present. The results of the evaluation were then decoded and are presented in Table 1.

#### Discussion

Currently, most clinicians prefer to either only remove unsupported enamel (the “butt margin”), or to prepare a

bevel in the enamel with or without a feather edge (Fig. 2). The bevel preparation has been advocated for its superior esthetics and retention compared to the butt joint margin. These restorations have been in clinical use for approximately a decade; it is now becoming apparent that the thin margins of the bevel preparation frequently deteriorate within a few years (Fig. 1).<sup>4</sup>

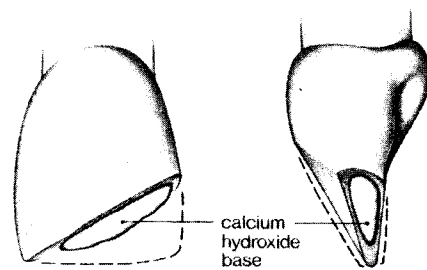
A more recent enamel preparation technique is advocated by Jordan et al.<sup>1</sup> This “chamfer” preparation offers excellent esthetics, limited tooth preparation, improved retention, and less marginal deterioration (Fig. 3).

The average life expectancy of the adhesive fracture repair – depending on both marginal and esthetic integrity – is between five and ten years. After that time, the restoration is either repaired, entirely replaced, or cast crown coverage is elected. Our results indicate that to achieve the longest life span for the restoration, the most effective preparation is the chamfer.

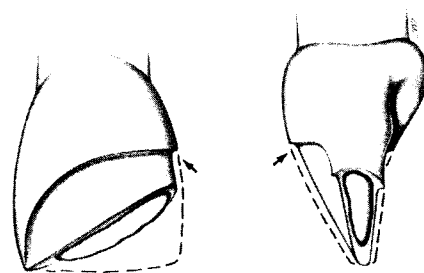
A criticism of mechanically preparing teeth prior to their restoration, especially if the final repair is immediately posttrauma, is the potential of added trauma to the tooth. It is, therefore, important to note that the chamfer preparation is kept entirely within the



Figure 1



Bevel Preparation



Chamfer Preparation

Figure 2

Figure 3

Table 2 Comparison of Marginal Leakage of Microfill Composites

Test Subgroup	Material	Number of Teeth	% No Leakage
I. Bevel Preparation	B	15	73
II. Chamfer Preparation	B	15	67
III. Bevel Preparation	C	15	47
IV. Chamfer Preparation	C	15	40

enamel, that a calcium hydroxide-type base covers any exposed dentin, and that only a light touch with a diamond bur is necessary for this enamel preparation. Consequently, no additional chemical or mechanical trauma occurs. The actual enamel preparation for the chamfer should produce no more trauma than the mandatory pumice prophylaxis of the enamel surface prior to etching.

As noted, differences of opinion exist regarding the necessity for prior enamel preparation. Ripa and Shey<sup>3</sup> reviewed various types of preparations and pertinent research. Their findings support the premise that no preparation other than removal of unsupported enamel is warranted. Our belief is that the chamfer preparation offers improved adhesion, decreased marginal leakage, and significantly improved esthetics.

In particular, retention is improved since the active surface area is increased and the enamel made available for the reaction has not been exposed to salivary constituents, plaque organisms, and similar deactivating experiences. Further, it is difficult with the butt margin preparation to provide a gradual shade transition from the composite to the tooth. The bevel preparation provides the best initial esthetic transition but at the expense of longterm marginal

integrity. The chamfer offers both improved marginal integrity and shade transition.

The final objection raised against preparation prior to restoration is that unaffected tooth structure is being altered. It is important to note that the chamfer preparation removes only a small amount of enamel and that the tooth will, for its lifetime, require some form of restoration, be it adhesive material or full coverage.

In preparing the tooth one must also consider the proximal and lingual surfaces of the restoration. Since esthetics is a minor concern on the lingual surface, the butt joint margin is acceptable, but a small chamfer should offer improved marginal seal.

Speiser and Segat<sup>5</sup> have shown the advisability of adding a final layer of unfilled resin or glaze to the restoration. Although the bulk of this unfilled resin glaze is subject to wear, it should remain in the occasional marginal defect and help prevent percolation. To ensure that this glaze is of optimal value, a substantial thickness of glaze must be applied for appropriate polymerization. Layers thinner than 0.5 mm are subject to oxygen inhibition<sup>4</sup>. Again, not only the labial, but also the lingual surface needs similar consideration and should be sealed.

With respect to the choice of microfill versus standard composite materials, the microfill resins had a higher incidence of marginal leakage. This may result from less compatible coefficients of thermal expansion or more difficulty with initial marginal adaptation.

It is of note (Table 2) that microfill resin "B" demonstrated less marginal leakage than did resin "C". Finally, it would appear that for microfill composites, the preparation type is not significant.

### Conclusion

The chamfer preparation contained entirely within enamel is superior to the bevel preparation with respect to hydration and thermal effects on marginal integrity. The chamfer preparation also offers improved esthetics compared to the butt joint preparation. Further, since a light touch is used and the preparation is contained entirely in the enamel, no

further insult is presented to the potentially hyperemic pulp of the traumatized tooth. In conjunction with a final glaze of unfilled resin of adequate thickness, marginal deterioration of the adhesive composite fracture restoration is substantially decreased.

### References

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### Mediating Between Dentist and Patients

Problems may arise in even the best patient-dentist relationships. Resolving disagreements over treatment or quality of care can be time-consuming as well as costly.

As a service to both the public and the profession, the Dental Society of the State of New York offers free mediation of disputes between the society's members and their patients on matters other than fees through its peer review committees. Of the 153 cases dealt with by the committees last year, 62 percent of them were resolved in favor of the patient, the society reports.

The peer review committees' members, who are drawn from the society's rolls, serve on panels in each of its 12 districts throughout the state, including 5 in the metropolitan area. The first step in seeking the society's assistance is to outline the details of the dispute in a letter that must be sent to the district of the society to which the dentist in question belongs (the society will supply the necessary locating information).

If the complaint is found to be a legitimate one, the patient will be asked to meet informally with the dentist and a mediator before a formal hearing is arranged.

"The point of the peer-review process is to have the disputes resolved in the fairest and fastest way possible," said Nicole Millmann-Falk, the society's assistant executive director. "We often find that the cases are not so much disputes over negligence as they are problems resulting from a misunderstanding about treatment or a lack of communications. Sometimes if both parties are brought together the matter can be settled without a hearing and the professional relationship resolved."