

Double-Blind Randomized Clinical Trial of Posterior Composite Restorations with and without Bevel: 6-Month Follow-up

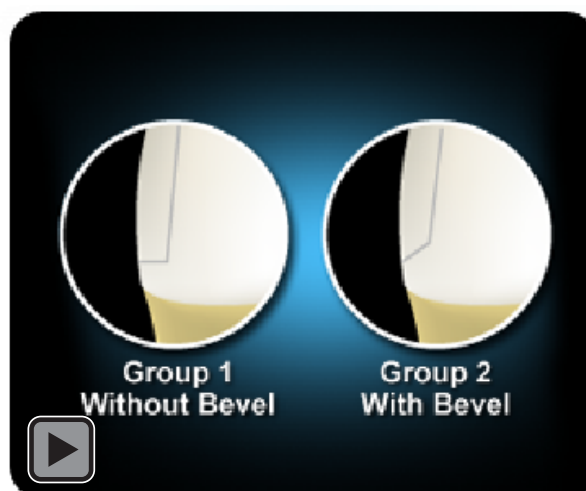
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Abstract

Aim: This double-blind randomized clinical trial compared the performance of posterior composite restorations with and without bevel.

Methods and Materials: Thirteen volunteers requiring at least two posterior Class II restorations were selected. Twenty-nine cavity preparations were performed, comprising 14 without bevel (butt joint) and 15 with marginal beveling. All cavities were restored with a simplified adhesive system (Adper Single Bond, 3M ESPE, St. Paul, Minnesota, USA) and composite resin (Filtek P60, 3M ESPE, St. Paul, Minnesota, USA). A halogen light-curing unit (XL 3000, 3M ESPE, St. Paul, Minnesota, USA) was used throughout the study. Restorations were polished immediately. Analysis was carried out at baseline and after six months by a calibrated evaluator (kappa), according to FDI criteria.

Results: The results were statistically analyzed by Kruskal-Wallis and Mann-Whitney tests ($p < 0.05$). Beveled and nonbeveled restorations performed similarly after six months in relation to fractures and retention, marginal adaptation, postoperative hypersensitivity, recurrence of caries, surface luster, and anatomic form. However, for surface and marginal staining, beveled restorations showed significantly better performance than butt joint restorations ($p < 0.05$).



Conclusion: Restorations performed were acceptable after six months, but beveled restorations showed less marginal staining than nonbeveled restorations.

Clinical Significance: Bevel used in posterior composite restorations decreased the surface and marginal staining, in six-month evaluations.

Keywords: clinical trial, composite resins, bevel, posterior teeth

Citation: Coelho-de-Souza FH, Klein-Júnior CA, Camargo JC, Beskow T, Balestrin MD, Demarco FF. Double-Blind Randomized Clinical Trial of

Posterior Composite Restorations with and without Bevel: 6-Month Follow-up. *J Contemp Dent Pract* [Internet]. 2010 March; 11(2):001-008. Available from: <http://www.thejcdp.com/journal/view/volume11-issue2-souza>.

Introduction

Despite significant improvements in dental materials, especially regarding composite resin, some problems are still present, such as polymerization shrinkage and a long-lasting seal at the interface of the composite/dental structure, which could cause postoperative sensitivity, marginal staining, and perhaps pulpal problems.¹⁻⁴ Several techniques have been developed to prevent or reduce these undesirable problems, such as the incremental technique, which reduces the C-factor;⁵ improved adhesive systems;⁶ and different cavity preparations.⁷⁻¹⁰ Bevel confection has been associated with beneficial results for composite restorations in anterior teeth: transversal exposition of the enamel prisms, favoring acid etching;¹¹ increase in the surface area to be conditioned, enhancing the adhesion;¹² reduction in microleakage;^{7,8} and an increase in the resistance to fracture of restored teeth.¹⁰ Based on these observed improvements, bevel preparation in posterior composite restorations has been considered to improve the clinical performance of these restorations.

Generally, clinical evaluation of restorations has been performed using the USPHS system (Ryge criteria).¹³⁻²⁰ However, this method presents

some shortcomings, especially in view of the new concepts regarding caries development. Recently, Hickey²¹ in a task force from the Federation Dentaire Internationale (FDI), elaborated a new proposal to evaluate restorations that could provide better individualization of the data, improving the standardization and making the data from different studies comparable.

Therefore, the aim of this randomized clinical trial was to evaluate posterior composite restorations prepared with and without bevel, using the FDI criteria.

Methods and Materials

Study Design

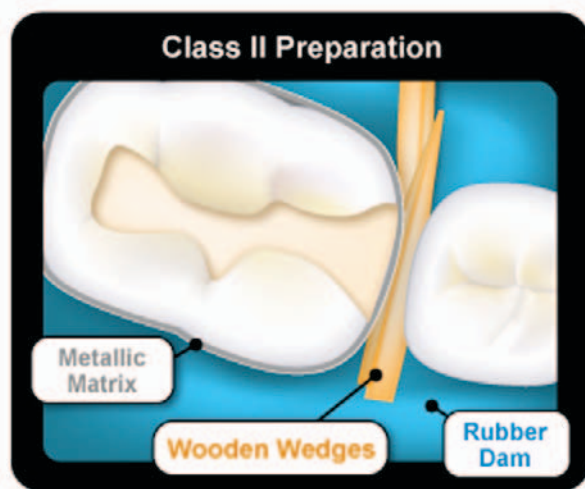
This study was a double-blind randomized clinical trial using the split-mouth design. Class I or II restorations were prepared in molars or premolars, with or without bevel preparation. The study had the approval of the local Ethical Committee (CEP-ULBRA 2007-170H).

Thirteen patients were selected and they signed an informed consent to participate in the study. The patients were aged 20–30 years old, either male or female, each one needing at least two Class I or II restorations in either the mandible or maxilla.

Patients with poor oral hygiene, parafunctional habits, teeth requiring large restorations, and teeth without an antagonist were excluded from the study.

Each patient received two cavity preparations from composite resin, both performed with Filtek P60 (3M ESPE, St. Paul, Minnesota, USA) and adhesive system Adper Single Bond (3M ESPE, St.





Paul, Minnesota, USA), which were used following the manufacturer's indications. The restorations were randomly assigned to two groups:

- Group 1: cavity preparations without bevel (butt joint) (n=14).
- Group 2: cavity preparations with bevel (n=15).

The bevel was prepared in the enamel cavosurface angle using a diamond bur 2135 (KG Sorensen, Alphaville, Brazil), at a 45° angle.

All restorations were placed using a rubber dam to avoid contamination. The operative procedures were made under air-water cooling to avoid pulp damage. A metallic matrix with wooden wedge was used for Class II preparations. A halogen light-curing unit (XL 3000, 3M ESPE, St. Paul, Minnesota, USA) with an energy higher than 450

mW/cm² (\pm 50 mW/cm²) was used throughout the experiment and the energy was constantly monitored.

After restoration placement, finishing and polishing were performed using diamond burs no. 3195F or 1190F (KG Sorensen, São Paulo, Brazil) and the Enhance system (Dentsply, Milford, Delaware, USA).

The operators were trained and calibrated to perform the restorations. The restorations were evaluated soon after polishing (baseline) for a calibrated examiner (kappa), according to the FDI method,²¹ which is composed by five scores for each one of the different criteria. Only restorations classified as clinically excellent for all criteria were included in the follow-up.

After six months, restorations were reevaluated by the same examiner from the baseline, using the same evaluation method.

Data obtained in each evaluation interval were subjected to statistical analysis using Kruskal-Wallis and Mann-Whitney tests, with the significance level of $p < 0.05$.

Results

In 13 patients, 29 restorations were carried out in molars and premolars, 14 without bevel (butt joint) and 15 with bevel. Data regarding the scores

Table 1. Clinical evaluation of restorations: functional properties.

Functional Properties	n	Clinically excellent	Clinically good	Clinically sufficient	Clinically unsatisfactory	Clinically poor
Fractures and retention						
1: No Bevel	14	12	1	1	—	—
2: Beveled	15	12	3	—	—	—
Total	29	24	4	1	—	—
Kruskal-Wallis	$p>0.05$		kappa=0.75			
Marginal adaptation						
1: No Bevel	14	14	—	—	—	—
2: Beveled	15	14	1	—	—	—
Total	29	28	1	—	—	—
Mann-Whitney	$p>0.05$		kappa=1.0			

Table 2. Clinical evaluation of restorations: biological properties.

Biological Properties	n	Clinically excellent	Clinically good	Clinically sufficient	Clinically unsatisfactory	Clinically poor
Postoperative hypersensitivity						
1: No Bevel	14	14	—	—	—	—
2: Beveled	15	15	—	—	—	—
Total	29	29	—	—	—	—
kappa=1.0						
Recurrence of caries						
1: No Bevel	14	14	—	—	—	—
2: Beveled	15	15	—	—	—	—
Total	29	29	—	—	—	—
kappa=1.0						

Table 3. Clinical evaluation of restorations: aesthetic properties.

Aesthetic Properties	n	Clinically excellent	Clinically good	Clinically sufficient	Clinically unsatisfactory	Clinically poor
Surface luster						
1: No Bevel	14	8	5	1	—	—
2: Beveled	15	10	5	—	—	—
Total	29	18	10	1	—	—
Kruskal-Wallis	$p>0.05$		kappa=0.75			
Surface and marginal staining						
1: No Bevel	14	8	6	—	—	—
2: Beveled	15	14	1	—	—	—
Total	29	26	7	—	—	—
Mann-Whitney	$p=0.025$		kappa=0.66			
Anatomic form						
1: No Bevel	14	12	1	1	—	—
2: Beveled	15	14	1	—	—	—
Total	29	26	2	1	—	—
Kruskal-Wallis	$p>0.05$		kappa=1.0			

obtained for different criteria are expressed in Tables 1–3.

The statistical analysis showed no significant difference for most of the criteria: fractures and retention, marginal adaptation, postoperative hypersensitivity, recurrence of caries, surface luster, and anatomic form. The only difference was observed for surface and marginal staining,

where the beveled restorations exhibited less marginal staining than nonbeveled restorations ($p=0.025$).

Discussion

The present study showed that posterior composite restorations performed well after six



months and beveled restorations presented similar behavior to nonbeveled restorations, but with better marginal sealing, corroborating previous laboratory studies.^{7,8,9}

Longitudinal studies are considered outstanding studies to generate scientific-based evidence regarding treatment procedures.^{3,21}

Few clinical data are available in the literature concerning the effect of bevel preparation, especially in posterior teeth. Bevel preparation has been reported to produce some beneficial results in composite restorations: removal of the aprismatic layer of enamel, favoring acid etching; increase in the surface energy and wettability of the substrate, producing higher surface area for acid etching, reducing microleakage, and improving marginal sealing; better esthetic results, masking the interface between enamel and composite; and improved restoration retention.^{7-9,11,12,22,23} The only disadvantage related to bevel preparation is the removal of additional sound tissue; however, this is a small removal of tissue structure, which is overcome by the improved sealing obtained for beveled restorations.^{7,10}

In the present study, we used the method proposed by the FDI to evaluate the longevity of posterior restorations.²¹ This method is a significant improvement in the evaluation accuracy when compared with the largely employed USPHS method (United States Public Health Service, Ryge criteria).^{1,13-20} This new method presents a higher number of scores that facilitate the ability to discern potential differences

regarding restoration quality. Moreover, this method allows the evaluation of the different categories: functional, biological, and aesthetic. The task force that produced this new method recommends its utilization in clinical studies to facilitate future comparisons between different studies.²¹

Nonbeveled and beveled restorations performed similarly in almost all the criteria evaluated. Nevertheless, beveled restorations exhibited better marginal sealing and this finding could be related to the benefits provided by the bevel, as previously reported here. The more favorable exposition of enamel prisms after bevel preparation¹¹ improves the marginal sealing,^{9,10} making it difficult for substances or bacteria byproducts to penetrate along the interface.⁸ Swanson²⁴ observed less microleakage in beveled restorations compared to butt-joint restorations when using a total-etch adhesive system like the one used in our study.

This study presents some limitations, such as the small number of patients and the relative short-term follow-up (six months). However, even with these shortcomings, differences were possible to detect. The authors are following the patients for longer periods of time to evaluate the longevity of the posterior composite restorations with and without bevel. Long-term clinical trials are the outstanding method to provide scientific evidence regarding durability of restorative treatments.

Conclusion

Within the limitation of this study, it was possible to conclude that

1. After six months all restorations were acceptable, in spite of the cavity preparations.
2. Beveled and nonbeveled restorations performed similarly in most of the criteria evaluated, but beveled restorations showed a lower level of marginal staining.

Clinical Significance

Bevel used in posterior composite restorations decreased the surface and marginal staining, in six-month evaluation.

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