

## Posterior composite restorations in primary molars: an in vivo comparison of three restorative techniques

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*This in vivo study evaluated the clinical performance of class II restorations, in primary molars after 12 months. Three restorative techniques were used: filling the cavities in bulk; filling with three horizontal increments and placement in three horizontal increments using pre-polymerized composite inserts. The composite resin used was Prisma TP.H (Caulk-Dentsply) with the adhesive system Scotchbond Multipurpose (3M). Initially 90 class II restorations were placed in 27 patients from 8 to 10 years of age and followed-up for 12 months. After this period 55 restorations were evaluated for anatomic form, color alterations at the margins, presence of decay and marginal adaptation. The results showed that all groups presented similar rates of wear, the bulk insertion technique showed better results for marginal adaptation, color alterations of the margins and less presence of caries at occlusal margins, and that composite resin TP.H could be used in class II restorations in primary molars.*

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### INTRODUCTION

Some positive properties of the composite resins are: excellent esthetics, little thermal conductivity, and facilitation of a more conservative cavity preparation, hence preserving sound dental structures.<sup>1,2</sup>

Even with the composite improvements specially related to the physical properties these materials when used in posterior teeth show early evidences of marginal deterioration and polymerization contraction seems to be the major factor of this process.<sup>3-6</sup> This is an inherent characteristic of the composite resins and can produce such strength to create a gap between dental tissues and the resin, leading to marginal leakage. This contraction strength is proportional to the amount of the material and incremental apposition and polymerization techniques have been proposed to reduce or

even eliminate the final polymerization contraction and consequently minimize marginal leakage.<sup>7</sup>

Color alterations of the restoration margins are also a clinical indicative of the leakage between the tooth and restoration. Another factor, which can be added to margin deterioration, are the fractures of the margins. These deficiencies associated to the polymerization contraction effects will lead to secondary decay.<sup>8,9</sup>

The objectives of this *in vivo* study was to evaluate, after 12 months the clinical performance of class II restorations, in primary molars in which three restorative techniques were compared: filling in bulk, filling in three horizontal increments and filling in three horizontal increments using pre-polymerized resin inserts. Anatomic form, presence of caries, color alterations at the margins and marginal alterations were analyzed.

### MATERIALS AND METHODS

Ninety class II restorations were performed in primary molars of 27 children with ages between 8 and 10 years. Each child and their parents were instructed in hygiene and dietary habits. All teeth were restored under rubber dam isolation and the cavities were filled with the Prisma TP.H (Caulk-Dentsply) composite resin and the Scotchbond Multipurpose (3M) adhesive system. The teeth were divided into three groups according the restorative technique.

Group I, with 30 restorations and a bulk filling technique was used. Preparations were performed with a # 330 carbide bur, with the cervical walls located at the enamel/cement junction. Dentin and enamel were acid etched for 30 seconds with a 37% phosphoric acid, then

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**Table 1.** Rating criteria for evaluation

**1. Color alterations of the margins**

Alfa- No discoloration is present.  
 Bravo- Staining is present, it can be polished away.  
 Charlie- Obvious staining is present, it can not be polished away

**2. Marginal adaptation**

Alfa- Restoration is contiguous with existing anatomic form, sharp explores does not catch.  
 Bravo- Explorer catches, no crevice is visible into which explore will penetrate.  
 Charlie- Crevice is present at margin, enamel margin is present.  
 Delta- Obvious crevice is present at margin, dentin or lute is exposed.

**3. Anatomic form**

Alfa- Restoration is continuous with tooth anatomy  
 Bravo- Restoration is slightly under contoured or over contoured  
 Charlie- Restoration is missing, restoration causes pain

**4. Presence of caries**

Alfa- There is no visible evidence of caries contiguous with the margins  
 Bravo- Caries is evident contiguous with margin of restoration

washed and dried without desiccating. The primer was applied for 15 seconds, air-dried and the adhesive applied in two layers each one photocured for 20 seconds with a visible light activation unit (Optlight, Gnatus). An automatrix (AutoMatrix Retainerless Matrix system, Caulk-Dentsply) was adapted and the resin inserted in bulk, in the proximal box with a syringe (Centrix) and photocured for 60 seconds in a cervico-occlusal direction, a second layer of resin was inserted to fill the occlusal box. After removal of the rubber dam, occlusal interferences were removed and the contact adjusted.

For group II also with 30 teeth the preparations were restored in three horizontal increments, with 1 to 2 mm in width each, photocured for 40 seconds each increment in a cervico-occlusal direction, the remaining occlusal box was filled and cured for 40 seconds.

The other procedures as cavity preparation, acid etch and primer and adhesive techniques as well finishing and polishing were the same as those described to group I.

Finally, group III with 30 restorations filling was initiated with a first horizontal increment, followed by a insertion of a pre-polymerized resin insert, which was used to condense this first layer against to cavity walls and photocured for 40 seconds. A second increment was condensed over the insert and photocured for 40 seconds and finally a third increment was inserted and cured. The remaining occlusal cavity was filled and cured for 40 seconds. The other procedures were the same of the other two groups. A bitewing radiograph was taken of each tooth at the baseline and at 12 months. Final evaluation was done after the experimental period to evaluate anatomic form, color alterations of the margins, presence of caries and

marginal adaptation. The evaluation criteria used were based on modifications of the criteria laid down by Ryge<sup>10</sup> (Table 1).

**RESULTS**

From the total of 90 restorations after 12 months, 52 (57.7%) were evaluated, being 21 restorations from group I, 18 from group II and 13 from group III.

In Table 2 we can observe the results for anatomic form. Eighteen (85.7%) restorations from group I were rated Alfa and 3 (14.3%) were rated Bravo; in group II 13 (72.2%) were Alfa and 5 (27.8%) Bravo.

In group II three restorations were missing (23.1%) and 10 (76.9%) were Alfa. Proportion test (Z) did not show significant statistical difference ( $p > 0.05$ ) between the groups.

Table 3 shows the results for discoloration of the margins. All groups were rated Alfa and Bravo, none of them was rated Charlie, but groups III and I were statistically better than group II. In groups III and I only one restoration showed discoloration of the margins, while in group II 4 restorations showed marginal discoloration. The results for the presence of caries lesions on enamel margins (Table 4) shows that in group I, 21 (100%) restorations were rated Alfa and 14 (77.8%) and 12 (92.3%) restorations were rated Alfa in groups II and III respectively. Group I showed statistically significant better results ( $p < 0.05$ ) than group II, but the results were statistically equivalents ( $p > 0.05$ ) to group III. On table 4 we can also observe the results for caries lesions on the cervical walls of the restorations. Group II showed better results than group I ( $p < 0.05$ ) but was statistically equivalent when compared to group III ( $p > 0.05$ ). Groups I and III did not show statistically differences ( $p > 0.05$ ) when compared with each other.

For marginal adaptation (Table 5) all restorations from group I were rated Alfa, while 16 (88.8%) and 10 (76.9%) from groups II and III were rated Alfa. In group III 3 (23.1%) restorations were totally lost. Group I was statistically better than group II and III ( $p < 0.05$ ), while these two groups were equivalents.

**DISCUSSION**

Clinical behavior during dental restorations is directly affected by operatory procedures performed.

Dentists should be aware of all the steps required when using dental materials, especially when using composite resins in posterior teeth, because any misuse will cause early restoration deterioration and defects.

In the present study restoration wear was not statistically significant between the three techniques, which we can conclude that wear is not dependent by the insertion technique. Pavarini, Vono, Cunha<sup>11</sup>, Araujo<sup>12</sup>, Cunha<sup>13</sup> related that wear in composite restorations in primary molars is minimum specially because the increased physical properties of the newly composite

**Table 2.** Summary of 1-year clinical assessment findings for anatomic form.

	Alfa	Bravo	Charlie
Group I	18 (85.7%)	3 (14.3%)	0
Group II	13 (72.2%)	5 (27.8%)	0
Group III	10 (76.9%)	0	3 (23.1%)

**Table 3.** Summary of 1-year clinical assessment findings for discoloration of the margins.

	Alfa	Bravo	Charlie
Group I	20 (95.2%)	1 (4.8%)	0
Group II	14 (77.8%)	4 (22.2%)	0
Group III	12 (92.3%)	1 (7.7%)	0

resins and the composite used, TPH (Caulk-Dentsply) is a well known material with good wear resistance.

Other studies<sup>14,16</sup> have shown that wear of composite resins in primary molars are lower than in the permanent teeth because the mastication forces in primary dentition are lower and the primary enamel wears at the same rates of the composite resin. The results showed that the composite resin TPH was accepted, no matter the restoration technique used, which was found by others authors.<sup>1,5,6,11,16,17</sup>

Group III, where resin inserts were used, showed higher failure rates for marginal adaptation with three completely lost restorations. This fact could be related to failures probably occurred during operatory procedures, because it is a more sensitive technique. Varpio *et al.*,<sup>19</sup> George *et al.*<sup>20</sup> have reported that failures in composite restorations are often related to a more sensitive technique. The bulk filling technique showed better results related to marginal adaptation, color alterations and development of caries and because this is an easier technique that should be preferred to use in children when a faster operating time is needed. More complex techniques should be indicated to those situations where one has better clinical work conditions. The success of composite restorations in posterior teeth is dependent upon the right selection of the teeth, suitable composite resin and use of a recognize technique.<sup>11</sup>

In this study all patients were stimulated to follow healthy hygienic and nutritional habits, but alterations in the restorations were found. This could be attributed to individual conditions of oral health care. These results are in agreement with Ferrari *et al.*<sup>21</sup> who believe that oral hygiene is an essential condition for a the good performance of a resin restoration. Triadan<sup>22</sup> states that the development of caries at occlusal margins could be avoided if the patient is under a well controlled preventive program and use of fluoride.

**Table 4.** Summary of 1-year assessment findings for secondary caries.

	Alfa	Bravo
Group I occlusal	21 (100%)	0
cervical	19 (90.5%)	2 (9.5%)
Group II occlusal	14 (77.8)	4 (22.2%)
cervical	17 (94.4%)	1 (5.6%)
Group III occlusal	12 (92.3%)	1 (7.7%)
cervical	12 (92.3%)	1 (7.7%)

**Table 5.** Summary of 1-year assessment findings for marginal adaptation

	Alfa	Bravo	Charlie	Delta
Group I	21 (100%)	0	0	0
Group II	16 (88.8%)	1 (5.5%)	1 (5.5%)	0
Group III	10 (76.9%)	0	0	3 (23.1%)

All restorations were performed using the total etch technique and there was no observed post operatory sensitivity during the experimental period, which is in accordance to Ferrari *et al.*<sup>21</sup> and White<sup>23</sup> that believe that such procedures are biological acceptable and leakage in this period was not of major relevance to cause pulpal injuries.

### CONCLUSIONS

On the basis of this *in vitro* evaluation we conclude that:

1. The bulk insertion technique showed better results related to marginal adaptation, color alterations and no presence of caries at occlusal margins.
2. All groups showed similar rates of wear at 12 months.
3. The composite resin TPH can be successfully used in restorations of primary molars.

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