



**UNIVERSIDADE FEDERAL DE UBERLÂNDIA**  
**FACULDADE DE ODONTOLOGIA**



**JOÃO VICTOR DE SOUSA**

**CLASS II RESTORATIONS IN PRIMARY  
TEETH: A COMPARATIVE STUDY OF RESIN  
MODIFIED GLASS IONOMER CEMENT AND  
BULK FILL RESIN**

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Trabalho de conclusão de curso  
apresentado a Faculdade de  
Odontologia da UFU, como requisito  
parcial para obtenção do título de  
Graduado em Odontologia

Orientadora: Prof<sup>a</sup>. Dr<sup>a</sup>. Alessandra  
Maia de Castro Prado

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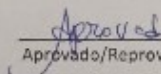
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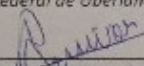
ATA DA COMISSÃO JULGADORA DA DEFESA DE TRABALHO DE CONCLUSÃO DE CURSO DO (A) DISCENTE **Joao Victor de Sousa** DA FACULDADE DE ODONTOLOGIA DA UNIVERSIDADE FEDERAL DE UBERLÂNDIA.

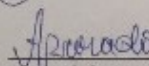
No dia **05 de novembro de 2018**, reuniu-se a Comissão Julgadora aprovada pelo Colegiado de Graduação da Faculdade de Odontologia da Universidade Federal de Uberlândia, para o julgamento do Trabalho de Conclusão de Curso apresentado pelo(a) aluno(a) **Joao Victor de Sousa**, COM O TÍTULO: "**CLASS II RESTORATIONS IN PRIMARY TEETH: A COMPARATIVE STUDY OF RESIN MODIFIED GLASS IONOMER CEMENT AND BULK FILL RESIN**". O julgamento do trabalho foi realizado em sessão pública compreendendo a exposição, seguida de arguição pelos examinadores. Encerrada a arguição, cada examinador, em sessão secreta, exarou o seu parecer. A Comissão Julgadora, após análise do Trabalho, verificou que o mesmo se encontra em condições de ser incorporado ao banco de Trabalhos de Conclusão de Curso desta Faculdade. O competente diploma será expedido após cumprimento dos demais requisitos, conforme as normas da Graduação, legislação e regulamentação da UFU. Nada mais havendo a tratar foram encerrados os trabalhos e lavrada a presente ata, que após lida e achada conforme, foi assinada pela Banca Examinadora.

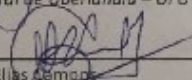
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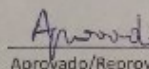
  
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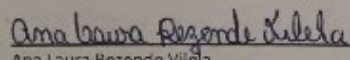
  
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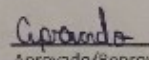
  
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**Class II restorations in primary teeth: a comparative study of resin modified glass ionomer cement and bulk fill resin**

**Short title: Bulk fill restorations in primary molars**

**Key-words: dental restoration, primary tooth, pediatric dentistry**

**Abstract**

**Purpose:** The objective of the study was to assess the clinical performance of Bulk fill resin when used as Class II restorations in primary molars. **Methods:** A total of 17 children, aged 4-7 years old, having dentinal caries on the occlusal and/proximal surfaces without signs and/or symptoms of irreversible pulpitis were selected. It was placed 41 restorations primary molars, 22 were of resin modified glass of ionomer cement (RMGIC) and 19 of Bulk fill resin (BFR). The restorations were evaluated clinically at baseline and after 1, 6 and 18 months following the criteria of United States Public Health Service - USPHS (retention, color, marginal adaptation, marginal discoloration, tooth secondary, surface texture and anatomical form). For the statistical analysis the Mann-Whitney U test was applied. **Results:** Both materials showed failures of clinical evaluations, however statistically significant differences were found for the anatomical form, retention and coloring, being the BFR the material of better performance. **Conclusion:** The two materials presented satisfactory performance, but at 18 months in Class II restorations in primary molars, for anatomical form, retention and coloring the resin Bulk fill showed superior performance.

**Introduction**

Tooth decay remains one of the major concerns of Contemporary Dentistry, especially in Pediatric Dentistry. The process of tooth decay may be preventable and/or reversible, but if left untreated, directly impacts on the quality of life of children with presence of caries.<sup>1</sup> When have presence of cavities, the restorative treatment must be carried out and carefully planned, resulting in a practical and effective technique. Also, the choice of the material is fundamental in this process.<sup>2</sup>

Because of fluoride release, resin modified glass ionomer cements (RMGIC) may be considered for Class I and Class II restorations of primary molars in a high caries risk population. This material, with the acid-base polymerization supplemented by a second resin light cure polymerization, has been shown to be efficacious in primary teeth.<sup>3</sup>

The composite resins has good performance with respect to mechanical and physical properties.<sup>4-6</sup> However, the composite resins require a greater operating time and is a more sensitive technique, where the site isolation with a rubber dam is essential to the success of the procedure.<sup>7</sup> In order to minimize the issues related to the execution time of the restorative technique, the use of resins with low polymerization contraction, used in single increment has been recommended. These resins present the convenience with the characteristics already presented by the conventional ones and are called *bulk fill* resins (BFR).<sup>8,9</sup>

Thus, this material emerges as a good option, especially in pediatric dentistry, where a reduced operating time is fundamental for the child behavior. However, the literature is still scarce in relation to the clinical use of these resins in primary teeth. So, the aim of this study was to evaluate the clinical performance of *BFR* placed in class II cavities of primary molars and compare it with a resin-modified glass ionomer cement (RMGIC).

## **Methods**

This project was submitted to the Committee of Ethics in Research of the Federal University of Uberlandia and was approved under protocol number CAAE: 48606415.5.0000.5152.

A randomized clinical study design was used to compare the performance of the BFR (Filtek Bulk Fill 3M ESPE, SUMARE SP) and the resin-modified glass ionomer cement (RMGIC – Vitremer - 3M ESPE, SUMARE SP) during eighteen months in class II of primary teeth. This study was carried out at the Dental Hospital of the Federal University of Uberlandia (UFU), from January 2016 to July 2018.

### **Sample:**

For this study, 135 children from four to seven years of age, registered into the database of the Dental Hospital were called for screening. From those, 90 attended for the selection, but just 20 presented the inclusion criteria.

Inclusion criteria:

- 1- Be Healthy
- 2- Having at least two primary molars with dentinal caries on the occlusal and/proximal surfaces extending at least one-third of dentine. The teeth should be in different quadrants of the oral cavity.
- 3- For the clinical examination, the selected teeth could not present symptoms, mobility, and presence of fistula, abscesses, or extensive coronary destruction.
- 4- For the radiographic examination, the selected teeth could not present bone destruction, pathological resorptions, previous endodontic treatment and root resorption in more than 2/3 of the tooth.

Parents and/or guardians signed an informed consent form authorizing the participation of children in the study.

The children were scheduled for the interventions, and the anamnesis was conducted by one postgraduate student followed by prophylaxis and clinical examination. It should be noted that all other treatment needs of children were performed. After that, it was performed a drawing lot, where one of the envelopes contained the number of tooth and another contained the material that would be used. Each tooth has been restored in one session, by the same operator.

### **Restorative technique - common procedures to both types of restoration**

At first, topical anesthetic was applied (Benzotop, DFL, Brazil) to the mucosa and after 2 minutes the anesthetic solution of lidocaine 2% with epinephrine 1/100.000 (DFL, Brazil) was introduced with short needles (Injex, Brazil). The teeth were isolated using rubber dam sheet (Madeitex, Brazil) with staples (Golgran, Brazil) and Young arch (Indusbello, Brazil). The tooth to be restored and an adjacent one were kept isolated during all the procedure.

Soon after, the access of the cavity was performed at high speed burs (just when it was necessary), and then decayed and affected dentin was removed with drills at low speed and/or dentine excavator. At this time, one of the two evaluators checked this step. The cavity was cleaned with 2% chlorhexidine solution (Maquira, Brazil) and when necessary, a protection of the dentinopulpar complex was performed using calcium hydroxide cement (Dycal, Dentsply, Brazil).



In order to better define the proximal shape of the restoration and provide a satisfactory point of contact between one tooth and the other, it was used a metallic matrix (Orthomaster – AAF, Brazil) and wooden wedges (Iodontosul, Brazil) in the operative site.

#### **Restorative technique - *bulk fill* resin (Filtek 3M ESPE)**

It was used a one-step adhesive (Single Bond Universal- 3M ESPE) into the cavity. The active application of the material was performed for 20 seconds with microbrush (KG Sorensen), then was photo activated for 10 seconds using Fotopolimerizador Rádii Plus - SDI.

The material was inserted in a single increment and anatomical definition of the resin into the cavity was done with a spatula. Then the material was photo activated during 30 seconds on all sides of the restoration.

The remotion of the rubber dam was performed at the end of the restoration, and the finishing and polishing were performed after the checking of occlusal contacts.

#### **Restorative technique - resin-modified glass ionomer cement (VITREMER 3M ESPE)**

The primer of the product was applied for 15 seconds and photo activated for 20 seconds.

Then, the material was handled according to the manufacturer's instructions, and inserted into the cavity with metal spatula in vibratory movements, avoiding the bubbles formation. The material was photo activated for 30 seconds.

The rubber dam was removed at the end of the restoration and the finishing and polishing were performed after checking the occlusal contacts.

## Evaluation

The evaluation of the restorations was carried out by two evaluators previously calibrated, at baseline, one month, six months and eighteen months after the restoration, according to the criteria USPHS (Figure 1)<sup>10</sup>

Statistical analysis: The Mann-Whitney U test was applied to obtain the results of the clinical evaluation, and to compare the two materials in each criterion of USPHS. The significance level was set at 0.05 in bilateral test.

## Results

The study included 17 children, 4 to 7 years old, in which were performed restorations in 41 primary teeth, 23 first molars and 18 second molars. It was restored 22 cavities with RMGIC and 19 with BFR. These restorations were evaluated at baseline, one month, six months and eighteen months after. In this study, only one patient did not attend the return of six months. At eighteen months, 2 patients did not return, and 3 children had their teeth exfoliated. So, 27 restorations were evaluated at 18 months, 12 restored with BFR and 15 with RMGIC.

When the two materials were compared considering the time of evaluation, it was observed that only the criterion anatomical form showed statistical differences between BFR and RMGIC after six months. After eighteen months, retention, coloring and anatomical form presented statistical differences. (Table1). And for the remaining criteria; staining marginal, adaptation to marginal, secondary caries and surface texture, the materials do not exhibit significant differences. (Table 1)

In order to verify the existence of differences between the results obtained for each one of material, for BFR, at baseline and 6 months, it was showed that there was no statistically significant difference between the periods evaluated. When compared baseline to eighteen months, the results showed differences in the coloring and adaptation marginal. (Table 2).

For the RMGIC, when comparing the baseline to six months after, differences were found in the criteria, anatomical form and marginal adaptation. And baseline compared after eighteen months, differences were presented in all criteria, except for secondary caries. (Table 2).

## Discussion

The restoration of primary teeth differs from permanent teeth, mainly owned to the differences in dental morphology, as primary teeth present thinner enamel and dentin and broader proximal contacts.<sup>3</sup> These tight contact points between the proximal surfaces of the primary molars could be associated with an increased risk of the presence and activity of proximal caries, as the initiation and progression of proximal caries lesions are related to higher plaque accumulation in these conditions.<sup>11,12</sup>

According to the guideline on Restorative Dentistry<sup>3</sup>, in primary teeth, there is strong evidence that composite restorations for Class I restorations are successful and there is just one randomized controlled trial showing success in Class II composite restorations that were expected to exfoliate within two years.<sup>13</sup> In one study, three materials evaluated (Vitremer, Z100 and Dispersalloy) presented satisfactory clinical performance for approximately 2 years, but almost half of the composite resin restorations presented radiographic defects that might require replacement at a later date. In contrast, glass ionomer and amalgam restorations presented significantly less radiographic defects at the time of the final examination.<sup>13</sup>

The BFR is a recent product and could be a good option for restorations, especially in posterior teeth, since it presents behavior and characteristics appropriated because, according to one study, the BFR have smaller post-gel contraction which results in less deformation of cusps, guaranteeing greater resistance of the material. Such positive traits of the BFR among others, described in previous studies have encouraged its clinical application in pediatric dentistry.<sup>9,14,15,16</sup>

There are still few clinical studies with BFR in primary teeth. In a randomized clinical trial of five years evaluating longevity of restorations with resin flow *bulk fill* in permanent teeth there was no statistically significant differences with the conventional resins and neither relevant failure over time evaluated. In another study, BFR presented similar properties to conventional composites in terms of microleakage and may be preferred for class II restoration of primary posterior teeth to decrease working time.<sup>16,17</sup>

In this study the RMGIC was chosen to be compared to BFR because its frequently used in pediatric dentistry, since it presents characteristics such fluoride release, adequate marginal sealing, low rates of infiltration, and it is a procedure that requires less time of execution, characteristic that the BFR presents as evolution to conventional resins. A retrospective study that evaluated the longevity of restorations in the posterior primary teeth showed that up to 4

years of follow-up, the annual failure rates were 9.5% for composite fillings, 12.2% for light-cured glass ionomer restorations, and 12.9% for conventional glass ionomer restorations with statistical difference between the materials.<sup>18</sup>

With respect to the retention, the BFR showed no failure, different from RMGIC that failures in (4.6%) of the cases at six months, and (33,4%) of the cases at eighteen months. However, one study showed failures in only 1.4% of 129 RMGIC cavities at six months, and these values remained low (6.6%) after three years of evaluation, which did not compromise the success of the use of this material.<sup>19</sup>

Another important property of restorative material is the stability of color and this is important by the fact that this is one of the main reasons of change of restoration. However, few studies deal with this topic for BFR, but in a recent one, it was observed that color change of BFR was greater than that of the conventional one after coffee staining and it was also a function of increment thicknesses.<sup>20</sup> In this study until 6 months of evaluation, no change in color of the restoration of BFR was observed, and for RMGIC, just 2 (9.5%) of restorations showed color alteration, but it was clinically acceptable. At 18 months, 3 (25 %) restorations with BFR and 10 (66,7 %) restorations with RMGIC presented color alteration, but this color alteration has not suggested restoration change.

The rough surfaces facilitate accumulation of plaque, leading to inflammation, as well as the staining of these materials causing losses in aesthetics and longevity of the restorative procedure.<sup>21</sup> Thus, the texture of the material was analyzed in and it was observed that at six months, the rough surfaces was maintained for BFR and for RMGIC, 2 (9.5%) restorations showed very rough surfaces, but there was no significant difference. At eighteen months, for BFR, 1 (8,4 %) restoration presented alteration, without statistically significant differences. For RMGIC, 6 (40 %) restorations showed alteration of surfaces.

One study in vitro assessed the adaptation of the material to cavity class II in 30 teeth, using BFR (Sonic fill); GIC (EQUIA) and RMGIC (VITREMER). It was observed that both the BFR and the EQUIA, showed good performance in respect of the marginal adaptation but VITREMER, showed failures of adaptation, a result which is in accordance in this study.<sup>22</sup> It was observed that the marginal adaptation was one of the criteria that showed statistically significant differences for the RMGIC, when the material was evaluated at 6 and 18 months.

The marginal discoloration was also higher for RMGIC, suggesting that relationship with the adaptation of the material. This material showed statistically significant differences in this study, at eighteen months.

Because of fluoride release, RMGIC may be considered to short and long term management of patients at high caries risk,<sup>23</sup> however in this study, 2 of cases presented secondary caries in RMGIC restoration and for the BFR had 1 case of secondary caries. This can be justified by the fact of the failures of adaptation found in RMGIC, high risk of caries,

As for the anatomical form, the BFR showed better results than the RMGIC. This was the criterion that showed statistical difference between the materials at eighteen months after the restorative procedure. This result can be explained, since the fluidity of RMGIC do not allow to obtain a good shape in restorations, different from resin, which allows to match the anatomy of the tooth. In addition, the physic-mechanical properties of BFR and more hardness contributed to the preservation of anatomical form.<sup>9</sup>

A restorative material ideal that best meets the needs of the patient is a constant search in dentistry This work conducted a clinical evaluation of the resin *bulk fill* for a period of eighteen months, it is important to highlight that more clinical studies are conducted in order to observe for a longer period of time the performance of the BFR in the mouth. In addition to the need for a larger sample should be investigated so that comparisons even more representative can be conducted.

## **Conclusion**

It was possible to conclude that, according to the proposed methodology, was found statistically significant differences, between the materials, for retention, coloring and anatomical form, showing the best performance of the BFR in comparison to RMGIC for these criterions, at 18 months of evaluation.

## Bullet points

Why this paper is important to paediatric dentists:

\*Clinical performance of Bulk fill resin when used as Class II restorations in primary molars.

\*Due to their properties, Bulk fill resin allows larger increment insertion, reducing working time. This is an advantage in Pediatric Dentistry.

## Acknowledgements

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## Tables

**Table 1** – Comparison between the BFR and RMGIC when applied the Mann-Whitney test considering the times: at baseline, one month, six months and eighteen months after the restorative procedure FOUFU/UFU.

<b>Variables analyzed</b>	<b>Probabilities</b>	<b>Probabilities</b>	<b>Probabilities</b>	<b>Probabilities</b>
	<b>Baseline</b>	<b>1 month after</b>	<b>6 months after</b>	<b>18 months after</b>
<b>Retention</b>	1.0000	0.3527	0.1845	0.0297*
<b>Color</b>	1.0000	0.5649	0.1845	0.0305*
<b>Surface Texture</b>	1.0000	0.5054	0.0997	0.0671
<b>Marginal discoloration</b>	1.0000	0.1833	0.3490	0.1210
<b>Marginal Adaptation</b>	0.3055	0.3527	0.1608	0.4278
<b>Secondary Caries</b>	1.0000	0.3527	0.0995	0.2636
<b>Anatomical Form</b>	0.9721	0.1833	0.0165*	0.0347*

(\*)  $p < 0.05$

**Table 2** - Comparison between the evaluation times (baseline, one month after and six months after) for each material (BFR and RMGIC) when applied the Mann-Whitney test. FOUFU/UFU

<b>Material</b>	<b>Variables analyzed</b>	<b>Probabilities Baseline and one month after</b>	<b>Probabilities Baseline and six months after</b>	<b>Probabilities Baseline and eighteen months after</b>
<b>BFR</b>	Retention	1.0000	1.0000	1.0000
<b>BFR</b>	Color	0.0679	1.0000	0.0014*
<b>BFR</b>	Surface Texture	0.1414	1.0000	0.0714
<b>BFR</b>	Marginal discoloration	1.0000	0.2918	0.0714
<b>BFR</b>	Marginal Adaptation	0.3297	0.4913	0.0019*
<b>BFR</b>	Secondary Caries	1.0000	1.0000	0.0714
<b>BFR</b>	Anatomical Form	0.3297	0.9398	0.1980
<b>RMGIC</b>	Retention	0.3286	0.1522	0.0049*
<b>RMGIC</b>	Color	0.1621	0.1522	0.0000*
<b>RMGIC</b>	SurfaceTexture	0.3286	0.0759	0.0017*
<b>RMGIC</b>	Marginal Discoloration	0.1621	0.0759	0.0050*
<b>RMGIC</b>	Marginal Adaptation	0.3286	0.0091*	0.0032*
<b>RMGIC</b>	Secondary Caries	0.3286	0.0757	1.0000
<b>RMGIC</b>	Anatomical Form	0.5635	0.0087*	0.0024*

(\*)  $p < 0.05$

## Figure

**Figure 1-** Clinical criteria of evaluation, based on the United States Public Health Service USPHS, with modifications.

Retention	Alpha: present  Charlie: clinically unacceptable partial loss or absent
Color	Alpha: no color alteration  Bravo: slight mismatch, but acceptable  Charlie: esthetically unacceptable
Marginal Discoloration	Alpha: no discoloration at the marginal interface  Bravo: superficial discoloration on the margin, without need of replacing  Charlie: deep discoloration
Marginal Adaptation	Alpha: no visible evidence of crevice along the margin can be detected by an explorer  Bravo: crevice detected by the explorer, but without exposure of the dentin or base  Charlie: dentine or base exposed
Secondary Caries	Alpha: absence of caries  Charlie: presence of caries
Surface Texture	Alpha: surface is as smooth as the surrounding enamel  Bravo: surface is rougher than surrounding enamel, but acceptable  Charlie: unacceptable roughness
Anatomical Form	Alpha: restoration continuous with tooth  Bravo: anatomy shows slight discontinuity, clinically acceptable  Charlie: excessive wear, with dentine exposure, requiring replacement

