

# RESTORATION OF AN AMALGAM-STAINED TOOTH WITH BULK-FILL COMPOSITE RESIN: A CASE REPORT

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**Palavras-chave:** Materiais Dentários. Polimerização. Resinas Compostas. Corantes. Descoloração de Dente.

## Resumo

**Introdução:** Recentemente, foram lançadas no mercado resinas compostas que apresentam baixa contração e baixa tensão de polimerização, as chamadas resinas compostas Bulk-Fill. Estas oferecem ao cirurgião-dentista a possibilidade de inserir incrementos de até 4 mm, tornando o procedimento restaurador mais rápido. **Objetivo:** relatar um caso clínico de restauração de um dente posterior com substrato escurecido utilizando uma resina composta Bulk-Fill de média viscosidade associada a um agente opacificador. **Relato do caso:** após exame clínico e radiográfico, um paciente do sexo masculino com 50 anos de idade foi informado sobre a necessidade de substituição de uma restauração de amálgama de prata insatisfatória na superfície oclusal do dente 16. A restauração foi removida e, em seguida, foi realizada a técnica adesiva para a restauração da cavidade utilizando-se um sistema adesivo autocondicionante de dois passos clínicos (AdheSE, Ivoclar Vivadent, Schann, Liechtenstein). Devido ao substrato dentinário escurecido, foi aplicado no fundo da cavidade um agente opacificador (IPS Empress Direct Opaque, Ivoclar Vivadent, Schann, Liechtenstein) e este, então, fotoativado por 40 s. A restauração foi executada com uma resina composta Bulk-Fill (Tetric N-Ceram Bulk-Fill IVB, Ivoclar Vivadent, Schann, Liechtenstein) em incremento único que foi fotoativado por 40 s. Acabamento e polimento foram realizados com auxílio de borrachas abrasivas. **Resultado:** ao final, obteve-se, com o auxílio do agente opacificador, uma restauração esteticamente satisfatória. **Conclusão:** é possível executar restaurações de maneira mais rápida com resina composta Bulk-Fill de média viscosidade. Entretanto, por se tratar de um material essencialmente translúcido, é recomendado o uso de um agente opacificador em dentes com substrato escurecido a fim de se obter um resultado esteticamente satisfatório.

**Keywords:** Dental Materials. Polymerization. Composite Resins. Coloring Agents. Tooth Discoloration.

## Abstract

**Introduction:** Recently, composite resins that have low shrinkage and low polymerization stress have been released, the so-called Bulk-Fill composites. These offer the dental surgeon the possibility of inserting increments of up to 4 mm, making the restorative procedure faster. **Objective:** to report a clinical case of a posterior tooth restoration with discolored dentin substrate using a medium viscosity Bulk-Fill composite resin associated with an opacifying agent. **Case report:** upon clinical and radiographic examination, a 50-year-old male patient was informed about the need to replace the defective silver amalgam restoration on the occlusal surface of tooth 16. The unsatisfactory restoration was removed and then the bonding technique was performed to restore the cavity using a two-step self-etching adhesive (AdheSE, Ivoclar Vivadent, Schann, Liechtenstein). Due to the discolored dentin substrate, an opacifying agent (IPS Empress Direct Opaque, Ivoclar Vivadent, Schann, Liechtenstein) was applied to the bottom of the cavity, and then was photoactivated for 40 s. The restoration was performed with a single increment of Bulk-Fill resin composite (Tetric N-Ceram Bulk-Fill IVB, Ivoclar Vivadent, Schann, Liechtenstein) that was photoactivated for 40 s. The finishing and polishing procedures were performed using abrasive rubbers. **Result:** at the end, an aesthetically satisfactory restoration was obtained with the aid of the opacifying agent. **Conclusion:** it is possible to perform restorations faster with medium viscosity Bulk-Fill composites. However, as it is an essentially translucent material, the use of an opacifying agent in discolored tooth substrate is recommended, in order to obtain an aesthetically satisfactory result.

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## INTRODUCTION

Recent researches in the field of composite resins have developed new materials that can be used in single increments instead of the traditional incremental technique.<sup>1-3</sup> The manufacturers claim that these new compounds exhibit low volumetric shrinkage, lower polymerization stress, and increased depth of cure.<sup>1-3</sup> This

allows for the placement of a single increment of up to 4 mm thickness.<sup>1-3</sup> The advantages of the Bulk-Fill composites are that they simplify clinical techniques and save time.<sup>1-3</sup> In addition, the single increment method prevents the incorporation of bubbles and contamination between the layers of material, resulting in a more compact filling.<sup>2</sup> Due to the increased translucency, light transmission through

the material is made possible.<sup>1-3</sup> Moreover, the Bulk-Fill composites provides a modulation of the polymerization stress, due to the use of specific monomers that “relieve” this stress.<sup>3</sup>

Bulk-Fill composites can be classified into two categories according to their viscosity: low viscosity (flowable) and medium viscosity (sculpted).<sup>2,4-6</sup> Low viscosity Bulk-Fill composites are better suited to the cavity walls when compared to medium viscosity, especially on irregular surfaces.<sup>5,6</sup> On the other hand, they show higher polymerization shrinkage, and generally have lower amounts of fillers, leading to lower mechanical properties.<sup>5,6</sup> Hence, when restoring occlusal surfaces with low viscosity Bulk-Fill composites, it is necessary to place a 2 mm thick cover layer of medium viscosity conventional composite.<sup>2,5,6</sup>

Medium viscosity Bulk-Fill composites are more resistant, and contain a greater amount of inorganic fillers, allowing them to restore cavities up to 4 mm deep in a single increment.<sup>5,6</sup> However, they exhibit limitations, such as monochromaticity and high translucency.<sup>6</sup> This implies poor aesthetic restoration properties.<sup>6</sup> The increased translucency may be inconvenient in discolored tooth substrate cases, such as sclerotic dentin or dentin stained by the corrosion products from amalgam restorations, as discussed in this case report.

Since this is a new material, there has been little time for clinical follow-ups to be made, and literature to be developed. Therefore, the objective of this study is to report a clinical case that demonstrates the restoration technique using Bulk-Fill medium viscosity resin composite in discolored substrate tooth.

## CASE REPORT

A 50-year-old male patient was presented at the Federal University of Rio de Janeiro’s Department of Clinical Dentistry. Upon clinical and radiographic examination, a dental amalgam restoration presenting marginal defects was found on the occlusal surface of tooth 16 (Figure 1).



**Figure 1:** Initial aspect of tooth 16, with the unsatisfactory amalgam restoration.

Informed about the need to replace the defective restoration, the patient requested to replace the amalgam restoration with a composite resin restoration. After being informed of the details of the treatment, the patient agreed and signed the consent form.

After tooth prophylaxis, color selection and occlusal contacts verification, the rubber dam isolation was completed. The unsatisfactory dental amalgam restoration was then removed with a high rotation 1045 spherical diamond bur, under abundant cooling, forming a cavity of approximately 4 mm depth (Figure 2).



**Figure 2:** Tooth cavity after removing the amalgam restoration, showing a discolored dentin.

The enamel was etched with 37% phosphoric acid gel (N-Etch, Ivoclar Vivadent, Schann, Liechtenstein), and rinsed for 30 s with an air-water spray. Excess water was removed with sterilized absorbent papers. A two-step self-etching adhesive system (AdheSE, Ivoclar Vivadent, Schann, Liechtenstein) was selected to complete the hybridization of the dental structures. The acidic primer was actively applied on the dentin for 30 s with a disposable brush, followed by a mild air jet. The adhesive was then applied in enamel and dentin with a disposable brush and, after a mild air jet, it was photoactivated for 20 s (Bluephase N, Ivoclar Vivadent, Schann, Liechtenstein).

Following cavity preparation and dental hybridization, the opacifying agent (IPS Empress Direct Opaque, Ivoclar Vivadent, Schann, Liechtenstein) was applied to the bottom of the cavity, and was photoactivated for 40 s (Figure 3).

A single increment of Bulk-Fill composite (Tetric N-Ceram Bulk-Fill IVB, Ivoclar Vivadent, Schann, Liechtenstein) was inserted and compacted against the cavity walls with a condenser (M1, Cosmedent, USA). The final sculpture was performed with a spatula (Suprafill No. 1, SS White, Brazil) to achieve the better definition of principal sulcus and correct



**Figure 3:** Placement of the opacifying agent (IPS Empress Direct Opaque, Ivoclar Vivadent).

inclination of cusps, followed by 40 s of photoactivation (Bluephase N, Ivoclar Vivadent, Schann, Liechtenstein).

After the restoration was complete, the rubber dam isolation was removed. The occlusion was checked with an articulating paper (Accufilm, Parkell, USA) and occlusal adjustment was performed with a fine diamond bur (2200 F, KG Sorensen, Brazil). After 48 hours, the restoration was finished with an ultra-fine diamond bur (2200 FF, KG Sorensen, Brazil), and abrasive rubbers in medium and fine granulations (Astropol, Ivoclar Vivadent, Schann, Liechtenstein). The composite was then polished with a brush impregnated with silicon carbide (Astrobrush, Ivoclar Vivadent, Schann, Liechtenstein) (Figure 4).



**Figure 4:** Aspect of the Bulk-Fill resin restoration after sculpture and photoactivation.

## DISCUSSION

The main advantage of Bulk-Fill resin composites is the possibility of a single increment placement, rendering

the conventional incremental technique redundant. The use of a single increment decreases the clinical time to perform the restorative procedure, and reduces the sensitivity of the technique.<sup>7,8</sup>

Manufacturers claim these new composites have low polymerization shrinkage, low polymerization stress and increased polymerization depth, allowing for the insertion of a single increment of up to 4 mm thick.<sup>3</sup>

The polymerization shrinkage of composite resins occurs due to the conversion of monomers into polymers, which results in a reduced volume of material. The higher the degree of conversion, the greater the polymerization shrinkage. This process can cause failures in the margin integrity and postoperative sensitivities.<sup>7</sup>

Bulk-Fill composites allow for the placement of increments that are more than 2 mm thick, which is the recommended limit for conventional composite resins. The insertion of increments up to 4 mm is possible for the Bulk-Fill composite due to technologies developed by the manufacturers, which aim to minimize the polymerization shrinkage.<sup>6</sup> One of these technologies seeks to reduce the polymerization stress by means of a “relief”, that functions as a spring between the polymers. Another technology allows for the fragmentation of the polymer chains and, consequently, relieves the polymerization shrinkage stress, without impairing wear resistance.<sup>1,6</sup> According to Hirata et al.<sup>7</sup>, Bulk-Fill composites present a reduction of the polymerization shrinkage, which reduces the possibility of gap formation between the restoration and the cavity walls.

Polymerization shrinkage alone is not responsible for the failure of composite resin restorations. The stress developed by the shrinkage when resin is bonded to dental structures is the main causal agent. This stress is directly related to the elasticity modulus of the material, a phenomenon explained by a parallel to Hooke's law, where stress is the product of polymerization shrinkage versus modulus of elasticity.<sup>9</sup> Kim et al.<sup>5</sup> confirmed a strong linear relationship between shrinkage stress and debonding at the tooth-composite interface. In terms of polymerization shrinkage stress and tooth-composite interfacial debonding behavior, it was shown in the same paper that medium viscosity Bulk-Fill composites do not seem to be advantageous compared to the medium viscosity conventional composite, while low viscosity bulk-fill composites demonstrated superior results compared with the low viscosity flowable conventional composite.<sup>5</sup>

The higher polymerization depth of the Bulk-Fill composites is mainly achieved through their higher translucency, when compared to conventional resins. Generally, this translucency is justified by the reduction of

the amount of fillers, and the increased size of these fillers. This results in a lower light scatter and, consequently, deeper penetration of the light.<sup>10,11</sup> Zorzin et al.<sup>11</sup> demonstrated that the Bulk-Fill composite achieved sufficient polymerization at 4 mm depth, by showing that there was no significant difference between the conversion degree at the top and the bottom of the specimens. On the other hand, Yap et al.<sup>12</sup> verified that the polymerization depth, which in Bulk-Fill composites is dependent on the product, was higher when compared to conventional resins. Despite this, Bulk-Fill composite resins did not reach the adequate polymerization in depth of 4 mm. Based on the results of this study, Bulk-Fill composite resins should not be placed in single increments with more than 2.5 to 3 mm thickness.

Bulk-Fill composites do not represent a uniform category of material.<sup>12</sup> According to the manufacturers specifications, Bulk-Fill composites have different types of monomers with different reactivity, and different volumetric filler concentrations, with unknown degrees of silanization. In addition, Bulk-Fill composites also have different photoinitiator systems, affecting the photocure degree.<sup>13</sup>

Light-cured resins contain photoinitiators, which decompose after the visible blue light irradiation, releasing free radicals that activate the polymerization.<sup>6</sup> Two types of photoinitiators are used in Dentistry: type I and II. Type I has a higher quantum yield, and requires fewer photons to generate a free radical than type II. Type I is, therefore, more reactive and has greater quantum efficiency.<sup>14</sup> The Bulk-Fill composite used in this study, Tetric N-Ceram Bulk-Fill (Ivoclar Vivadent, Schann, Liechtenstein), presents greater depth of cure according to its manufacturer. However, this is not caused by the greater translucency of the material. It is due to the presence of Ivocerin, a type I photoinitiator patented by Ivoclar Vivadent. That makes the restoration with increments of up to 4 mm possible, without compromising the composite optical properties, such as translucency and color.<sup>15</sup>

Ivocerin is more reactive within the range of 390 to 445 nm of the light spectrum. Therefore, it is activated by the radiation located between the blue and violet range. This led manufacturers to incorporate another color into the LED, providing a simultaneous combination of violet and blue wavelengths. Thus, considering that the Bulk-Fill composite used in this case report contains Ivocerin, the third-generation LED Bluephase N was used.<sup>16</sup>

In the present case, the cavity pulp wall was discolored due to deposition of amalgam corrosion products. Since the Bulk-Fill has a great translucency, the use of an opacifying agent (IPS Empress Direct Opaque, Ivoclar Vivadent, Schann, Liechtenstein) was indicated to cover discolored dentin

substrate. Opacifiers are fluid resin-based materials with high value, and they are applied to the tooth surface in thin layers. These materials can prevent the light to pass and, consequently, can mask the unpleasant colors of the dental substrate.<sup>17,18</sup> However, the excessive opacity of the restoration results in an artificial appearance. On the other hand, the excessive translucency turns the restoration into a greyish color by decreasing the value.<sup>19</sup>

Although the medium viscosity Bulk-Fill composite allows for a single increment placement, simplifying the technique, the restoration can be difficult to sculpt. The larger volume of this material makes it difficult to reproduce the anatomical details of the tooth.<sup>7</sup> In this context, it becomes imperative that the professional develops an adequate restorative technique, in order to obtain the best functional results for the restoration.

Based on this case report, it is possible to observe that Bulk-Fill composites are a significant technological progress. These materials simplify the technique for surgeons, reducing clinical time and the sensitivity of the technique. Its best feature is certainly the low polymerization shrinkage. Other advantages, such as the possibility of restoring up to 4 mm increments or single increments, are consequences of this new technology. However, the technique must be well indicated, and still have limitations such as the translucency and monochromaticity of the material. This can make it difficult to obtain a pleasant aesthetic result. This material is also difficult to sculpt, due to the larger volume of resin used for the restoration. In this way, it is possible to obtain satisfactory results with Bulk-Fill resin composites, once their characteristics and indications are known.

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