Clinical performance of low and high-viscosity bulk fill resin composites: Six-month follow-up

Marilia Velo[1,2]
Natália Almeida Bastos[1,3]
Maria Angélica Sivério Agulhari[1,3]
Tamires de Luccas Bueno[1,3]
Juliana Fraga Soares Bombonatti[1]
José Mondelli[1]

1) Universidade de São Paulo, Faculdade de Odontologia de Bauru, Departamento de Dentística, Endodontia e Materiais Dentários (Bauru/SP, Brazil).
2) Doctor in Dentistry, Faculdade de Odontologia de Bauru, Universidade de São Paulo (Bauru/SP, Brazil).
3) Master in Dentistry, Faculdade de Odontologia de Bauru, Universidade de São Paulo (Bauru/SP, Brazil).

Abstract: Bulk fill resin composites have been introduced with the particularity to be placed in 4-mm thick bulks without adverse effects on polymerization shrinkage and cavity adaptation. Clinically, widely destroyed teeth are easily restored, thus reducing chair time. The present case reports evaluated the clinical performance of two Class I cavity restored with low and high-viscosity bulk fill resin composites. Male patient, 15 years old, searched for the Department of Operative Dentistry, Endodontics and Dental Materials, School of Dentistry (University of São Paulo, Bauru/SP, Brazil), after removal of the orthodontic appliance, for a restorative treatment. In the case 1, on clinical examination, it was observed in the tooth #46 a slightly demineralized enamel and an underlying shadow. The treatment plan included the removal of the carious tissue and the confection of the restoration. The restoration was performed using low-viscosity bulk fill resin, posteriorly restored with nanohibrid resin composite, color A2. In the case 2, the tooth #36 was restored using the same previously described adhesive and restorative procedures. The confection of the restoration was conducted using high-viscosity bulk fill resin composite Filtek Supreme placed in two layers of 2-mm thick bulks. After six-month follow-up, the restorations presented good clinical aspect, absence of biofilm accumulation and abrasive wear, suggesting a promising performance of these new composites.
Keywords: Bulk fill. Composite resin. Polymerization shrinkage.

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Contact address: Juliana Fraga S. Bombonatti
Faculdade de Odontologia de Bauru/USP - Dpto. de Dentística
Alameda Octávio Pinheiro Brisolla, 9-75 Vila Cidade Universitária
CEP: 17.012-901 - Bauru/SP
E-mail: julianafraga@usp.br

INTRODUCTION

With the possibility of a minimally invasive dental treatment, composite resin restorations have increased considerably, becoming routine in the dental clinic.[1] However, during polymerization process, the conversion of monomers into polymers cause a volumetric shrinkage. Clinically, this dimensional change is impaired by the confinement of the material bonded to cavity walls. As a result, shrinkage manifests itself as stress and has been associated to potential clinical problems and is responsible for marginal failure, recurrent caries and dental fracture.[2]Most operative interventions in posterior teeth are accomplished with the direct placement of composite resins.[3] In order to reduce polymerization shrinkage stress, the most commonly used method is the application of the composite resin composite resin in several increments of 2 mm thickness,[4,5] providing adequate light penetration and, consequently, adequate polymerization.[5] However, this layering technique is time consuming, as eachincrement is individually polymerized, voids may be included and the failure risk increased, especially when applied in deep posterior cavities. Accordingly, a new generation of composite resins, called bulk fill, composite resinwas introduced onto the dental market, with the proposal of insertion in larger increments, allowing its placement in 4 mm thickness without adverse effects on polymerization shrinkage and cavity adaptation.[6] Therefore, the use of bulk-fill resins in larger increments allows dentists to perform a variety of direct posterior restorations in a simpler and faster way. Some bulk-fill composites are used as underlining or base materials (low-viscosity composites), and then a second increment of composite resin for enamel is placed to finish the restoration. The other type is the high-viscosity bulk-fill resins, indicated for use as posterior restorations.

Bulk-fill composite resins may be promising and their performance proved to be comparable or better than nanohybrid composite resins.[7] Clinically, low-viscosity bulk-fill resins might be an advantage in deep or narrow cavity restorations, because they decrease working time and reduce polymerization shrinkage, also preventing postoperative sensitivity. This new type of composite presents different monomer and filler formulations, which makes the clinician have many doubts regarding its use and the adhesion technique that must be applied. In addition, little is known regarding the clinical performance of bulk-fill composite resins. This paper describes the clinical performance, after six months follow-up, of two Class I deep cavities restored with low and high-viscosity Bulk-fill composite resins.

CASE REPORTS

A 15-year-old male patient attended the Department of Operative Dentistry, Endodontics and Dental Materials of Bauru School of Dentistry, University of São Paulo, Bauru – SP – Brazil) after removal of the orthodontic appliance for a restorative treatment.

At clinical examination, it was observed presence of dental biofilm in the posteriors teeth.

CASE 1

The enamel of the tooth # 46 occlusal surface was slightly demineralized clinically and an underlying dark coloration was detected (Fig 1). The treatment plan for the tooth 46 included the removal of all carious tissue and the confection of a restoration using low-viscosity Bulk-fill resin (3M/ESPE, St. Paul, MN, USA), to be subsequently restored with nanohibrid composite resin (Z-250 3M ESPE, St. Paul, MN, USA). All clinical

steps were performed under absolute isolation for the best access of the operative field, as well as to obtain better results in the confection of the restorations. First, a #245 carbide bur was used to perform cavity access, and a steel drill was used to remove all carious tissue (Fig 2). The glass ionomer cement (Vitrebond, 3M/ESPE, St. Paul, MN, USA) was inserted on the sclerotic dentin (Fig 3) and, posteriorly, the restorative technique was conducted following the entire adhesive restorative protocol. cid etching in enamel and dentin was performed with 37% phosphoric acid, using Condac 37 gel for 30 and 15 seconds, respectively (FGM, Joinville / SC, Brazil) (Figs 4 and 5), followed by application of three-steps etch-and-rinse adhesive system, Adper™ Scotchbond™ Multi-Purpose adhesive (3M/ESPE, Joinville, Brazil) (Fig 6).

In order to perform the restoration, Filtek Supreme low viscosity bulk-fill resin (3M ESPE, St. Paul, MN, USA) was inserted in a 4 mm thick increment (Figure 7) and polymerized (Figure 8). Afterwards, a conventional composite resin (Z-250 3M ESPE, St. Paul, MN, USA) was used in 2 mm thick increments, allowing the achievement of the dental sculpture (Figs 9a and 9b), removal of excesses (Fig. 10) and completion of the restoration (Fig 11).

Figure 1: Initial aspect of the tooth 36.

Figure 2: Removal of carious tissues.

Figure 3: Insert of glass ionomer cement.

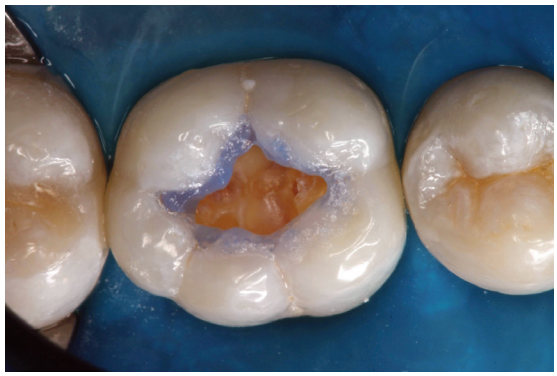

Figure 4: Surface enamel etching was performed with 37% phosphoric acid gel for 30 seconds.

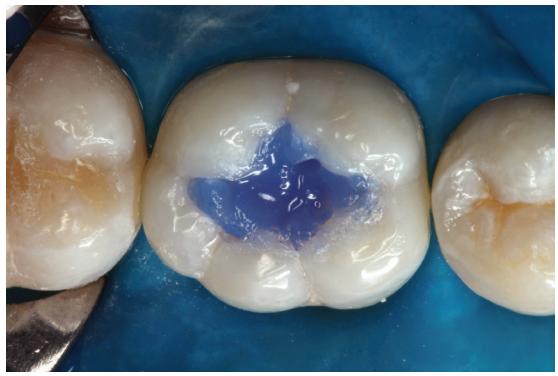

Figure 5: Surface enamel etching was performed with 37% phosphoric acid gel for 15 seconds.

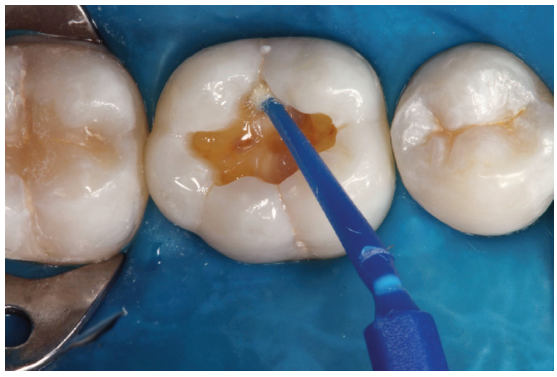

Figure 6: Application of primer and adhesive.

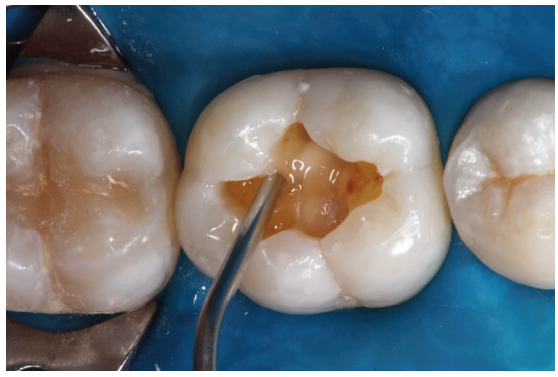

Figure 7: Insert of low-viscosity bulk-fill composite resin.

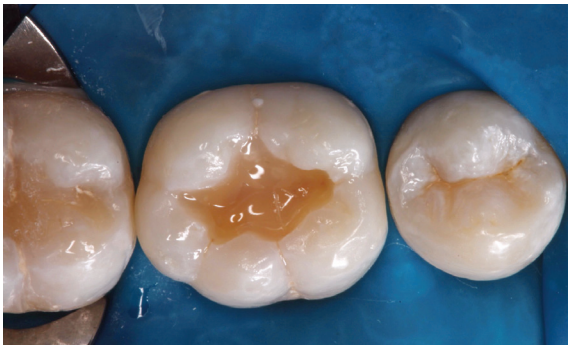

Figure 8: Low-viscosity bulk-fill composite resin polymerized.

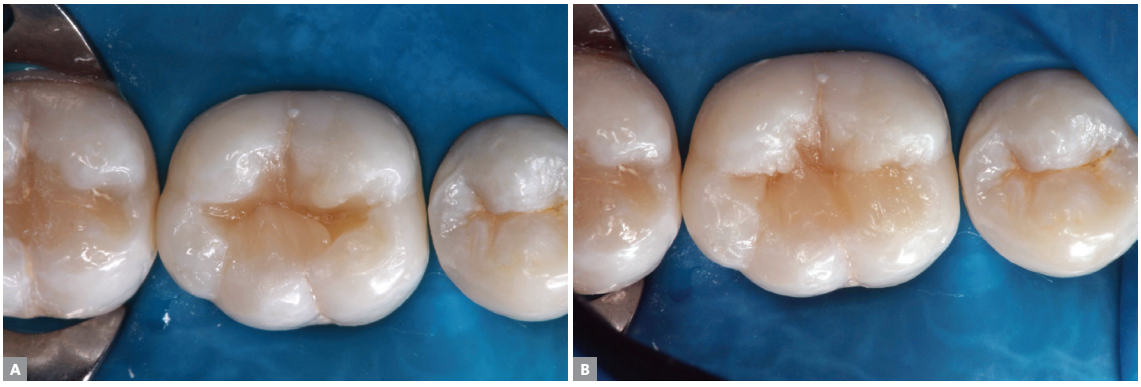

Figure 9: A) Insertion of the first increment of composite resin. **B)** Finished restoration.

Figure 10: Removal of gross excess.

Figure 11: Immediate final aspect of the tooth 36.

CASE 2

Tooth #36 was also affect by caries lesion (Figure 12). The treatment plan included the initial removal of the carious tissue. All the same previous described adhesive restorative procedures were conducted before the restoration. In this case, low-viscosity bulk-fill was not used, as we choose to use only high-viscosity bulk-fill to restore the cavity (Figure 12B). The high-viscosity bulk-fill composite resin (Filtek Supreme, 3M ESPE Joinville/SC, Brazil) was placed in two 2mm thick layers (Fig 12C).

After six months of follow-up, a good clinical performance was observed in both cases (#36 and #46), with no biofilm accumulation, good sealing and no abrasive wear for both clinical cases (Figs 12D and 12E, respectively).

DISCUSSION

The possibility of conservative procedures makes the composite resin the material of choice in many clinical situations.[1] Direct restorations with composite resins can be placed in a single visit and often allow little or no tooth structure to be worn for tooth preparation purposes, which are some advantages when compared with indirect restorations. In the present case reports, Filtek Flowable and High-viscosity Bulk-fill were used to restore cavities with different depth types. In the tooth #46, a 4mm thick increment of low-viscosity bulk-fill composite resin was used (Fig 7). as it has been suggested that bulk-fill resins can polymerize up to 4mm thick increments without adversely effecting polymerization shrinkage stress and cavity ad-

Figure 12: A) Initial aspect of the tooth 46. **B**) Immediate final aspect of the tooth 46. **C**) Final aspect after 6-month of tooth #36 follow-up. **D**) Final aspect after 6-month of tooth #46 follow-up.

aptation.[8] This fact occurs because Filtek Bulk-Fill Flow (that was used here) has an "intelligent monomer" (Procrylat), which is a high molecular weight monomer with a lower viscosity, due to the lack of pendant hydroxyl groups (3M ESPE, 2014), therefore producing a restorative with low polymerization stress. Clinically, the present cases also presented, after six-month follow-up, a great clinical performance of this restoration, without biofilm accumulation and well-sealed (Fig 14).It is important to highlight that, although the composition of bulk-fill composites is different from conventional composites, the same adhesive procedures were conducted for nanohybrid and microhybrid composites were used (Figs 4, 5 and 6), for both case reports. The same adhesive and restorative procedures were also reported by Manhart (2016).[9] The authors describe a new bulk-fill of nanohybrid ORMOCER (Admira Fusion x-tra, VOCO), launched in 2015 as a simpler, faster and more cost-effective treatment.[9]When the high-viscosity bulk-fill was used, it was possible to perform a good restorative procedure in a shorter time (Figure 13). However, as the studies about this subject are still recent and there are few clinical studies, in the present case, it was chosen to use two increments of 2 mm to prevent a stress in the interface. After six months of follow-up, a good clinical performance of the restorations was observed, with no biofilm accumulation, good sealing, no abrasive wear and excellent polishing for both clinical cases (Figs 12D and 12E). The longevity of this material was also evaluated in previous in vitro study after three years, presenting excellent clinical performance.[10] Based on the present clinical reports, it is possible to conclude that this new type of restoration can be used, for example, when patients present defective amalgam restorations, in pediatric and elderly patients, as well as in large restorations, as this restorative material needs less application steps, thus reducing the treatment time. Both clinical cases reported here showed that bulk-fill materials can be used to achieve an esthetic and functional restoration and at the same time, saving considerable time.

CONCLUSION

With the bulk-fill composite resins, it was possible to develop an esthetic restoration with practicality and reduced clinical time. Additionally, this procedure proved to be more practical and less costly when compared to indirect restorations. Therefore, this simplified approach has the potential to extend the advantages to a great number of patients

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