Caries removal conservative technique using light probe and dental restoration with bulk fill resin composite: Case report

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Abstract: The use of auxiliary instruments for the detection and removal of caries has been more and more widespread in the modern cosmetic and restorative dentistry, as well as the use of resins into single increment in order to decrease the clinical time necessary to perform the restorations. The objective of this study was to present a case report of posterior restoration (class II), associating an auxiliary method (light emission) to the removal of caries and a low contraction resin. In order to detect and remove the carious tissue, the Proface system (W&H, Austria) was used, which utilizes fluorescence to highlight the contaminated dentine. On the other hand, for the restoration of the cavity, a bulk fill resin composite was used (Tetric N-Ceram Bulk Fill, Ivoclar Vivadent, Liechtenstein). The association of the used techniques was successful, preserving the healthy structure and reducing the clinical time of the procedure. Proface system and the use of low contraction resins represent efficient methods, which are of easy execution for the treatment of caries in posterior teeth. Besides, the use of bulk fill resins presents a satisfactory aesthetic-functional result.
Keywords: Dental caries. Composite resins. Dental restoration, permanent.

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» Patients displayed in this article previously approved the use of their facial and intraoral photographs.

INTRODUCTION

Tooth decay detection and removal process, which is classically proceeded subjectively,[1] in which the tactile sensation of rigid tissue and the visualization of non-pigmented dentin[2] dictate the completion of the cavity preparation, can be performed more objectively with the aid of alternative methods in modern restorative dentistry.

Carious dentin, as described by Fusayama,[3] can be divided into two layers: a more external, highly infected, irreversibly denatured and with no possibility of remineralization; and an inner one, whose tissue is partially affected, having physiological remineralization potential. This layer can, and should, be preserved[4,5] to avoid excessive wear of dental tissue. In a study made by Corralo and Maltz[6] the disorganized infected dentin showed remineralization, fact that make it possible to be preserved.

Dental caries can be managed by controlling its causatives factors- fermentable carbohydrates and dental biofilm.[5] Knowing that, it is possible to preserve the non-demineralized and remineralizable tissues, as long as a seal can be achieved in sound dentin and enamel on the peripheral restoration. Making it necessary to the dental practitioner to know exactly where the limits between the layers are, but these clinical discrimination is difficult.[5] Thus, the use of caries detectors, chemomechanical methods and the use of fluorescence has been used to preserve the dental tissue that can be remineralized.[7]

Among the auxiliary methods in caries detection and removal, the Fluorescence-Aided Caries Excavation (FACE) system stands out, using fluorescence to guide the removal of carious tissue[7,8] and it's a reliable method of detecting caries.[9-11]

Following the evolution of the means of detection and removal of caries, new materials and restorative techniques were proposed. Among them, bulk-fill composites, which were developed to accelerate the restorative procedure,[12] since they can be used in a single increment from 4 mm to 6 mm.[13] The use of thicker increments reduces the time taken by resin stratification,[12] increasing clinical productivity.

The objective of this work was to present a case report of posterior restoration, using the fluorescence-guided caries' removal system and subsequent restoration of the cavity with a bulk-fill resin.

CASE REPORT

Patient E.B.S, 20 years old, male, showed signs of inadequate oral hygiene, with generalized biofilm accumulation and intense gingivitis. After clinical and radiographic examination, the presence of a carious lesion in element 16 mesial occlusal region (class II) was verified (Fig 1).

After prophylaxis of the hemiarch, with 0.12% chlorhexidine solution and pumice powder, and local infiltrative anesthesia, the occlusal access through the enamel was performed with the aid of a spherical diamond burr in high-speed handpiece, to expose the affected dentin. The preparation of the proximal box was made with a cone-shaped diamond burr; the proximal walls were regularized with a metallic sandpaper strip.

Then, absolute isolation of the operative field was performed, using Young's plastic arch and a rubber dam. The carious dentin removal process was started. Using a carbide spherical burr coupled to a multiplier handpiece, dentinal areas which showed a reddish-orange coloration when irradiated with violet light emitted by the PROFACE device (W & H, Austria) (Figs 2-4) were removed, considering that greenish color indicates healthy dentin and red color indicates infected dentin.

Once it was found that there were no more affected areas in the dentin (Figs 5 and 6), the cavity was abundantly washed with a jet of air and water and then dried. For a correct anatomy and proximal contact point, a split matrix and ring system was used along with a wooden wedge. A self-etching adhesive system (Clearfil SE Bond, Kuraray, Japan) was used with selective enamel etching. Therefore, 35% phosphoric acid (UltraEtch, Ultradent, USA) was applied only to the enamel for 30 seconds (Fig 7) and then washed with a stream of water and air for the same period of time. The cavity was properly dried and the primer was actively applied for 20 seconds throughout the dentin (Fig 8) inside the cavity. The primer solvent was evaporated with a long jet of air. A thin layer of bonding agent was applied (Fig 9), thinned with a light jet of air and polymerized for 20 seconds (Fig 10).

Figure 1: Inicial aspect of dental element 16. There is a carious lesion in the mesial occlusal region.

Figure 2: Proface system. Composed by a violet light illumination system and an orange filter glasses.

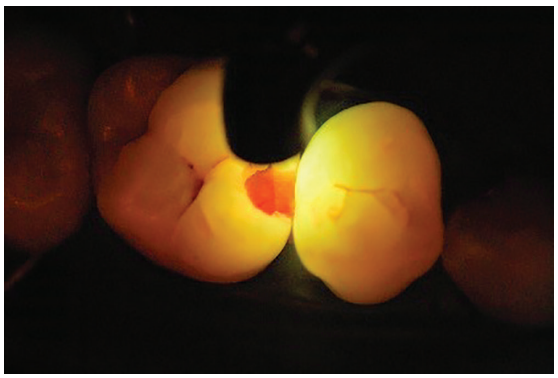

Figure 3: Verification of affected areas by caries. Red-orange coloration of the affected tissue can be observed.

Figure 4: Removal of carious tissue with spherical burr.

Figure 5 and 6: Final aspect of the cavity after removal of all carious tissue, with and without Proface lighting, respectively.

Figure 7: Selective enamel etching for 30 seconds with 35% phosphoric acid.

Figure 8: Primer conditioning of the adhesive system actively for 20 seconds.

Figure 9: Application of a thin layer of bonding agent.

Figure 10: Photopolymerization of adhesive system for 20 seconds.

The resin selected for cavity restoration was the Tetric Bulk Fill (Ivoclar Vivadent, Liechtenstein), color IVA (Fig 11). Following the manufacturer's recommendation, a 4 mm increment (Fig 12) were inserted into the cavity until dental shape and function were reestablished. The occlusal anatomy (Figure 13) was made with a thin n-5 probe (Hu-Friedy, USA). After a 60-second polymerization (Figure 14), a high irradiance light curing device (Bluephase G2, Ivoclar Living, Liechtenstein) was used. The occlusal contacts were checked and then the restoration margins were finished with a multilaminated tip and the polishing was made with a silicon carbide brush (AstroBrush, Ivoclar Vivadent, Liechtenstein), thus finalizing the restoration (Fig 15).

Figure 11: High viscosity Bulk Fill composite resin.

Figure 12: Insertion of the resin into the cavity in 4 mm increments.

Figure 13: Occlusal aspect after cavity filling with resin and conformation of the occlusal anatomy with probe n° 5.

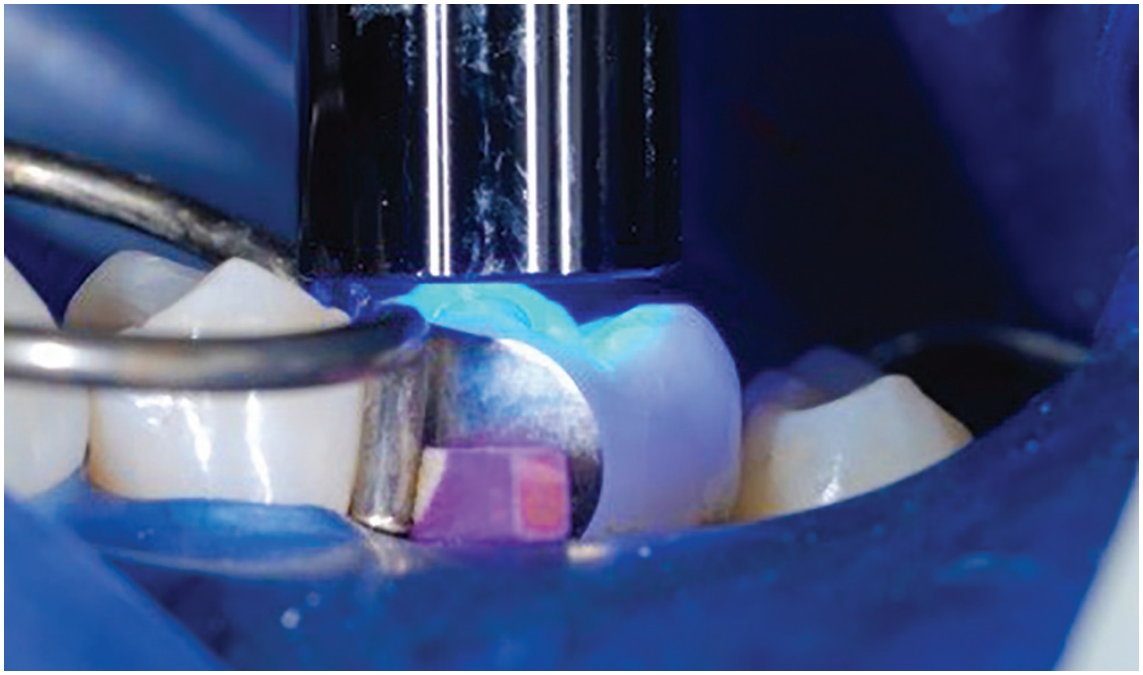

Figure 14: Photoactivation of the restoration for 60 seconds.

Figure 15: Final aspect of the restoration, after finishing the edges with multilaminated tip and polishing with AstroBrush (Ivoclar Vivadent, Liechtenstein).

DISCUSSION

The use of the FACE system aiding the diagnosis and the removal of caries promotes a cavity preparation with less residual tooth decay when compared to other methods.[9] With this technique, healthy dentin, when illuminated by violet light, presents green fluorescence; while bacteria-contaminated dentin emits reddish-orange fluorescence,[7] derived from the porphyrins produced from the metabolism of oral bacteria,[14] thus only the red fluorescent tissue is removed. As a result, less healthy tissue is removed than when using techniques, such as laser-induced fluorescence (LIF) of Diagnodent (Kavo, Germany) or the conventional digging technique.[7,15]

The LIF technique shows similar efficacy in the removal of infected tissue to that of FACE[16] - which can be explained by the resemblance of the operation's principles of both systems, which are based on the production of bacterial metabolites.[15] However, the use of fluorescence induced by laser may lead to overinstrumentation of the cavity when the residual dentin is pigmented, since dentinal staining interfere in the reading of DiagnoDent.[17] During the present clinical case, it was possible to observe that during the caries' removal with the aid of Proface system, there were pigmented dentin that, when irradiated, did not present coloration that could indicate presence of caries, therefore agreeing with previous studies that consider it a more conservative technique in the removal of carious tissue.[7,16]

Thus, the use of the fluorescence-guided caries removal system is recommended, since, when compared to conventional tactile-visual examination and the application of caries detecting dyes, it is more effective in the removal of infected dentin[9-11] and it is an ultraconservative technique.[7]

In relation to bulk-fill resins, manufacturers recommend their use in increments of up to 4 mm, and the literature does not show a decrease in the degree of resin conversion when used in this thickness.[18] The possibility of its use in larger increments is related to the fact of having more powerful photoinitiators and greater translucency.[19,20]

They are presented with two different viscosities: flow or high viscosity. The bulk-fill flow resins present good handling and some advantages, such as: the use in hard-to-reach cavities; less air incorporation between layers and their flexibility, which makes them a good material for cavity lining.[12] The high viscosity fillers have consistency and manipulation similar to conventional hybrid resins, with a higher amount of filler particles, which gives them a higher microhardness.[12,20]

For a bulk-fill resin to be considered ideal, it should be able to be inserted into a cavity with high C-factor, in a single increment, and yet exhibit a low contraction stress, avoiding the formation of internal and external marginal gaps. It has already been demonstrated in the literature that these resins have a rate of formation of internal interface gaps similar to the conventional hybrid resins used with the incremental technique.[13] Therefore, its use in single increment is not deleterious in relation to internal marginal adaptation.

From the mechanical point of view, the filling resins have an elastic modulus lower than that of the hybrid and microhybrid resins, and are therefore subject to a greater deformation when exposed to the masticatory efforts, which can lead to failure,[21] and to have better mechanical properties, the literature recommends extending the polymerization time of these materials.[18]

The use of bulk-fill resins should be carried out with caution, taking into account the recommendations of the manufacturers, since studies of longevity using these materials should be performed in order to verify their long-term clinical performance.

CONCLUSION

The use of auxiliary instruments in the identification and removal of caries, as well as the use of bulk-fill resins to restore cavities from tooth decay lesions, are efficient and easy to perform techniques. However, more clinical longevity studies are needed to demonstrate their long-term performance.

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