Adjusting opacity and translucency of composite resin veneers in discolored teeth

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Abstract: The search for dental treatments is not limited to painful situations or prosthetic rehabilitations. The restorations of shape, function and color discrepancy of teeth are major complaints: with the intention of improving aesthetics of the smile, these patients seek dental offices. The fracture of old restorations, associated with dental stain, can be caused by several situations and there are many ways of clinical resolution. Direct composite veneer is a predictable, safe and affordable modality. In the present article, a clinical case will be reported, demonstrating the steps of a direct veneer in a darkened and endodontically treated tooth, with a main focus on controlling opacity and translucency of the restoration. **Keywords:** Composite resins. Color. Endodontics. Dental care. Dentistry.

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INTRODUCTION

Contemporary Odontology follows the following principles: intervening minimally, optimizing dental format and providing aesthetics.[1] Thus, it is very challenging to reproduce the full dynamics of a natural tooth regarding color similarity, opacity, translucency, shape and texture.[3] Therefore, choosing materials that are able to block and transmit light becomes one of the most complex steps for darkened teeth restorations.[4]

Society, in general, values health and beauty, and seeks physical/mental well-being in their daily lives. However, in daily activities or extreme sports, dental trauma may occur in children or adults, which may require endodontic treatment and subsequent restoration. In some cases, dental darkening may occur due to trauma or other causes[5] and this further complicates the solution of the problem.

There is not a consensus in how to solve such situations and, therefore, there are different approaches, such as internal bleaching with sodium perborate, composite resin/ceramic veneers or even a full crown, the latter being a much more invasive treatment.

In teeth with endodontic treatment, an intracanal retainer is advised,[6] as there is the loss of the mechanoreceptors present in the pulp tissue, leaving only the receptors from the periodontal ligament, resulting in changes of the excitability threshold. Thus, the tooth can endure greater occlusal loads than when it was pulped[7], because the person can bite harder on an endodontically treated tooth than in a vital tooth.

The present article reports the direct restoration of a fractured and darkened central incisor, approaching strategies for the control of opacity and translucency in direct veneers with composite resins. For this, a brief review of optical concepts such as hue, chroma and value (translucency and opacity) will be carried out in order to understand the stratification used. Hue is defined as the group of colors in the spectrum of visible light, for example: green, blue, yellow, red, etc. In composite resins, it is identified by the initials A (brown), B (yellow + brown), C (gray + brown) and D (red + brown). Chroma, or saturation, represents the color intensity (light blue/dark blue); in composite resins, it is identified by numbers from 1 to 7, indicating saturation in a growing way.[8] Value, or luminosity, represents the ability of the object to reflect or absorb light; thus, the higher the value of the material, the opaquer and whiter the object will be, and the greater the ability to block and reflect light falling on it. In the same way, the inverse occurs: when the object has a low value, it is more translucent, allowing greater light passing and getting grayer. In the resins, it is identified by the initials after the saturation number, as follows: opaque resins [D (dentin), B (body)] and translucent resins or enamel [E (enamel)]. Some manufacturers do not identify brightness, presenting only hue and saturation (example: resin A2).

Thus, if there is a complaint from patients regarding the color of the restoration, they often report lighter (white) or darker (gray) tones. Based on the review of the previously mentioned concepts, it is easy to identify that the mistake may not have occurred in the choice of hue or chroma/saturation, but in the control of luminosity. In order words, the thickness of the opaque resin layer may have become bigger than necessary, leaving the restoration whitish or grayer if there is an excess of translucent resins.

CASE REPORT

A female patient referred to the clinic of the Specialization Course in Operative Dentistry at Faculty ILAPEO, in Curitiba, with a fracture in the

restoration of element #21 at cervical level (Fig 1). After the clinical and radiographic examination of the tooth structure and detailed anamnesis, a substrate color change and absence of an intra-radicular reinforcement pin was verified. In order to have sufficient structure to perform a direct restoration, the proposed treatment plan was the intra-radicular insertion of a glass fiber pin and a stratified restoration with composite resins. As an emergency, only a provisional restoration was performed (Fig 2).

In a second operation, a glass fiber pin was cemented in the intra-radicular channel, according to the manufacturer's recommendations (Fig 3). Then the remaining preparation for making a direct facet was carried out with the aid of an inverted cone diamond bur of rounded tip (Ref. 4138, KG Sorensen, Brazil) (Fig 4).

Figure 1: Initial case, with old restoration fracture at cervical level, in which a slight darkening of the remnant can be observed.

Figure 2: Temporary restoration with composite resin after checking pulp and periodontal normality.

Figure 3: Installation of a glass fiber pin (Whitepost DC, FGM), which better distributes incident occlusal forces on this tooth, thereby increasing the retention of the restoration.

Figure 4: Removal of the old dental restoration and the remaining's preparation for a direct veneer in composite resin with a diamond bur# 4138 (KG Sorensen).

After the modified rubber dam insulation, the enamel and dentin structures were etched with 37% phosphoric acid, and then hybridized with a conventional single bottle adhesive system. To start the stratification, a highly translucent resin layer was used to build the palatal base (Opallis TN, FGM) (Fig 5). Next, the restoration body was made with the opaque dentin resins inserted in one layer with two different saturations, with the most saturated on the cervical (Opallis DA1) to the middle third, and the least saturated hue (Opallis Bleach D) from the middle to the incisal third. In this last third, grooves were made to reproduce the mamelons present in natural tooth dentin (Fig 6).

In the incisal edge, a dentin resin layer (D Bleach Opallis) approximately 1 mm thick was inserted to reproduce the opaque incisal halo (Fig 7). In natural teeth, this halo is formed by the meeting of vestibular enamel prisms with those of the palatal surface, which give the visual perception of a white line in the region. Among the mamelons, a translucent resin was applied (Opallis TY) to copy the incisal opalescence (Fig 8). Like the dentin layer, the translucent resin layer corresponding to the enamel was made with different saturations: Opallis E-A1 in the cervical third-A1, Opallis E-B1 in the middle third and Opallis E-Bleach L in the incisal third. The result of these saturations' interaction can be seen in Figure 9. In the incisal third and interproximal areas, due to the large amount of enamel and high translucency, a thin layer of transparent resin (Opallis VH), also called achromatic, was inserted to enhance the passage of light in this region and to allow greater realism (Fig 10).

Figure 5: First highly translucent composite resin layer inserted in the palatal region to reproduce the outer contour of the tooth (TN Opallis, FGM) and insertion an opaque resin (D Bleach Opallis) at the interface between the tooth and restoration.

Figure 6: Second layer of the restoration with the incisal and middle thirds (Opallis Bleach D) less saturated than the cervical third (Opallis DA1). Watch the making of incisal mamelons in this restoration step.

Figure 7: Third layer of the restoration with a whitish effect resin (D Bleach Opallis) to reproduce the opaque incisal halo present in natural teeth, particularly in younger patients.

Figure 8: Fourth layer of the restoration with a translucent resin (Opallis TY) to copy that region's opalescence.

Figure 9: Fifth layer of the restoration with translucent resins of different shades from the cervical to the incisal third (Opallis E-A1; E-B1; E- Bleach L), to manufacture the buccal surface.

Figure 10: Sixth layer of the restoration (Opallis VH) inserted only in the incisal and proximal regions of the teeth to be restored: serves to increase the translucency of the region simulating the characteristic of natural vitreous enamel.

The result, especially color wise, shall never be evaluated immediately after the restoration is complete, as adjacent teeth are dehydrated and opaquer than the natural one. It is always recommended to wait at least twice as much as the restoration time to make such evaluation. In this case, specifically, when evaluating the restoration color after the recommended time, it was observed that it was less bright than the adjacent teeth, that is, it was grayer, more translucent (Fig 11). An alternative to correct this is to change the amount or thickness of opaque and translucent materials used in the restoration. If the idea is to increase opacity, what we have to do is to remove the layers of translucent resins, add opaquer resin and redo the enamel portion of the restoration. However, when we simply opt for this restorative protocol, we often lack sufficient space to make a thicker opaque layer and to accommodate the subsequent translucent resins. Thus, there are two options that can be performed: 1) increase the space for restoration, i.e., wear the tooth more; or 2) use a material of high opacity and little thickness. In order to preserve as much tooth as possible, the proposed treatment to correct the color of the restoration was the second option.

The used protocol for repairs on composite resin was: 1) wear of the resin with a thick diamond bur (Fig 12); 2) sandblasting with aluminum oxide 50mm; 3) etching with phosphoric acid for 15s; 4) application of silane for one minute and air-jet evaporation, sequentially; 5) adhesive system application and solvent evaporation; and 6) restoration.

Figure 11: Result after rehydration of the restored tooth and adjacent teeth. The grayer shade indicates the need for a repair to increase the restoration opacity.

Figure 12: Removal of the superficial layers of translucent resins, in a casing preparation type without removing the incisal edge.

The material, high in opacity and low in thickness, used soon after the adhesive was a liquid opacifier (Monopaque 110, Ivoclar Vivadent AG, Schaan, Liechtenstein) (Figs 13 and 14). Then, the dentin, enamel and transparent resin layers were applied to complete the restoration (Figs 15 and 16).

The finishing procedures were initially performed with the removal of cervical excess with a scalpel blade # 12 (Feather, Japan) (Fig 17); a very fine sandpaper for interproximal finish (Epitex Salmon, GC, Japan) (Fig 18); and a coarse abrasive disc for the restoration contour finishing. In this step, it was possible to adjust the external shape and also to properly define the reflection and light leakage areas, increasing or decreasing the mirror area of the restored tooth, according to the tooth on the side (Figs 19 and 22) .

Figure 13 and 14: Insertion of a liquid opacifier (Monopaque 110, Ivoclar Vivadent) to increase opacity: it is observed that the thin layer is placed over the grayer areas only and should not be an extremely uniform layer.

Figure 15: Dentin resin layer, in the same initially selected color, but without the mamelons' delimitation, so that the previous layer of opacifier does not show.

Figure 16: Layer of enamel and transparent resins to finish the restoration.

Figure 17: Removal of the cervical composite resin excess with a # 12 scalpel blade (Feather).

Figure 18: Interproximal finish with an extra – fine abrasive sandpaper (salmon Epitex – CG).

Figure 19 and 20: Marking of tooth mirror and restoration areas with black graphite, and verification of symmetry with the help of a dry-point compass.

Further, reproduction of perikymata and vertical development grooves was performed using surface texturing with coarse (Ref. KG Sorensen 3195) and fine (Ref. KG 3195F Sorensen) diamond burs mounted in a multiplier contra-angle (WE-99 LED G, W & H). (Figs 23-25). The finishing was then performed with a medium abrasive disc to leave the surface smoother and less rough. (Fig 26) Initial polishing was made with an extra fine abrasive disc (Fig 27) and finally, a felt disc with a polishing paste to obtain the final glaze of the restoration (Fig 28).

Figure 21: Adjust of mirror areas with a coarse abrasive disc (Diamond Pro – FGM).

Figure 22: Symmetry between the lines that make up the tooth mirror and restoration areas.

Figure 23 and 24: Surface texturing with a multiplier contra-angle (WE-99 LED G, W & H) and the diamond burs (Ref. 3195 and 3195F, KG Sorensen).

Figure 25: Result after the making of horizontal lines to simulate perikymata and vertical lines for the developmental grooves.

Figure 26 and 27: Restoration polishing with abrasive discs of medium and fine granulations (Diamond Pro, FGM).

Figure 28: Restoration polishing with a felt disc (Diamond Flex, FGM) and an aluminum oxide based polishing paste (Diamond ACII, FGM).

The immediate final result can be seen in Figures 29 to 32 and, after two months of follow-up, in Figures 33 to 37.

Figure 29 to 32: Immediate results.

Figure 33 to 37: Extremely satisfactory final result after two months follow-up.

CONCLUSIONS

The direct restorative treatment with composite resins, when properly indicated and performed correctly, is an excellent alternative in situations of darkened tooth fractures, since it reestablishes the harmony between function and aesthetics, meeting the patient's expectations and increasing their self-esteem, besides being a more conservative treatment option in relation to indirect restorative procedures.

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