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A Conservative Technique for Repairing Class IV Composite Restorations

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Clinical Relevance

The repair of the facial surface of a class IV composite restoration with poor coloration is a minimally invasive treatment that allows satisfactory restoration of esthetics and function.

SUMMARY

Composite resin may make a restoration noticeable as time passes, on account of its color instability. The repair technique is a minimally invasive treatment for class IV composite resin restorations that show unsatisfactory coloration. Thus, the objective of the present article was to report a clinical case involving a conservative technique used for repairing a class IV composite resin restoration in the left maxillary central incisor and the replacement of a class IV restoration in the right maxillary central incisor.

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INTRODUCTION

Restorative treatment with composite resin in a fractured anterior tooth is generally considered successful when there is optical integration between the tooth structure and the restoration. In this context, the concept of natural stratification proposes the combination of optical properties from different resin layers, with the objective of mimicking the natural color and translucency of dental tissues without needing a bevel.[1-4] Nevertheless, there are still difficulties in mimicking remaining tooth restorations in fractured anterior teeth using composite resin stratification. This difficulty occurs because of the variety of currently available shades, chroma, and translucency levels of composite resin. Hence, it is necessary to have a professional, detailed perception of natural optical tooth characteristics and knowledge of the optical behavior of the composite resin used to reproduce the restorations.

In addition, the color instability of composite resin[5-7] can make the restoration noticeable over time. Therefore, when an anterior composite resin restoration is considered clinically unacceptable, a decision should be made whether the best option is to repair or replace the entire restoration. Generally, replacement is the treatment of choice, mainly in situations of color incompatibility between the tooth and the restoration. The repeated replacement of the

Figure 1. *Initial aspects of the patient's smile. Note the unsatisfactory color of the class IV restorations in the two maxillary central incisors.*
Figure 2. *Intraoral view of maxillary anterior teeth.*
Figure 3. *Palatal view of maxillary anterior teeth. Observe that the palatal surface of the restoration in tooth No. 9 has adequate marginal adaptation, unlike the restoration in tooth No. 8.*

same restoration causes wear of sound tooth structure, leading to the need for more extensive restoration, injuries to the dentin-pulp complex, or fractured tooth remnants.

Repair of a restoration is a conservative treatment, entailing the addition of restorative material after the preparation of the aged restoration.[8] Such a procedure favors restoration longevity and preserves healthy tooth structure.[9,10] There is growing scientific support in the literature for the repair of direct composite resin restorations.[8-16] A clinical study found that composite resin restorations in posterior teeth showed a clinical survival of 10 years after the repair procedure.[16] Opdam and others[10] reported that the repair of composite resin restorations in posterior teeth had a failure rate of only 5.7% four years after clinical evaluation.

This technique can be an alternative to treating aged class IV composite resin restorations with unsatisfactory color, in which the original color and composition of the materials are unknown. A prerequisite for performing this technique is having optimal marginal fit on the palatal surface. Furthermore, the repair may be performed in cases of a fractured anterior tooth, where the restoration is initially performed with a composite resin corresponding to the basic color of the remaining tooth structure and without stratification. In the following session, the preparation of the facial surface is performed, and the repair with composite resin is stratified to reproduce the opalescent effect and enamel.

With this in mind, this article reports on a clinical case in which a conservative technique was used for repairing a class IV composite resin restoration in the left maxillary central incisor and a replacement was made of a Class IV restoration in the right maxillary central incisor.

CASE REPORT

A 22-year-old patient came to the Federal University of Santa Catarina dissatisfied with the color of 2 class IV composite resin restorations, one in the right maxillary central incisor (No. 8) and the other in the left maxillary central incisor (No. 9; Figures 1 and 2). The radiographic examination showed that the patient's teeth had normal periapical and periodontal tissues. During the clinical examination, teeth Nos. 8 and 9 showed pulp vitality. The palatal surface of the restoration in tooth No. 8 was discontinuous, featuring marginal leakage. The restoration on the palatal surface of tooth No. 9 was complete and had adequate marginal adaptation (Figure 3). The replacement of class IV restoration in tooth No. 8 and the restoration repair in tooth No. 9 were proposed to the patient.

Prophylaxis was initiated in the restoration region with a nylon brush and prophylactic paste, followed by color selection. The restoration in tooth No. 8 was removed, and an elastomeric impression of the upper and lower jaw of the patient was taken (Express XT, 3M ESPE, St Paul, MN, USA) to make diagnostic wax-ups of tooth No. 8. A tapered diamond bur (2135 F, KG Sorensen, São Paulo, SP, Brazil) was used to

Figure 4. *Restoration in tooth No. 8 removed and preparation of the facial surface of the restoration in tooth No. 9 with a tapered diamond bur.*
Figure 5. *Aspect of the prepared facial surface of the restoration.*
Figure 6. *Lateral view of the silicone guide in position. Note that the space for insertion of the composite resin is 0.7 mm.*
Figure 7. *Design of the dentin mamelons with a sharp-ended diamond bur.*

Figure 8. *Intraoral view of the palatal enamel on tooth No. 8 and the preparation of tooth No. 9 after adhesive procedures.*

remove the restoration in tooth No. 8 and to prepare the facial surface of the restoration in tooth No. 9 (Figure 4). The preparation was conducted to provide space for the composite resin stratification, across the entire facial surface of the restoration, respecting the inclination of the mesial and incisal thirds. In addition, the mesial surface was prepared to create space for insertion of proximal artificial enamel (Figures 5 and 6). A design of the mamelons was made in the incisal region, using a sharp-ended diamond bur (2137F, KG Sorensen), to obtain space for the reproduction of an opaque and opalescent halo (Figure 7). Afterward, a mock-up was conducted to verify the correct composite resin color selection and was left for 1 week as a temporary restoration.

During the next session, the operative field was isolated with a rubber dam, the surface of the old resin was sandblasted with aluminum oxide (50 μm, MicroJet Gold Line, Essence Dental VH, Araraquara, São Paulo, Brazil), and the enamel and resin were etched with phosphoric acid at 37% for 30 seconds (PowerEtching, BM4, Palhoça, SC, Brazil, Table 1). Afterward, silane was applied (Monobond Plus, Ivoclar Vivadent, Schaan, Liechtenstein) using a disposable brush (Microbrush, Coltène/Whaledent, Altstatten, Switzerland). The silane was gently air dried for 60 seconds. Adhesive was applied (Scotchbond Universal, 3M ESPE) with a disposable brush (Microbrush, Coltène/Whaledent). Care was taken to ensure adequate solvent evaporation prior to light curing (20 seconds), which was conducted using a light-emitting diode-based light-curing unit (Translux, Hereaus Kulzer, Hanau, Germany, intensity of 800 mW/cm^2).

The stratification of the composite resin on tooth No. 8 included high translucent resin EB1 (IPS Empress Direct, Ivoclar Vivadent) to reproduce the palatal enamel, using a silicone guide obtained from

Figure 9. *Aspect of the upper arch after the restoration is finished and polished.*
Figure 10. *Palatal view of the finalized restorations.*
Figure 11. *Patient's smile after restorative treatment.*

the waxing (Figure 8). The incisal halo was reproduced with low translucent resin DB1 (IPS Empress Direct, Ivoclar Vivadent). Low translucent resin DA1 (IPS Empress Direct, Ivoclar Vivadent) was used to reproduce mesial thirds dentin, and low translucent resin DB1 (IPS Empress Direct, Ivoclar Vivadent) was used to reproduce incisal third dentin and dentin mamelons. A translucent resin was used (Trans 30, IPS Empress Direct, Ivoclar Vivadent) to reproduce the opalescent halo, which was lightly applied to the dentin mamelons. The facial enamel was finished with a thin layer of high translucent resin EB1 (IPS Empress Direct, Ivoclar Vivadent). The restoration in tooth No. 9 was performed with

Table 1: *Materials Used For the Patient Treatment*

PowerBleaching 16%	BM4, Florianópolis, SC, Brazil
PowerEtching 37%	BM4, Florianópolis, SC, Brazil
Monobond Plus	Ivoclar Vivadent, Schaan, Liechtenstein
Scotchbond Universal	3M ESPE, St. Paul, MN, USA
IPS Empress Direct (composite resins)	Ivoclar Vivadent, Schaan, Liechtenstein
Finishing strips	3M ESPE, St. Paul, MN, USA
Sof-Lex (polishing discs)	3M ESPE, St. Paul, MN, USA
Diamond Excel (polishing paste)	FGM, Joinville, SC, Brazil
Diamond Flex (felt disc)	FGM, Joinville, SC, Brazil

low translucent resin DB1 (IPS Empress Direct, Ivoclar Vivadent), in order to reproduce the dentin body, and a translucent resin (Trans 30, IPS Empress Direct, Ivoclar Vivadent), to reproduce an opalescent halo. The facial enamel was reproduced with a thin layer of high translucent resin EB1 (IPS Empress Direct, Ivoclar Vivadent). Coarse removal of excess material from both restorations was done with a No. 12 sharp curved blade (Feather, Osaka, Japan).

In the next session, the finishing and polishing procedure was initiated with abrasive strips (3M ESPE) on the proximal surfaces. The facial surfaces were finished with sequential polishing discs of decreasing grit size (Sof-Lex Pop On, 3M ESPE). A carbide bur (FG 7664F, KG Sorensen) was used to remove excess resin from the preparation margin and to reproduce vertical texture. A felt disc (Diamond Felt Disc, FGM, Joinville, SC, Brazil) with diamond polishing paste (Diamond Excel, FGM; Figures 9-11) was used to perform the final polishing.

Potential Problems

When assessing the three color dimensions, value is what most influences natural tooth appearance, followed by chroma and shade.[17-19] Greater translucency of artificial dentin can decrease the restoration value and make the restoration more noticeable than an error in shade selection.[4] In the case presented, the facial preparation depth of 0.7 mm on tooth No. 9 provided adequate space for insertion of dentin resins, opalescent effect, and facial enamel. This depth was necessary since the color of the aged composite resin was incompatible with the remaining tooth structure. Thus, the thickness of the artificial dentin provided adequate opacity without interfering with the restoration value.

In the clinical cases in which the professional restores a fractured tooth in its basic color and carries out the repair in another session, the reduction of the facial surface can be slight without requiring a chamfer at the adhesive interface. It is important to highlight that the thickness of the high translucent resin, corresponding to the enamel, must be smaller compared with the natural enamel in order to prevent a decrease in restoration value.[20] The repair technique for the class IV composite resin restoration may also be a conservative alternative in cases of permanent restorations that remain noticeable after treatment, due to errors in color selection. Once the facial surface has been repaired, the color can then be corrected, resulting in reduced clinical time and preservation of sound dental structure in comparison with replacement.

It is important to note that a restorative mock-up should be performed whenever possible to ensure greater outcome predictability, since the composite resin color changes during polymerization, as well as 24 and 48 hours after polymerization.[5]

With regard to the surface treatment of the aged resin, studies report that the most favorable results were obtained with the roughening and application of a silane agent. The roughening procedure can be performed using diamond burs, sandblasting with aluminum oxide, or applying a tribochemical silica coating. This creates irregularities on the surface of the aged resin, which increases the contact area for micromechanical retention of the adhesive and for chemical adhesion with the new composite resin.[8,21-23] In the case presented, the surface treatment was sandblasted with aluminum oxide (50 μm), enamel and resin were acid-etched, and silane and adhesive were applied.[24]

In this clinical case, the replacement of the class IV restoration in tooth No. 8 was necessary because of the presence of a defect in the interface between the palatal surface and the restoration. This condition contraindicates facial surface repair because of possible early restoration failure. The restoration in tooth No. 9 could be repaired because of the optimal marginal adaptation of the palatal surface. However, the final esthetic result between the repaired restoration and the replaced restoration was similar, and both were satisfactory.

Advantages

- Greater preservation of sound tooth structure
- Decreased chance of pulp injury
- Increased restoration longevity
- Does not require anesthesia
- Less clinical procedure time
- Lower treatment cost for the patient
- Good acceptability by the patient

Limitations

- Color difference between the restoration and the tooth, because of the difficulty in color selection and layering of the composite resin

CONCLUSIONS

- The esthetic result of the new technique for repairing the facial surface of a class IV composite resin restoration is similar to that obtained by replacing the restoration.
- The repair of a class IV composite resin restoration with unsatisfactory color is a viable alternative treatment that preserves sound tooth structure, restoring function and esthetics satisfactorily.

Conflict of Interest

The authors have no proprietary, financial, or other personal interest of any nature or kind in any product, service, and/or company that is presented in this article.

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