

A Predictable Way for Function and Aesthetic Direct Restoration in Anterior Teeth-A Case Report

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Abstract: *Currently, one of the choices of treatment are the direct adhesive restorations with light curing composites. By improving the performance and the probability of survival of direct adhesive restorations, numerous studies have been performed in dental scientific literature. Today's direct adhesive restorations allow replacing moderate loss of tooth structure. This has resulted in considerable improvements in medico-biological and socio-economical aspect, as these newer adhesive materials are more conservative and give a perfect esthetic result. Both the enamel and dentin have intrinsic physical and optical properties. Dentin is approximately 20% more opaque than enamel, providing most of the tooth's true color. Enamel acts like a fiber optic layer that adjusts the perception of the underlying dentin color. The qualities of contemporary adhesive light curing materials provide an opportunity for a good biomimetic restoration even at high aesthetic requirements in the front area. Aesthetic results and the average longevity of restorations in anterior teeth are in high correlation with the quality of marginal adaptation. The aim of this case report is to describe step by step the clinical protocol of the restoration process in anterior teeth. Also to discuss the importance of a predictable and reproducible way for functional and aesthetic outcome and last but not least – to show the management and importance of marginal adaptation.*

Keywords: aesthetic, anterior teeth, composite, direct restoration, finishing

1. Introduction

The contemporary challenge in dental practice is to restore teeth by biomimetic concept with all characteristics of natural appearance. The biomimetic concept helps for better perception of natural structures. The natural tooth is polychromatic and a large number of colors and optical characteristics can be perceived when it is observed under ideal light conditions. Color is defined in physics as the result of the interaction of light with an object [13].

The aesthetic quality of a restoration is linked to its capacity to simulate the natural visual characteristics of the dental structure regarding enamel and dentin. It is well accepted that the color of a tooth is mainly determined by its dentin component [10]. Dentin has a higher opacity and chroma than enamel. The value in a tooth is mostly imparted by the enamel, which interferes with the color of dentin, making it less saturated (with less chroma). The result of applying a clear and translucent enamel-like composite material over a saturated and opaque dentin-like composite material has been described as a “double-effect layer” [10].

2. Case Report

A 52-year-old female was referred for aesthetic treatment of central incisors with unsatisfactory old restorations (Fig.1). The patient's desire was to improve the aesthetics of the frontal teeth and to restore the incisor edges with conservative restorative treatment option. Clinical examination revealed that tooth 11 had suffered a large

Class IV restoration that has fractured 6 years ago, enamel chipping from tooth 21 and worn dentition-Ist stage which has affected both anterior and posterior teeth. The fracture line extended into the dentin but did not involve the pulp. An intraoral examination showed that the oral hygiene was good and carieses were absent.

Preparation of teeth structures

Accurate shade selection is a critical step when placing anterior composite materials. A preoperative color map was made. It is very important that the operator becomes familiarized with the composites available. The selection of the color should precede the restorative process and isolation with rubber dam, when the teeth are still hydrated. The chromatic chart is very useful in composite placement protocol. Photographs were taken before the restorative process start. A mock up was made which involved correction of the incisal edges and a silicon index was taken from the palatal side of the teeth (Fig.2). The teeth were anesthetized with 2% Articaine with 1: 100 000 epinephrine (Septanest, Septodont). A diamond bur for microinvasive treatment was used to remove the old composite material close to the natural structures. This microinvasive diamond bur with red ring (30-40µm) was used also for the preparation of scalloped 1.5mm 45° bevel in the enamel. The beveled margins were finished with a coarse-grit disk - Soflex with 50µm (#2381C-3M, ESPE)(Fig.3). This preparation design would allow a wide enamel surface for adhesive procedure, as well as to attain an imperceptible marginal adaptation.



Figure 1: Preoperative view showing the color disharmony and the lack of incisal part of the frontal teeth.



Figure 2: Silicone index taken from the mock-up



Figure 3: Finishing of the beveled margins with a coarse-grit disk.

Composite technique placement

After the isolation with rubber dam the prepared teeth structures are etched with 37% phosphoric acid (Fig.4). The etching gel was applied to the dentin for 15 seconds and 20 seconds for enamel. Then the gel was rinsed off and the enamel and dentin were blown dry with air (Fig.5). A desensitizing agent was used as a second step (Telio CS Desensitizer, Ivoclar Vivadent, Liechtenstein) for re-wetting the collapsed collagen fibers for 10 seconds after the etching process and preservation from postoperative pain (Fig.6). The glutaraldehyde achieves its effects by precipitation of plasma proteins, which reduces dentinal permeability and occludes the dentin tubules. Layer of 5th-generation adhesive agent (Excite F, Ivoclar Vivadent, Liechtenstein) was applied and gently brushed for 10 seconds (Fig.7). It was light-cured for 10 seconds with a high intensity LED curing light (BluePhase Style, Ivoclar Vivadent, Liechtenstein) at intensity of 1100 mW/cm². For the restoring of these teeth Empress Direct (Ivoclar Vivadent, Liechtenstein) composite was used. With the help of the silicon index, a thin layer of enamel composite was placed (Fig.8) and a thin layer flowable composite was applied on the bonded teeth structures (Fig.9). The simultaneous polymerization of flow composite and thin layer into silicon index created a predictable palatal shell which acted as a three-dimensional framework. Highly translucent enamel

allows light to be transmitted through it to reach a deeper, more opaque dentin. By placing the first palatal layer from enamel composite we are imitating these natural properties of natural dental tissues. The mesial contact point was created by Bioclear (Fig.10) matrix system, which provided an appropriate approximal outline form and correct position of the contact point. The next step is to use an opaque dentin material to create the core of the tooth 11 (Fig.11) and a very small amount for the tooth 21. The opaque material was used to create internal mammelons (Fig.12). An enamel layer was applied and the final layer was from the composite material with opal properties (Fig.13). The glycerin gel (Liquid strip, Ivoclar Vivadent, Liechtenstein) was used to reduce oxygen inhibited layer after final polymerization (Fig.14).

Finishing & Polishing protocol

The occlusion was checked as the first step of finishing protocol. There were no premature contacts because of the silicon index usage which created a predictable and reproducible palatal surface. A medium-grit bur was used to form the primary anatomy (Fig.15). After that a medium finishing disc was used (Fig.16). To mimic the tertiary anatomy a coarse diamond bur was used to simulate the perikymata (Fig.17).



Figure 4: Etching of the frontal incisors



Figure 5: Rinsing the etching gel and drying the teeth.



Figure 6: Applying the desensitizing agent.



Figure 7: Applying the bonding agent.



Figure 8: Forming the palatal shell wall on the silicone index.



Figure 9: Applying a flowable composite material at the palatal side



Figure 10. Using two Bioclear matrices in order to form the approximal contact.



Figure 11: Usage of the opaque dentin mass



Figure 12. Creation of internal mammelons and final layer of enamel composite mass



Figure 13: Applying a glycerin gel in order to reduce the oxygen inhibited



Figure 14: Usage of a medium grit bur to create the primary anatomy.



Figure 15: Finishing with medium size coarse disk (3M ESPE).



Figure 16: Polishing with Sof-Lex Spiral finishing wheel (3M ESPE).



Figure 17: Polishing with Sof-Lex Spiral polishing wheel (3M ESPE).



Figure 18: The final polishing with buff disc (Shofu).

Finishing was done in a dry field with a light touch, which allows a better visualization of shape and contour of the final composite resin surface (Fig.18). Interproximal finishing and polishing was accomplished with gapped finishing and polishing metalstrips covered with submicron diamond particles (*Komet, Brasseler*). The best technique for final shaping the incisal edge is to have the patient seated in an upright position that mimics how the incisal edges are visualized, although silicon index.

3. Discussion

The direct restoration of Class IV defects with composite material represents a challenge for all clinicians. These restorations require knowledge of the structures and materials, attention to detail and artistic skills [6]. To restore the teeth with a vital appearance it is very important to select the appropriate materials which correspond with the natural layers of the teeth - the inner dentin layer, the outer dentin layer, the enamel layer and the surface layer. Nanofilled composites display opacity similar to that of natural enamel and dentin, with translucency similar to that of enamel [8,16]. Based on these characteristics, the material of choice was nanofilled composite-Empress Direct (Ivoclar Vivadent, Liechtenstein). The combination of aesthetic expectation of the patient and the desire for a conservative treatment by the dentist resulted in the implementation of different clinical protocols [1,17]. The restorative dentistry currently

recommends minimally invasive procedures. These procedures should prevent the unnecessary removal of healthy sound tooth structure during the preparation procedure [2,4,5]. The nature of tooth structure and color are both critical elements in the process of the replacement procedure of both natural structure and aesthetics. Before starting the clinical process of restoration, some important factors such as the extent of translucency of enamel and opacity of the dentin should be considered. These characteristics based on the nature vary in the factors such as enamel thickness and age in addition to other applied factors such as tooth bleaching. These variations alter the perception of the underlying dentin color, its chroma-colorfulness and value-brightness. This creates the appearance of an enamel of lower color value (less luminous tone). More opaque or cloudy enamel serves as a barrier that disperses, absorbs, and reflects light so a minimal amount of color is perceived, creating an enamel of higher and brighter color value [6]. The restorative process of predictable management of palatal wall has shown favorable results compared to indirect restorations [7, 14, 18].

In contemporary dental practice the clinicians are responsible for restoring realistic restorations that mimic the existing natural tooth structures. A precise finishing and polishing protocol further allows the clinician to seal the restoration and maintain natural surface luster and contour, which are of great importance for correct perception of

restorations [12]. The principles governing the polishing of composite resins are similar to those of dental metals. Similar to metal polishing, the sequence of polishing for composite resin progresses from the coarsest abrasive to the smoothest. The finishing and polishing movements should be from the composite to the enamel because the opposite is forming the visible white line.

The goal for placement of any composite resin is minimal finishing and polishing. The choice of finishing bur and diamond abrasive is usually a decision made by the practitioner based upon his or her ability to control the instrument without notching the restoration. Diamond composite finishers usually have diamond particle sizes of approximately 30-40 microns for fine grit, 15 microns for extra-fine grit and 8 microns for ultra-fine grit. The gloss of the composite resin contributes to the overall aesthetic appearance of the restoration, as in the presented clinical case. It is possible that even following all the recommendations for finishing and polishing composite resins to their highest luster, that outside influences can have deleterious effects on the smooth composite surface. Because of these potential adverse effects, composite resin restorations need to be reassessed for repolishing at every recall. Oral maintenance of restorations and oral health can also have an impact on the appearance of composite resins.

4. Conclusion

The clinical performance of this restorative process showed favorable results and also the technique for predictable position of palatal wall which achieves a satisfactory final aesthetic outcome. The biomimetic concept provides a preservation of sound dental tissues and gives high aesthetic results in clinical practice.

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