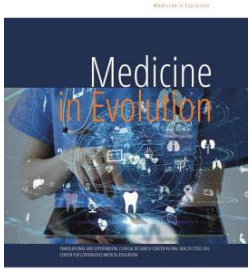
Biomimetic Restorations for Dental Aesthetics - Case Report



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Abstract

In the field of dental aesthetics, we aim to obtain restorations that imitate natural teeth. Using the right materials and technique is thus very important.

Aim and objectives: to explore and evaluate the potential of biomimicry in direct aesthetic restoration of anterior teeth.

Materials and methods: The direct restorations were realized with a nanohybrid composite resin- Filtek Ultimate (3M ESPE), using the celluloid strip technique.

Results: The direct restoration of teeth affected by enamel fractures was successful, highlighting an aesthetic and natural appearance.

Conclusions: Simplification and predictability are the key directions in the continuous improvement of the quality of direct restorations for tooth enamel fractures.

Keywords: Aesthetics, biomimetic restoration, composite resins, predictability

INTRODUCTION

Direct and conservative aesthetic restoration of anterior teeth is a common procedure in dental practice. According to the biomimetic principle, when there is a localized lack of tooth substance, adhesive ceramic restorations are not necessarily needed. Instead, we can opt for the use of direct composite resins.

Given the constant evolution in the field of dental materials science, a significant development of esthetic restorative materials has been observed. One of these materials is represented by resin-based composites (RBC), which offer both improved aesthetic and physical properties.

An ideal restorative material must have properties similar to dental tissues. Resistance is an important aspect, the material must withstand masticatory forces, wear (attrition and abrasion) and chemical insults (erosion), ensuring thermal insulation of vital dental tissues against thermal variations. In terms of aesthetics, the material must match the shade, translucency and natural texture of the surrounding teeth. It must also present permanent adhesion to the dental structure, be easy to apply and manipulate, being able to initiate the process of repair or regeneration of damaged or missing tissues.

Currently, resin-based composites (RBC) are the most widely used aesthetic restorative materials, due to their universal use, minimization of tooth structure loss, and the possibility of direct application, without the need for additional laboratory procedures. Advances in resin-based materials and application techniques have resulted in almost complete fulfillment of the ideal criteria for a restorative material.

But besides the material used, the technique is also very important for the predictability of the restoration. One can use either silicone index technique, which is very predictable, or celluloid strip technique or even free hand technique, if the practitioner is very skilled.

Aim and objectives

The aim of this paper was to explore and evaluate the potential of biomimicry of composite resins, for the esthetic restoration of anterior teeth. The study aimed to identify first the specific characteristics of natural teeth and translate them into restorations that are as close as possible to natural appearance and functionality.

The study also aimed to improve the quality of aesthetic dental treatments through the applicability of biomimicry principles regarding the development and use of composite resins.

MATERIAL AND METHODS

The patient (female, 18y) came into dental office with the request of improving smile aesthetics. Her major complaint was represented by the enamel fractures (incisal angle) at the level of maxillary front teeth (dental trauma by falling).

The aesthetic diagnosis was: dental disharmony of shape and position with class I Ellis fractures. (Fig. 1)

Figure 1. Initial aspect of smile (a) and dental composition (b)

The materials used for the aesthetic restoration of upper frontals were:

- Filtek Ultimate (3M ESPE) - nanohybrid composite resin
- Enamel acid and bonding resin (3M ESPE)
- LM Arte restoration kit (LM Instruments)
- Diatech ShapeGuard polishing set (Coltene), polishing paste and brush.

The method used for direct restoration was the celluloid strip technique.

The restoration protocol included the following: color analysis, enamel beveling, adhesion steps, composite resin stratification, finishing and polishing of the restoration.

Color analysis was realized in 2 steps: basic color determination with Vitapan Classical Shade Guide and drawing of chromatic map (Fig. 2 a, b).

Figure 2. Color analysis: a. determination of basic color; b. drawing of chromatic map

After beveling the enamel - classic straight bevel (fig.3.a), the stages of adhesive substrate followed (fig.3.b).

Figure 3. a. Classic straight enamel bevel; b. Enamel etching

Then we moved on to the layering of the composite resin (fig.4), using celluloid strip technique.

Figure 4. a, b Composite resin stratification with celluloid strip technique

The protocol of finishing and polishing the restoration was realized with Diatech ShapeGuard polishing set (Coltene), polishing paste and brush (fig.5).

Figure 5. a, b Aspects of restoration polishing

RESULTS

The use of resin composite in the restoration of anterior teeth requires precise technique and advanced skills to achieve aesthetically satisfactory and durable results.

The results obtained following the aesthetic restoration of the front teeth affected by dental enamel fractures were favorable, highlighting an aesthetic and natural appearance. The patient declared herself satisfied with the result. She is going to receive an orthodontic treatment in the near future, to improve not only the aesthetics but also the function.

Figure 6. Final aspect of smile (a) and dental composition (b) at the end of treatment session

DISCUSSIONS AND CONCLUSIONS

The aesthetic restoration of the anterior upper teeth is a major concern in dentistry, because these teeth are of particular importance in the aesthetic appearance and masticatory functionality. One of the main materials used is composite resin. However, the performance of these restorations can be improved by using composites with properties similar to natural teeth through biomimicry. Biomimicry refers to inspiration from nature to develop materials or technologies that imitate natural structures. The biomimetic approach can bring significant improvements in the aesthetic restoration of anterior teeth, leading to sustainable, functional and aesthetic results.

Simplification and predictability are the key directions in the continuous improvement of the quality of direct restorations for tooth enamel fractures, providing patients with full satisfaction regarding the aesthetics and functionality of dental restorations.

The use of nanohybrids, such as 3M ESPE Nanohybrid - Filtek Ultimate, is recommended in both anterior and posterior dental restorations. These materials have demonstrated excellent handling, wear resistance, easy polishing and long-term surface gloss retention. They also adapt well to the shape of cavities and provide predictable and reliable esthetic results.

In conclusion, composite materials represent a modern and effective solution for dental restorations, with advantages such as natural aesthetics, resistance to wear and the

possibility to choose from a wide range of shades, satisfying both the needs of patients and the requirements of dentists.

The key factors for achieving success are the clinician's knowledge of the following: choice of color, dental micro- and macro-anatomy, the basics of adhesion and occlusion, the work protocol. Choosing appropriate materials and applying the correct protocols can help reduce the difficulty of the procedure and achieve predictable esthetic and functional results.

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