

Management of dental erosive using composite layering technic and biomimetic efficiency

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Abstract

In the world, in 2006, the prevalence of dental wear was 46.9% among individuals aged 14 to 88 years. According to Schlueter N and colleagues, by calculating an approximate average from available data, they estimated the average prevalence of dental erosion to be between 30 and 50% for deciduous teeth and between 20 and 45% for permanent teeth worldwide. They found that patients with gastro esophageal reflux (GERD) and eating disorders associated with vomiting had a clear impact on the prevalence of erosion. Regardless of the type of dental substance loss in the anterior sector, composite crown restoration remains the most chosen restorative therapy by dentists. Located in the anterior region, these types of dental substance losses affect aesthetics and make the smile unattractive. The individual's personality is disturbed as well as their communicative life. The objective of this article was to present the case of a patient with dental erosions in the anterior sector, managed by the composite layering technique, and to demonstrate the biomimetic efficiency of the restoration.

Keywords: Biomimetic, dental erosion, layering, direct technique

1. Introduction

Faced with dental substance loss due to decay or tooth wear, composite crown restoration remains the primary restorative therapeutic option chosen by the dentist. Dental erosion is a chemical process characterized by acid dissolution of dental hard tissue not involving acids

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of bacterial origin. Erosive demineralization can result in progressive, irreversible loss of tooth mineral substance, and may be caused by intrinsic factors like acid reflux and excessive vomiting[1]. Located in the anterior region, these types of dental substance loses diminish aesthetics and make the smile unattractive. The individual's personality is disturbed as well as their communicative life. The objective of this article was to present the case of a patient with dental erosions in the anterior sector, managed by the composite layering technique, and to identify the factors determining the biomimetic success of the restoration.

2. Observation

This concerns a 44-year-old female patient, working as a client manager, who came to consult us at the specialized Odontostomatology center in Mahajanga. Her reason for consultation was an aesthetic concern. Upon examination of her general condition, the patient appears to be in good health, except that she frequently experiences almost daily gastro esophageal reflux. In order to limit this gastric problem, the patient frequently drinks lemon juice outside of meals. On physical examination, the extra-oral examination showed the absence of palpable or painful adenopathy in the submandibular, jugular-carotid, and supraclavicular areas. The intra-oral examination of the patient's hard tissues showed the presence of blatant erosive dental substance loss on the upper right and left central incisors. The dental wear was of moderate erosive type, with a BEWE score of 2, an ACE class IV, with a yellowish background indicating dentin exposure. The extent of the involvement includes the vestibular surface, the central incisal angle, one-third of the proximal surfaces, and one-third of the palatal surface of each tooth. The percentage of hard dental tissue involvement was less than 5%. Aggravated by the patient's dietary habits, this dental erosion was observed to be actively progressing and requires immediate management to prevent further wear to other sextants. After a refined analysis of the remaining dental tissues, we opted for management by composite layering. Our therapeutic choice was motivated by the importance of adhering to the therapeutic gradient developed by Tirlet and colleagues and the biomimetic dental restoration principle presented by Pascal M and colleagues. Referring to the literature data, we adapted our therapeutic protocol according to the available technical resources. The technical setup used included a visual aid, a conservative dentistry examination tray, a mouth opener, a full-arch impression tray, type A alginate, high-viscosity silicone, a wax-up plate, a PKT-type instrument, a Heidemann® spatula, a dental wedge, some micro-applicators, a turbine, a green-band contra-angle, diamond ball burs, composite finishing burs, an etching system, an MR3-type adhesive system, a Micerium® Enamel Plus HFO enamel composite, a Micerium® Enamel Plus HRi enamel composite, a Charm Fill Plus® dentin composite in shade A3.5, a Charm Fill Plus® composite in shade A3, a celluloid matrix, composite restoration spatulas, 40µm thick articulating paper, a silicone composite finishing kit, a 12-megapixel camera. The therapeutic protocol presented was consented to by the

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patient. In addition to patient clinical observation, eight steps were developed, including pre-stratification analysis of the causative tooth, making a silicone guide key, preparing the tooth for restoration, etching, applying the adhesive system, composite placement, composite finishing, and composite polishing. Pre-stratification analysis of the teeth to be restored was performed based on the anatomical shape and color of adjacent teeth. A visual chromatic analysis was performed in the absence of a spectrophotometer. A personalized shade taking was made using the chosen composites for restoration, which helped us assess the difference in dental tissue saturation. In addition to photography, a chromatography card of the two teeth to be restored was useful in guiding us on the choice of composites to use for each tissue to be restored. Brightness, enamel and dentin color, and intensity presence were noted on our chromatographic card. For shades, the dentin body was restored with Charm Fill® composite shade A3.5 at the cervical 2/3, the incisal 1/3 part was restored by Charm Fill composite shade A3, the dentin nipple was restored by Charm Fill® composite shade A2, the enamel on the vestibular and palatal surfaces was restored by HFO type OBN® enamel composite, and characterization was restored by Enamel Plus HRi composite by Micerium®. After the patient's consent to the therapeutic proposal, an impression was taken with type A alginate followed by pouring the positive model in plaster. Modeling of the desired morphology of the teeth to be restored was performed with CERA Reus Dental® modeling wax, followed by an impression of the positive model with high-viscosity putty silicone. To obtain the silicone guide key, the hardened silicone was cut in such a way that only the palatal part was preserved. Its adaptation was checked in the mouth. Prior to composite placement, a tooth preparation step was developed by forming a vestibular chamfer limit and a palatal "butt margin". We then opted for a two-step etching and bonding system by applying 37% phosphoric acid for 15 seconds at the enamel level followed by rinsing, and bonding with CharmBond® photopolymerizable mono-component. The curing time was 30 seconds. The actual stratification began with the palatal aspect, then the proximal surfaces, the dentin body, and was finalized by the vestibular enamel. Our goal was to build walls from the restorations to transform the lack of dental substance into a simple cavity. To do this, the previously prepared silicone key was placed on the palatal side after applying the non-photo-polymerized palatal enamel composite layer with the Heidemann spatula. Photo polymerization was activated after checking the key's positioning. Then the proximal walls were restored using a matrix system such as celluloid strip. Dentin masses in different shades were applied while respecting their respective positions recorded in the chromatography card. We ensured that the composite thickness did not exceed 2mm before each photopolymerization. Part of the characterization was reproduced at the dentin nipple edge using Enamel Plus HRi® composite. Before polymerization, while respecting the surrounding tissues, the vestibular enamel layer was finally placed by tapping without

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compressing the composite. As we did not have Modeling resin[®], smoothing was done with a micro-brush soaked in adhesive. The superficial enamel composite layer was checked to ensure it covers the vestibular chamfer to mask the tooth-restoration junction, and the thickness and optical effect were verified. Primary and secondary anatomies were recreated based on adjacent teeth using diamond flame burs and round-ended cylindrical burs. After checking for occlusal discrepancies, the polishing step was performed, with decreasing grit size Pop-on discs mounted on blue-band contra-angle used. The operative procedure lasted 60 minutes for the restoration of each tooth. Biomimetic effectiveness was assessed after 24 hours of composite restoration rehydration and then after twenty-nine months of restoration. Simultaneously, the patient was advised to discontinue acidic dietary habits. Dietary hygiene education was provided to the patient. For the management of gastro esophageal reflux, she was referred to a gastroenterologist.

3. Results

After twenty-four hours of restoration, the tooth was checked, and rehydration was achieved, comparing it with the adjacent natural tooth considered as reference (figure 11). After 29 months of tooth restoration, we found that the biomimetic efficiency obtained was maintained, and we concluded that the ultra-conservative approach and the composite layering principle were effective and sustainable for our clinical case (figure 12).



Figure 1
Dental erosive in 11 and 21

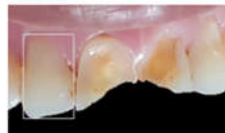


Figure 2
Choice of reference tooth

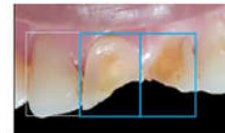


Figure 3
delimitation of the contour line
in 11 et 21

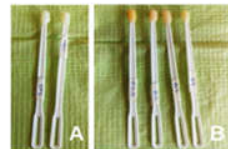


Figure 4
Personalized shade
guide

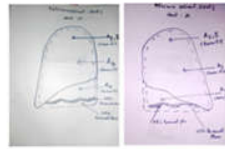


Figure 5
Chromatography card



Figure 6
Position of silicone key



Figure 7
Palatal surface mounting



Figure 8
Proximal surface mounting



Figure 9
Dentin body restorate



Figure 10
primary and secondary
anatomy recreated



Figure 11
Result after 24 hours
of rehydration



Figure 12
Result after 29 months of
restoration

4. Discussion

According to the literature, the aesthetic success of a composite layering restoration has depended on the following factors: the choice of composite shades, the type of composite used, and the composite layering system.

4.1 Aesthetic effectiveness of layering depending on the choice of composite shade

During the pre-stratification stage, the choice of shade and the recording of the five dimensions of tooth color for a composite restoration have been discussed depending on the type of shade guide used. According to Vanini, the use of the VITA® shade guide combined with the concept of chromatography has served as a means of communication for practitioners, refining and noting all parameters contributing to tooth color restoration [3-5]. For our clinical case, our shading concept was based on two principles: the use of a custom shade guide combined with the chromatography concept. This custom shade guide, made with the same types of composites used, helped us achieve precise shades for each composite layer to be restored and yielded an optimal and aesthetic result. This finding is consistent with the study by Magne B and colleagues in 2010 and the study by Manauti and

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colleagues in 2014, which evaluated the effectiveness of the custom shade guide for choosing composite shades compared to ceramic shade guides. The use of the chromatography guide was a very effective reference tool to avoid errors in placing each type of composite [6-8]. Using these two principles simultaneously yielded an aesthetically pleasing and biomimetic result.

4.2 Aesthetic effectiveness depending on the use of the silicone key

In terms of composite layering, we opted for using a single silicone guide key, which has been affirmed by Kleeberger B and colleagues in 2008 and Callin D and colleagues in 2014 as a key factor for aesthetic success and longevity of the restoration[9-10].

4.3 Aesthetic effectiveness depending on tooth form restoration

Regarding the form of tooth-restoration boundary, the use of a chamfer margin on the vestibular aspect and a butt margin on the proximal and palatal aspects has been suggested by Vanini and colleagues to combine aesthetic appearance with mechanical performance of the restoration[4]. For our clinical case, using chamfer margin on the vestibular aspect and butt margin on the palatal aspect, combined with adequate polishing, resulted in optimal aesthetic effectiveness. The ability to delimit the thickness of composite layers has been cited as a determining factor for the success of a restoration. In their layering practice, Dionysopoulos and colleagues in 2020 and Alleman and colleagues in 2017 emphasized the importance of limiting the thickness of the composite layers to less than 2mm to avoid the grayish effect of the restoration. For our clinical case, to reduce stress during polymerization, the thickness of the increment was limited to less than 2mm during the application of the dentin body and superficial dentin layers. The longevity of our therapeutic success marked this observation[11-12].

4.5 Aesthetic effectiveness depending on composite mounting technique

The layering technique chosen for our case was the modern three-layer histological layering technique. Our therapeutic choice was motivated by the principle of layering respecting the natural arrangement of dental tissues. According to clinical practice of this principle by several authors, its aesthetic effectiveness has been affirmed[13-14].

Conclusion

According to the philosophy of the author Magné P, biomimetic restorative dentistry involves respecting the natural structure and using it as a guide for restoration. The objective of this article was to present the case of a patient with dental erosions in the anterior sector, managed by the composite layering technique, and to discuss the expected results. The main

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factors that optimized the aesthetic success of our restoration were: the use of a custom shade guide combined with the concept of chromatography, chamfer margin on the vestibular aspect and butt margin on the palatal aspect, the use of a single silicone guide key for mounting the palatal and proximal walls, adherence to the thickness of each composite layer not exceeding 2mm, and the composite layering system in three layers respecting the natural structure of dental tissues. These principles helped us achieve biomimetic efficiency of the crown restoration and the longevity of the restoration. In order to consolidate the benefits obtained through biomimetic practice, an effective matrix system should be analyzed.

Conflicts of interests

We, the authors of this manuscript, declare no conflicts of interest regarding the publication of this article.

Patient consent

The patient has given full permission for the publication other use of his clinical case and photographs.

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