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Minimally Invasive Adhesive Rehabilitation for a Patient With Tooth Erosion: Seven-year Follow-up

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Clinical Relevance

This case report discusses a full-mouth rehabilitation using direct composite resin and whether this technique is viable for a young patient with tooth erosion. The seven-year follow-up indicates that a conservative approach with an appropriate diagnosis of the patient is a good choice for achieving esthetics, function, and restoration longevity.

SUMMARY

Tooth wear is a multifactorial condition of growing concern. In clinical practice, it is often a challenge for prevention and treatment since many etiological factors may be involved. This case report describes an esthetic rehabilitation of a young patient presenting tooth wear due to erosion. The etiological factor of this case was the patient sucking on lemons, an acidic fruit. The main complaint of the patient was the appearance of short maxillary incisors. The treatment involved orthodontic and restorative dentistry techniques. First of all, an orthodontic device was used to increase the vertical dimension of occlusion and create an adequate space for the direct restorations. The posterior teeth were restored with two direct composite resin techniques; the anterior teeth were then restored using a balanced occlusion. The seven-year follow-up of the case is presented. Replicas of the restorations were made and visualized under scanning electron microscopy up to the 12-month evaluation. In the clinical follow-up at seven years, maintenance of the results and restorations can be clearly seen.

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INTRODUCTION

Tooth wear is a modern concern for clinicians and has become a challenge to prevent and treat.[1,2] The etiology of tooth wear is multifactorial, and includes dental erosion as an important factor due to its increased prevalence.[3,4] According to Bartlett and

others,[5] more than 25% of the adult population in seven European countries showed tooth wear related mainly to the consumption of acidic fruits or gastric disorders.

Dental erosion is defined as tooth substance loss related to exogenous (foods and soft drinks) or endogenous acids (gastric acids due to regurgitation or reflux disorders) without bacterial involvement.[6,7] Erosion is a multifactorial condition caused by the interplay of numerous factors, such as acid consumption/production, abrasion, attrition, saliva flow rate, saliva properties, and tooth susceptibility to dissolution, all of which contribute to the erosion process.[3,8,9]

Patients are often late in perceiving that they suffer from erosion.[10] Erosive lesions are characterized by shallow defects on the smooth surfaces and flattening of the occlusal surface, eventually with exposure of dentin.[11,12] The teeth can appear yellowish, which is often the first sign of erosion noted by the patients themselves.[10,11] Another recognized sign is the shortening of the maxillary incisors, indicating advanced lesions, often associated with a loss of vertical dimension of occlusion (VDO).[10,13] The first approach for the patient with clinical symptoms of dental erosion should be the identification of the source of the acid exposure and elimination of the cause of the disease.[11] Restorative therapies are often necessary to restore the teeth.[13-15]

The restorative treatment should be chosen based on the severity of the tissue loss and the extent of existing restorations in the posterior teeth.[16-19] In fact, posterior tooth status typically determines the most appropriate restorative option. Direct restorations are indicated in cases of slight or moderate tooth loss with or without the presence of small restorations.[15] In case of extensive tooth loss and the presence of medium or large restorations, an indirect approach or a combination of indirect and direct restorations should be considered.[20] The possibility of direct restorative materials should always be considered since they allow for a minimally invasive treatment that replaces only the lost dental tissues without tooth preparation.[13,20] Extensive prosthodontic treatment in patients with tooth wear may compromise the survival of the dentition in the long term, which is especially relevant when patients are relatively young.[21]

Studies have concluded that direct resin composite materials represent a viable method for restoring moderate to severely worn teeth since the restorations exhibit a good clinical performance after three years.[22,23] Thus, the aim of this report is to demonstrate a conservative approach for restoring esthetics and function in a young patient with generalized tooth wear, performing direct restorations using composite resin.

CASE REPORT

A 22-year-old man presented at a clinical appointment complaining about the worn appearance of his teeth and his smile. His main complaint was about his anterior teeth, which appeared to be shorter than normal. An initial analysis of the patient revealed that he did not show his maxillary incisors with his lips at rest, and he presented a change in his smile line, which was not consistent with the plane of the incisors above the canines, causing an inverted smile (Figure 1). The initial clinical examination revealed that the patient suffered from generalized severe dental erosion and attrition involving both the anterior and the posterior teeth (Figure 2).

The areas most affected by erosion included the occlusal surfaces of the maxillary and mandibular posterior teeth and the palatal surfaces of the maxillary anterior teeth. The erosion caused a significant loss of enamel with the exposure of dentin, loss of anatomy, shortening of the teeth, and loss of marginal adaptation of the existing restorations (Figure 3). Although there was extensive dental wear, all affected teeth were vital, even though several of them presented hypersensitivity to air or temperature changes. Also, facial analysis revealed that the patient seemed to have a slight reduction in VDO caused by posterior tooth wear. A cephalometric analysis showed a low mandibular plane angle, reduced display of the upper incisors (related to the upper lip), and a low occlusal plane angle (Figure 4; see black traces). The patient's smile pattern indicated that the anterior teeth presented some extrusion, which compensated for the wear and caused some gingival display, although the patient had zero incisor display at the rest position. However, the cervical gingival margins presented good contour.

An extensive patient history revealed that the patient consumed excessive acidic beverages, including soft drinks, and routinely sucked on lemons. Because of this, no gastroenterological evaluation was requested to further establish the etiology of the dental erosion. Additionally, the patient reported the presence of parafunctional occlusal habits to include nocturnal bruxism without any previous intervention, such as the use of an occlusal guard. The

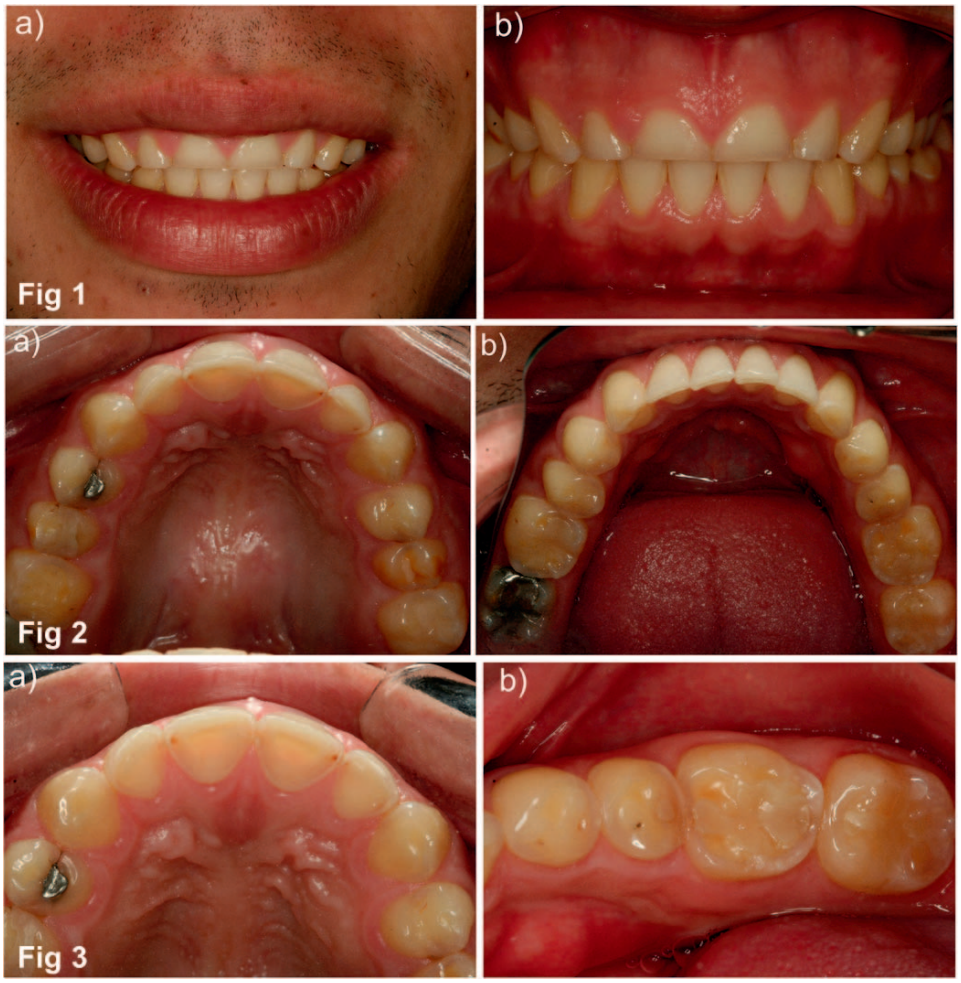


Figure 1. *Pretreatment aspect of the patient: extraoral (a) and intraoral (b) views showing the smile and the shortened incisors.*

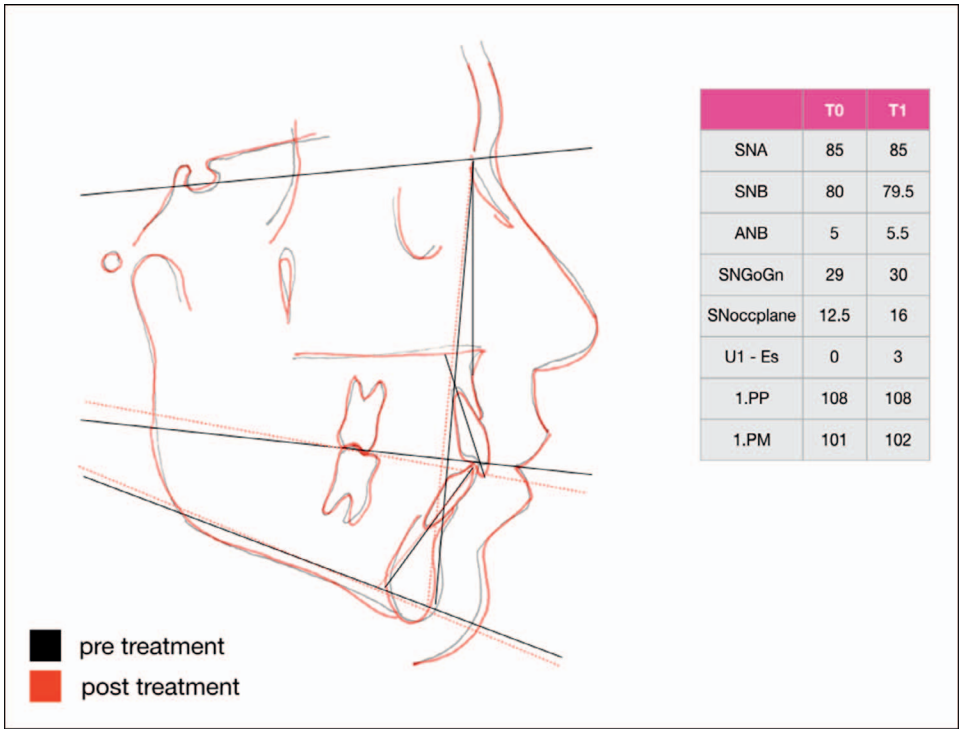
Figure 2. *Intraoral view of maxillary (a) and mandibular (b) arches showing the generalized erosive tooth wear.*

Figure 3. *Intraoral view of anterior (a) and posterior (b) teeth showing the damage from tooth wear: exposure of dentin, loss of anatomy, and loss of adaptation of the existing restorations.*

problem was extensively discussed with the patient to educate him regarding the importance of his habits in relation to his tooth condition and regarding the necessity of removing the etiological factors to treat and control the sequela of dental erosion.

Clinical examination revealed that to correct the esthetics of his maxillary anterior teeth, the patient's anterior guidance would need to be reestablished with restoration of the eroded posterior enamel and dentin surfaces. The treatment was proposed using composite resin restorations to eliminate further tooth loss. A fixed anterior bite plane was proposed to create anterior interocclusal space for the restorations and to control the parafunctional habit of the patient (Figure 5). Additionally, this fixed appliance induced the extrusion of the posterior teeth, thereby reducing the necessity of extensive restorations and allowing the most conservative treatment possible. This appliance was used for two months and increased the VDO by approximately 1.5 mm, producing adequate interocclusal space for the restorations. This phase was important to improve occlusion and allow the teeth to passively move until they were once again in occlusion. This phase also created anterior space for teeth, which were stabilized by the appliance.[2]

When the appropriate VDO was achieved, alginate impressions (Jeltrate 3M ESPE, St Paul, MN, USA) were made of the mandibular and maxillary arches, dental casts were prepared, and the casts were articulated on a semiadjustable articulator in maximum intercuspation to maintain the reestablished VDO (Figure 6). The occlusal posterior restorations were waxed up, and then the casts were duplicated to serve as a mold for fabricating a vacuum-formed matrix template (Figure 7) to reconstruct the posterior teeth with composite resins, a guide to determine the height of the new restorations, and a mold to create the final anatomy of the posterior restorations. All of the teeth were restored using rubber dam isolation (Figures 8 and 9). The teeth were first cleaned with pumice and sandblasted



	T0	T1
SNA	85	85
SNB	80	79.5
ANB	5	5.5
SNGoGn	29	30
SNoccplane	12.5	16
U1 - Es	0	3
1.PP	108	108
1.PM	101	102

Figure 4. *Cephalometric analysis performed before (black traces) and after (red traces) treatment.*

using a Rocatec (3M ESPE) to promote better conditions of adhesion under the previous restoration and the eroded, exposed dentin and enamel. Then 35% phosphoric acid (Ultra-Etch, Ultradent Products, Indaiatuba, Brazil) was applied for 15 seconds on dentin and 30 seconds on enamel and rinsed using copious amounts of water. Subsequently, the adhesive (Single Bond 2, 3M/ESPE) was actively applied using brushes, air-dried, and photoactivated for 20 seconds. It is important to floss between the teeth just before curing the adhesive layer to remove any excess adhesive and to avoid bonding the composite to the adjacent teeth. The composite resin used to restore the posterior teeth was a nanohybrid resin (Enamel Plus HRI, Micerium S.P.A., Avegno, Italy), which the manufacturer claims to present a higher refraction index due to its zirconia nanoparticles.

For reconstruction of the molars, the dentin increments (color UD4) were inserted to reproduce the lost cusps. To create a more natural anatomy, a brown pigment (Tetric Color, Ivoclar Vivadent, Barueri, Brazil) was applied with a fine paintbrush between the dentin increments. The restoration matrix was then placed to verify whether more dentin increments were necessary. Once an adequate amount of dentin resin was placed, a thin layer of enamel resin (color GE2) was inserted in the matrix, which was positioned on the tooth to be restored. The composite resin was photoactivated for 40 seconds through the matrix, the matrix was carefully removed, and excess composite resin was removed from the teeth using a scalpel blade and manual instruments (Microcut, TDV, Santa Catarina, Brazil). The composite was then light cured for an additional 60 seconds (Figure 8).

The procedures used to reproduce the dentin for the molars were repeated to restore the premolars. However, the outer layer of enamel was reproduced using a copy of the occlusal surface of the dental wax-up using a flowable resin (Filtek Z350 Flow, color A2, 3M ESPE). This reproduction of the occlusal surface was cemented on the restorations using a luting cement (Rely X Veneer, color A2, 3M ESPE) (Figure 9). It is important to note that the restorative procedures were individually carried out for each tooth to ensure that the removal of excess adhesive and resin from the adjacent teeth was easily performed with a scalpel blade and that the proximal areas were adjusted using sandpaper strips. After finishing the restoration of one tooth, the next was tooth was restored using the same steps as previously mentioned.

When the posterior restorations were complete, the occlusion was carefully adjusted to verify the appropriate distribution of the occlusal contacts

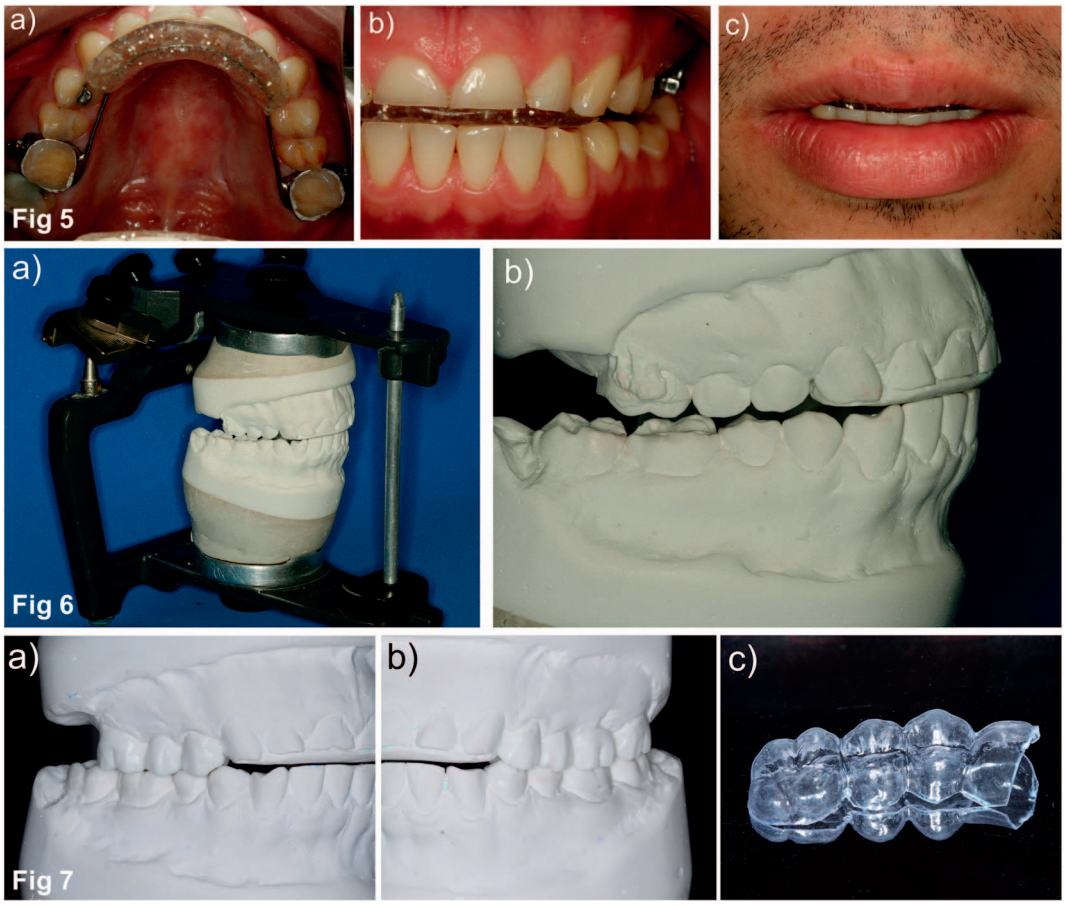


Figure 5. *Use of fixed appliance for the patient. (a): Design of the appliance fixed on the maxillary permanent first molars. (b): Interocclusal space created for the future restorations. (c): Lips at rest, demonstrating the loss of VDO. VDO, vertical dimension of occlusion.*

Figure 6. *Dental casts with the orthodontic appliance for planning the direct restoration (a) casts articulated on a semiadjustable articulator (b and c) demonstration of the provided interocclusal space.*

Figure 7. *The maxillary posterior restorations were waxed up (a and b), and a matrix template (c) was created to guide the restorative phase.*

(Figure 10). Finishing and polishing were performed using extrafine diamond burs (KG Sorensen, São Paulo, Brazil) and silicon rubber (Enhance, Dentsply, Catanduva, Brazil). Strips of sandpaper were used for interproximal polishing (3M ESPE).

After restoring the posterior teeth, the reestablished VDO (Figure 11) was tested for one month to allow for the detection of any possible nonadaptation to the new VDO and occlusion before delivering the anterior restorations. The patient maintained an anterior open bite during this phase and related that he was very comfortable with the new occlusion. No major modifications were required for the posterior composite restorations.

New dental casts were obtained from the patient to perform the wax-up of the anterior restorations. After the wax-up, the dental cast was duplicated, and a silicone matrix of the anterior teeth was obtained for use as a guide to construct the palatal surface of the restorations and to establish the correct height (Figure 12). The restorative procedures were performed under isolation using a rubber dam stabilized with clamps on the second premolars. The anterior teeth were prepared using 35% phosphoric acid for conditioning the enamel and dentin surfaces as previously described. The adhesive was placed, air-dried, and photoactivated for 20 seconds. The enamel resin was inserted in the silicone matrix in the region corresponding to the palatal enamel. The matrix was then positioned on the teeth and photoactivated. The palatal surface of each tooth was used as the basis for the other increments of composite resin (color GE2, Enamel Plus HRI, Micerium S.P.A). The lateral and central incisors were built using composite resin increments to

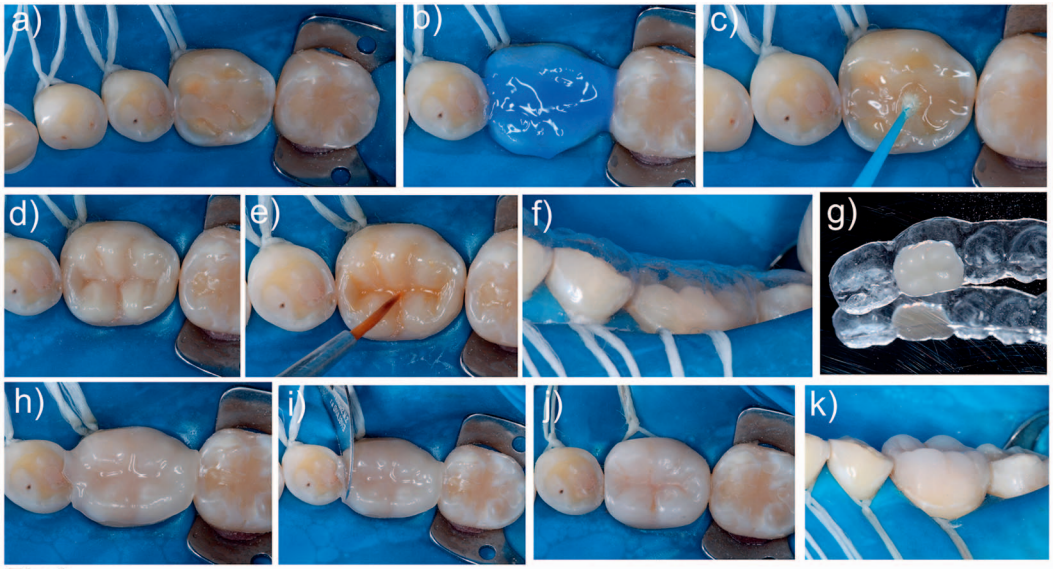


Fig 8

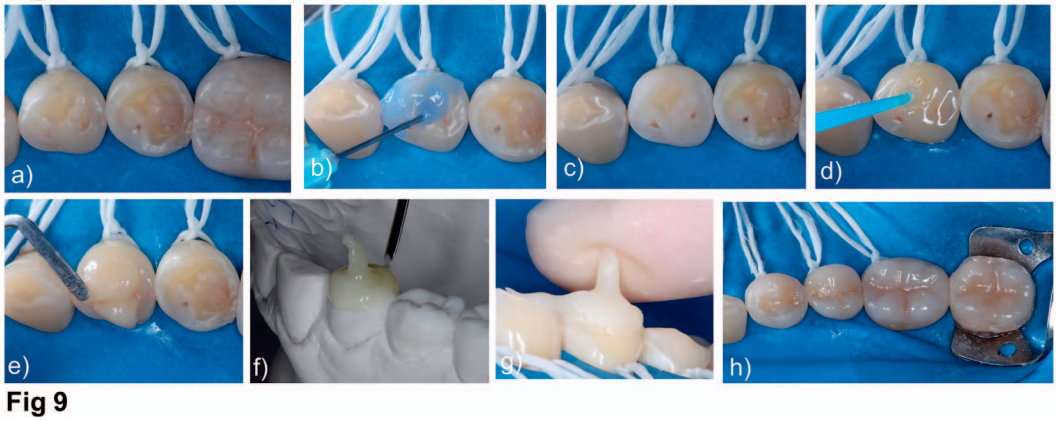


Fig 9

Figure 8. *Reconstruction of the molars. (a): Teeth after rubber dam isolation and sandblasting. (b): 35% phosphoric acid conditioning. (c): Application of adhesive. (d): Insertion of dentin increments. (e): Pigmentation of the restoration. (f): Placement of the matrix to guide the thickness of dentin and enamel increments. (g): Insertion of enamel resin in the silicon matrix. (h): Restoration after placement of the matrix and light curing. (i): Removal of the excess. (j and k): Final aspect of the restorations.*

Figure 9. *Reconstruction of the premolars. (a): Teeth after rubber dam isolation and sandblasting. (b): 35% phosphoric acid conditioning. (c): Teeth after conditioning. (d): Application of adhesive. (e): Insertion of dentin increments. (f): Placement of flowable composite under the copy of the occlusal surface. (g): Cementation of restoration. (h): Final aspect of the restorations.*

reproduce dentin using color A3 for the middle third and color A2 for the incisal third (Four Seasons, Ivoclar Vivadent). A small increment of translucent resin was placed on the incisal third to reproduce the characteristics of this region (Clear, Four Seasons, Ivoclar Vivadent). Finally, an enamel composite resin (Estelite Sigma, Tokuyama Dental, Encinitas, CA, USA) in color A2 at the middle and color A1 at the incisal third was used to construct the enamel surface. For the canines, color A3 resin was used for dentin (Four Seasons, Ivoclar Vivadent) and for the vestibular enamel (Estelite Sigma, Tokuyama Dental) (Figure 13).

Following the restorations, occlusal adjustment was performed, verifying contacts in protrusive and lateral excursive movements of the maxilla and mandible (Figure 14). Finishing and polishing of the restorations was performed using silicon rubber (Enhance, Dentsply), abrasives disks (3M ESPE), and felt disks (FlexiBuff, São Paulo, Brazil). Strips of sandpaper were used for interproximal polishing (3M ESPE). The final occlusal relationship was satisfactory. The patient's smile was immediately changed in tooth size and shape, giving him an appearance in agreement with his age and gender since he displayed his teeth even with his lip at rest (Figure 15). To maintain the restorations and to

Figure 10. *Occlusal adjustments after restorations: maxillary (a) and mandibular (b) views.*

Figure 11. *Aspect of the maxillary anterior teeth after reestablishing VDO. VDO, vertical dimension of occlusion.*

control for his habit of bruxism, an occlusal guard, a hard splint for the maxillary teeth, was delivered to the patient to be used during the night. The use of the hard night guard was also monitored at the seven-year follow-up.

The clinical follow-up was accomplished for seven years. Silicone impressions that were poured using epoxy resin were obtained at 12 months from completion of treatment. The mold of selected teeth, canines, and first molars was visualized under scanning electron microscopy (SEM), which showed wear of the cusp tips of the canines (Figure 16), the palatal cups of the maxillary molars, and the buccal cusp tips of the mandibular molars (Figure 17), which were restored and maintained in the SEM control at six and 12 months. Moreover, the patient was recalled every year, when a polishing was executed to provide maintenance of the restorations. After six years, a satisfactory appearance of the patient was still seen (Figure 18). The last clinical follow-up was completed at seven years (Figures 19 and 20), where the satisfaction of the patient (esthetic success) and maintenance of the restorations and teeth (biological success) can be seen. A new cephalometric radiographic analysis (Figure 4; red traces) was performed to show the changes that were achieved with the treatment.

DISCUSSION

Patients affected by severe dental erosion are frequently predisposed for a full-mouth rehabilitation treatment.[2,14,16-19,21] Often, tooth wear is diagnosed as a multifactorial condition[2,9,10] caused by several factors, such as erosion and bruxism in this case report. Currently, with improved adhesive techniques and suitable composite resin materials, a more conservative treatment may be proposed for the patient.[22,24] A modern approach for the treatment of tooth wear is to prevent the progression of this disease to avoid full prosthetic rehabilitation, causing large amounts of additional removal of tooth.[2] All treatment plans should include a clinical investigation of the causes of wear;[11] the control or removal of those etiological factors, in this case the habit of sucking on lemons and bruxism; and a restorative approach by means of direct composite restorations, followed by a maintenance phase, including the use of a mouth guard and regular checkups.[2] When planning a treatment, adequate communication with patients is essential to inform them of the importance of their problem and treatment. In most cases, patients may believe that a satisfactory result can be achieved by focusing only on anterior teeth, and thus they will not be interested in a more comprehensive treatment plan.

Figure 12. *Planning the anterior restorations. (a): Wax-up. (b): Silicon matrix in position.*

Figure 13. *Anterior restorations. (a): Teeth after isolation. (b): Placement of the first resin increments in the silicon matrix and light curing. (c): Reconstruction of the palatal face. (d and e): Palatal reconstruction with enamel resin in occlusal and frontal view. (f): Insertion of the dentin resin. (g): Insertion of translucent resin in the incisal third. (h): Immediate aspect of the restoration after insertion of the enamel composite.*

Figure 14. *Occlusal adjustments of the anterior restorations: lateral extrusive (a and b) and protrusive (b) movements.*

Figure 15. *Aspect of the restorations after polishing. (a): Intraoral view. (b): Smile view. (c): Lips at rest.*

The treatment protocol for this case report applied a sequence adapted from a treatment proposed by Vailati and others[17-19] that consisted of an assessment of the occlusal plane, reestablishment of the posterior occlusion, an increase of VDO, and the return of anterior guidance. Increasing VDO was necessary to compensate for the enamel loss and to gain interocclusal space that was shared equally between the mandibular and maxillary posterior teeth. Diagnostic wax-ups are important tools to be used for this clinical step. Modification of the protocol applied in the present report included using a fixed occlusal splint prior to the restorative approach that was applied to adjust the interocclusal space and control the parafunctional habits of the patient. Commonly, this step may be performed using provisional composite inlays bonded to the teeth and a removable guard, as proposed by several

reports.[13,17-19,25] Although this method might be more esthetic and comfortable for the patient, it has the disadvantages of additional lab fees, and it is not a truly reversible approach since it could require some tooth preparation to ensure a minimal thickness of the onlays.[17-19] Moreover, the presence of fixed provisional restorations would not allow for the extrusion of the posterior teeth, with the final rehabilitation performed with extensive restorations. As with the present case, bonding of provisional restorations was dropped in order to perform a less invasive treatment.

The use of a removable guard is traditionally indicated for a fully reversible approach; however, its use requires compliance of the patient. Considering the current lifestyle of most people, it is rather naive to expect that patients will wear an occlusal guard 24 hours a day.[18] The treatment plan indicated for this patient included the use a fixed orthodontic appliance for two to three months to correct the anterior bite plane. This appliance was fixed to the maxillary molars using orthodontic bands and contained an acrylic plane for disocclusion of the patient. To achieve good conditions of oral hygiene, this acrylic was polished to allow the use of dental floss for the patient. The aim of this appliance was to allow for the extrusion of the posterior teeth, thus increasing the VDO. Consequently, appropriate anterior interocclusal space was created for the indicated restorations. This occlusal stabilization splint is a reversible intervention that may reduce tooth grinding, muscular activity, and myofascial pain of the patient.[26] The use for two months was crucial for verifying the adaptation of the patient to his new VDO before the final restorative treatments were performed.[25] The expected extrusion of posterior teeth was around 1 to 2 mm, which increased the mandibular plane angle and caused an anterior open bite, providing space for incisor restorations. Cephalometric analysis showed that the upper occlusal plane was increased by 3.5 degrees, while the incisor display related to the upper lip at rest position increased 3 mm (Figure 4). Consequently, the occlusal plane provided a better smile for the patient.

Currently, the use of adhesive techniques and hybrid composite technology in particular has proven its potential in the treatment of moderate tooth wear.[16] Especially for young patients, adhesive restorations represent a more conservative treatment approach, reducing the need for preparation when restoring the morphology of worn teeth.[21] Retrospective studies evaluating the clinical performance of direct restorations in cases of tooth wear and with increasing VDO show that the composite resins are suitable materials for this treatment, with low failure rates in an average of three years of evaluation.[20,21,23] Additionally, technical improvements of resin restorative materials provide good and predictable clinical long-term results. The use of a vacuum-formed matrix template obtained from the model wax-ups, as reported in this case, allows for the establishment of restorations and a new vertical dimension without using a freehand technique and, as a consequence, an unbalanced occlusion.[23] Attin and others[20] evaluated the results of this noninvasive technique in a case series after three and after five and a half years and analyzed several parameters, such as surface texture, anatomical form, marginal discoloration, and integrity, among others. According to their results, all parameters analyzed were classified as minimal or no alterations (alpha criteria) after three years. At the five-and-a-half-year follow-up, most of the restorations presented some alteration (as indicated by an increase of the incidence of bravo criteria), although all of the alterations were easily solved with polishing and simple repair procedures.

As with Attin and others,[20] this case report evaluated the longevity of the restorations clinically and by using SEM analysis. The follow-up at six years represented by the clinical evaluation showed the clinical maintenance of the restorations over time (Figure 17). On the other hand, the SEM evaluation up to 12 months demonstrated the stability of the restorations in relation to anatomical form and marginal adaptation, especially for the canines and molars, since there were no visible wear facets or marginal maladjustments.

One of the most common concerns for resin restorations is the wear or degradation of the material over time. Especially in patients with an erosive/bruxism background, the clinical long-term success can be hampered due to a combination of abrasion, attrition, chemical degradation, and material fatigue, even in stress-free areas.[23] In these cases and in posterior restorations, the type of composite resin used is important. With respect to wear, fine hybrid composite resins have behaved well in clinical investigations.[20,27,28] Additionally, clinical follow-up studies have shown that fine hybrid composite materials exhibit wear similar to heavily loaded occlusal enamel areas.[27,28] These composites show adequate physical properties that are important for the longevity of extensive composite restorations under masticatory load, including

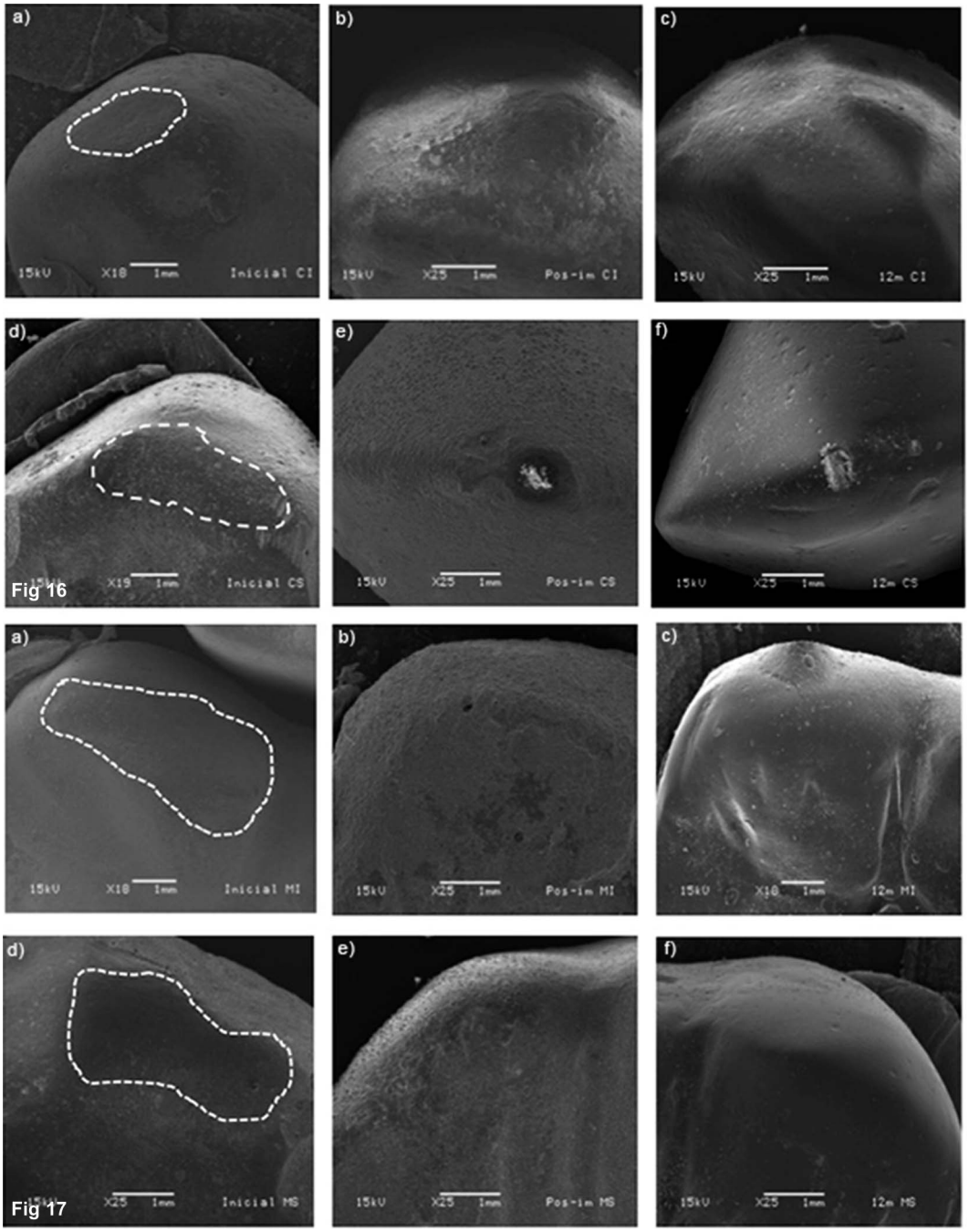


Figure 16. *Microscopic impressions of the maxillary (a-c) and mandibular (d-f) canines. (a and d): Initial. (b and d): After restorations. (c and f): After 12 months.*

Figure 17. *Microscopic impressions of the maxillary (a-c) and mandibular (d-f) molars. (a and d): Initial. (b and d): After restorations. (c and f): After 12 months.*

the properties of flexural strength, moduli of elasticity, microhardness,[29,30] and wear resistance.[30]

The composite used in this case report to restore the posterior teeth included a zirconia nanofiller. Manufacturers claim that including nanoparticles in resin composites allows for the production of materials with an increased filler load and better physical and mechanical properties. These nanofilled resins present viscosities and viscoelastic properties comparable to those of universal hybrid composites.[29] Randomized clinical trials have shown that there are

Figure 18. *Esthetic appearance of anterior teeth after six years: smile (a) and intraoral (b and c) views.*

Figure 19. *Intraoral view of the restorations during follow-up. (a and f): Immediate. (b and g): After 12 months. (c and h): After three years. (d and i): After six years. (e and j): After seven years.*

Figure 20. *Esthetic appearance of patient's smile after seven years.*

no significant differences between the wear rate of posterior restorations with nanofilled and microfilled resin up to six years of evaluation.[28,31] In addition to the good mechanical properties, the small filler particles in the composite resin improve the surface polishing and smoothness of the restoration. These composites also have improved optical properties because the diameter of the particles is a fraction of the wavelength of visible light, resulting in the inability of a human to detect the resin materials.[32]

According to the manufacturer, the composite resin Enamel Plus HRI (Micerium S.P.A.) has a refractive index similar to that of a human tooth (1.62). These characteristics and properties indicate the use of this composite for both posterior and anterior restorations, as performed in this clinical report.

The treatment of worn teeth with direct restorations needs a maintenance phase in which the patient uses a protective night guard or therapeutic appliance. In this phase, the night guard seems to be the most effective measure to prevent parafunctional activities and possible occlusal interferences, which are common in patients with bruxism.[16] Additionally, patients are required to return for regular checkups for possible repair of their restorations. Recent data advocate these conservative procedures in cases where the restorations are classified with bravo criteria.[33,34] Gordan and others[33] conducted a clinical trial with a seven-year recall and validated the success of repairing composite restorations instead of a full replacement as a conservative intervention.

CONCLUSIONS

The incidence of tooth wear represents an increasing concern in the clinical practice and has multifactorial origins. The clinical situation presented in this report showed a direct restorative approach to rehabilitate worn dentition. The use of an occlusal splint was important to control the parafunctional habits of the patient and to create a new occlusion pattern. The use of vacuum-formed and silicone matrices obtained from wax-up models are reliable techniques that can be employed to provide an esthetic and conservative result. This seven-year clinical follow-up indicates that a treatment of dental erosive lesions with direct composite resins is a predictive and conservative option for younger patients.

Regulatory Statement

This study was conducted in accordance with all the provisions of the local human subjects oversight committee guidelines and policies of approval of the State University of Maringá.

Conflict of Interest

The authors of this article certify that they 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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