Direct Restoration of Worn Maxillary Anterior Teeth with a Combination of Composite Resin Materials: A Case Report

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ABSTRACT

Tooth loss, alterations on tooth structure, and reduced vertical dimension are known to severely compromise the stomatognathic system. This case report describes the treatment of a patient who presented with an extremely worn maxillary anterior dentition with a loss of posterior support owing to the loss of almost all the posterior teeth, except the mandibular premolars. Provisional removable partial dentures were used to create an optimum maxillomandibular relationship and to provide restorative space prior to the restoration of the remaining teeth. This restoration was accomplished with a combination of layered hybrid and microfilled composite materials, which restored the maxillary anterior teeth to optimum esthetics and function.

CLINICAL SIGNIFICANCE

This article presents an alternative rehabilitation approach to a damaged stomatognathic system to achieve an optimally esthetic and functional result.

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Since esthetics is achieving growing importance in modern society, esthetic restorative treatment resulting in a beautiful smile seems to be an essential element of personal appearance.[1,2] Adhesive dentistry with direct composite resins can provide esthetic and durable results if proper materials and techniques are selected,[3] and if aspects of an optimum occlusal scheme are considered.[4]

Complex alterations of the stomatognathic system are considered to be caused by a heterogeneous cluster of factors that, together, may compromise esthetics and function.[5] The lack of posterior teeth, resulting in the absence of mandibular stability,[6] can lead to overloaded occlusal contacts on the remaining teeth, causing wear. The longer the teeth are exposed to this oral environment, the more they are affected by wear.[7] The loss of noncarious tooth tissue can be the result of abrasion, attrition, erosion, or abfraction.[8,9] Thus, the correction of esthetic alterations by direct restorative procedures, creating or recovering a sound harmony, depends on many factors, from the establishment of posterior stability to oral hygiene orientation to esthetic smile rehabilitation.[8,10] When the

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lack of posterior stability is associated with a reduced vertical dimension, a provisional prosthesis can be considered to immediately restore the vertical dimension,[8] reducing the risks of temporomandibular joint (TMJ) or masticatory muscle pain and creating the space necessary for the adhesive restorations.

This article describes treatment of a patient who presented with an extremely worn maxillary anterior dentition with a loss of posterior support owing to the absence of all posterior teeth except the mandibular premolars. A provisional prosthesis momentarily restored the posterior stability, and direct composite restorations provided the esthetic rehabilitation.

PATIENT EVALUATION

A 53-year-old patient came to the Dental School of Piracicaba complaining about the poor appearance of his teeth. The patient presented with extremely worn maxillary anterior teeth and the loss of almost all posterior teeth. The maxillary incisors and canines showed an extreme loss of tooth structure, and the other maxillary teeth were absent. The mandibular arc showed just the presence of extremely worn canines and premolars; the other mandibular teeth were absent. All worn teeth had dentin exposure owing to a high degree of enamel loss but were stable from a periodontal perspective, requiring only basic periodontal therapy. The exposed dentin was also discolored owing to smoking.

The high degree of tooth structure loss associated with the absence of some teeth resulted in a reduced vertical dimension and a loss of upper lip support. The reduced vertical dimension led to changes in the facial contour, resulting in thin lips and narrow vermilion borders and commissures, making appearance patient appear older than he should (Figure 1).

REHABILITATION PROCEDURE STRATEGY

Basic Periodontal Treatment

The patient presented poor oral hygiene, which had resulted in bacterial plaque and calculus retention. Nonsurgical periodontal therapy was proposed involving calculus removal and orientation to proper oral hygiene and diet through four appointments. This procedure brought the remaining teeth to a healthy condition, exposing a higher quantity of tooth structure, which facilitated the retention of esthetic adhesive restorations.

After careful evaluation of the existing occlusal vertical dimension, it was deemed necessary to fabricate provisional removable partial dentures to open the vertical dimension to the minimum amount needed for restorative space for the remaining teeth.

Provisional Dentures: Creating Space for Direct Restorations

Since the patient had lost the posterior teeth, the mandibular position was altered owing to the lack of posterior stability. This resulted in overloaded contacts on the remaining teeth, which led to the development of a severely worn dentition (Figure 2). Generally during patient assessment, pain and fatigue in the TMJ and masticatory muscles, difficulty in jaw movements, and the disappearance of anterior guidance as a result of tooth wear should be evaluated.[8] In this

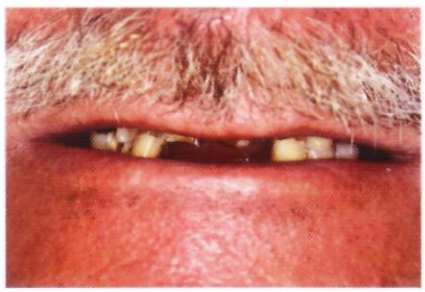

Figure 1. Initial aspect of the patient showing the absence of some dental elements, thin lips, and an inexpressive smile.

Figure 2. Rubber dam placement on the maxillary arc showing a closer image of remaining worn dental elements—functional and esthetic damage.

instance the remaining teeth were maintained and greatly needed esthetic and functional reconstruction that would only be possible after the restoration of the vertical dimension. It has been reported that the patient adapts to the existing vertical dimension because its decrease occurs over a long period of time.[8] However, since prosthetic rehabilitation aims to fulfill optimum occlusal parameters, correction of the vertical dimension cannot be postponed. In addition, the lack of space with a reduced vertical dimension makes the performance of rehabilitation therapy impossible. Provisional removable partial dentures were fabricated to make possible the use of direct composite restorations, but the patient will need to receive a definitive prosthesis in the immediate future to complete the treatment plan.

Alginate impressions were taken and the cast models were mounted in the centric relation position on a semiadjustable articulator by means of a jaw interference guide, which can either act as an occlusion program changer or facilitate the manipulation into centric relation by relaxing the musculature.[11] Wax-ups of the areas to be restored were created on the models for diagnostic analysis of the desired occlusal relationship. The possibility of establishing uniform contacts during mandibular movements, correct dental contour, and the maintenance of a desirable stomatognathic system balance was verified. Although some reports state that a lingual matrix is ideal to transfer the occlusal scheme obtained on the articulator to the clinical situation,[12] this approach was not performed. Instead, teeth were adjusted according to the parameters of an organic occlusion: when posterior teeth occlude, there is not contact between anterior teeth. Some authors have recommended the employment of cephalometric tracing or computer-generated axiography to reestablish anterior guidance,[13] but in this case phonetic tests and an optimum occlusal adjustment produced optimal results.

Esthetic Restoration of Remaining Teeth with Composite Resin: Initial Considerations

The evolution of adhesive dentistry began with acid-etching techniques and achieved great effectiveness with the development of the hybridization of hard dental tissues.[14–16] This adhesive procedure preserves tooth structure, is not very time consuming or costly to the patient, and may also protect the pulp dentin complex.[17]

The first step in adhesive restoration is color selection. When selecting the composite shades, the professional should know clearly the three color dimensions (hue, chroma, and value) to accomplish the correct perception of colors and luminosity areas of the surface to be restored.[18] To avoid false perceptions, color selection must be performed before placing a rubber dam; otherwise, the teeth dehydrate and false color perceptions can occur. The teeth should be copiously cleaned with a slurry of pumice and water prior to shade selection. Initially it is important to establish the tooth hue, the quality of the color's main pigment, and then use the shade guide to define its ideal saturation. When the hue is defined, the professional can establish a combination of composites to produce the same hue, varying the chroma or pigment intensity. Brightness is better obtained when the microfilled composite is used in the final surface layer because of its high degree of translucence.[17]

In this case dentin and enamel shades of Filtek Z250 universal hybrid resin (3M ESPE, St. Paul, MN, USA) were selected: A3 dentin to match the color of the cervical region and A2 enamel to match the color of the medium third region. Enamel shades of Filtek A110 microfilled composite (3M ESPE) were selected—A3, A2, and incisal—reproducing the enamel structure. The microfilled composites were applied on only the final facial surface of the tooth.

Cavity preparation for erosion/abrasion lesions is limited to the removal of localized caries that may take place because of the exposed dentin. The regions of hard, discolored dentin are sclerotic areas, which are a natural response of human pulp to pathologic disturbances or posteruption physiologic

changes.[19] The sclerotic dentin has a high degree of mineralization: the dentin tubules are closed by deposits of an inorganic component, rendering a significantly reduced dentin permeability.[20] This hypermineralized layer is highly acid resistant, precluding optimal acid-etching of the sclerotic dentin,[19,21,22] compromising the hybrid layer/resin tag formation,[19,22,23] and reducing bond strength by about 25% compared with sound dentin.[22] Moreover, the presence of bacteria on the dentin surface resulting in bacteria entrapment within the resin layer has also been documented.[22] Intertubular resin infiltration is important in achieving a good bond to sound dentin; this fact supports either the removal of the smear layer or the use of adhesives that penetrate through it into the underlying dentin matrix.[11] Thus, the presence of a hypermineralized layer, bacteria, and tubular mineral casts in sclerotic dentin (acting analogous to the presence of a smear layer and smear plugs in sound dentin) are obstacles for primer and resin infiltration.[23]

In general, these characteristics make sclerotic dentin less receptive to bonding protocols that are normally designed to be used on sound dentin,[24] owing to reduced adhesion.[22,25] Although some researchers have speculated that the lower bond strength of sclerotic dentin is due to the lack of resin tag formation,[19] other studies have not proved this association because there was no correlation between the depth of hybrid layers and bond strength, and the same values of bond strength were obtained whether there were few or many tags.[22,25] Although the effect of tubular orientation has no significant influence on bond strength, total acid-etching of sclerotic dentin perpendicular to the tubular orientation produces higher bond strength values.[22] Thus, the initial portion of the resin tags seems to be important to achieve better bond strengths on sclerotic dentin; this improved strength may be achieved by acid-etching the dentin with 37% phosphoric acid.[22]

Previous studies have suggested that bonding to sclerotic dentin may be improved by modifying the protocols that are normally employed for sound dentin. These include the removal of the surface hypermineralized layer with high-speed burs or the use of stronger acids.[26,27] Since sclerotic dentin is believed to be a natural protection of pulp, its complete removal is not recommended (see Figure 2). Effective adhesion can be obtained on surrounding dentin areas and remaining enamel.

In our case, after pumice water slurry, acid-etching with 35% phosphoric acid (Scotchbond Etch gel, 3M ESPE) was performed for about 30 seconds (Figure 3) over both the enamel and sclerotic dentin since the time variation between 15 and 60 seconds has no significant effect on the morphology and the adhesive retention qualities of enamel.[28] This step achieves a demineralized zone that is later filled with the adhesive.[15] Dentin morphology is different from enamel; thus, careful attention must be employed when etching, rinsing, and drying dentin.[29] Maintaining a moist dentin prior to resin bonding is the most important aspect of dentin adhesion, principally when using adhesives with high-volatile solvents such as acetone.[30] This can be successfully achieved by using small pieces of autoclaved tissue paper.[31]

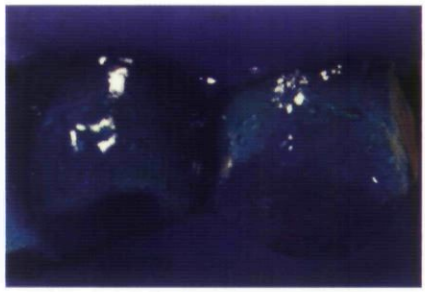

Figure 3. 35% phosphoric acid etching for 30 seconds over the entire dental structure.

A one-bottle adhesive, Single Bond (3M ESPE), that contains hydrophilic and hydrophobic monomers diluted in water and ethanol was chosen to create the hybrid layer with the tooth structure (Figure 4).

Restorative Technique

Hybrid composites better enable the reproduction of the area that receives normal occlusal load since they possess a reinforced organic

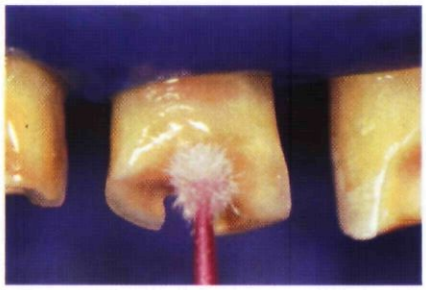

Figure 4. Dentin adhesive application.

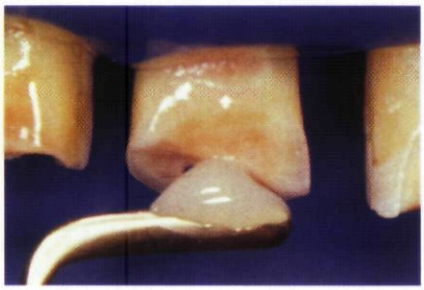

Figure 5. Application of the hybrid composite to create the palatine wall.

Figure 6. Palatine wall incrementally constructed.

matrix, resulting in better physical properties. These types of composites are reinforced by inorganic fillers. Increments of the universal hybrid composite, Filtek Z250, were applied and light polymerized for 20 seconds to create the restoration body, that is, to restore the lingual surface (Figures 5 and 6) and reproduce two-thirds of the faciolingual thickness (Figure 7).[32] To mask the transition line between the composite and tooth structure, the dentin shade composite resin was applied over this union line. This composite resin was also applied to create the basic facial tooth anatomy represented by dentin development lobes. The hybrid composite offers the resistance and opacity of dentin.[33]

Subsequently a microfilled composite resin, Filtek A110 (A3 and A2 shades), was applied over the hybrid composite base, just on the facial surface of the tooth. Then incisal composite resin was applied to the facial surface in small increments to create an ideal translucent color, good esthetics, and a smooth texture similar to enamel (Figures 8 and 9).[33]

Occlusal Adjustment, Finishing, and Polishing

After removal of the rubber dam, an occlusal adjustment was performed with a fine diamond bur to remove interfering occlusal contacts. Subsequently an analysis of the excursive mandibular movements was performed, reproducing the anterior and canine guidance and making a harmonic distribution of the occlusal contacts possible.

The insertion of the composite resin should permit the correct definition of the basic tooth anatomy; however, the precise individual anatomy is correctly determined during finishing and polishing procedures. Ultrafine diamond or multilaminated burs are indicated to remove small excesses. Next,

Figure 7. Increments of the hybrid composite being applied to create the restoration body (A3—cervical, A2—incisal surfaces).

Figure 8. Final aspect of the restoration of left maxillary teeth after the use of a microfilled composite. Note that the right side is not yet restored.

Figure 9. Final aspect of the restoration of all maxillary teeth showing the correct tooth anatomy, resulting in excellent esthetics.

fine aluminum oxide disks (Sof-Lex, 3M ESPE) at low speed were used to achieve brightness and superficial smoothness. To reproduce the enamel surface texture, a diamond bur and then a superfine grit disk were used at low speed, creating an excellent final esthetic result (Figure 10).

FINAL CONSIDERATIONS

The goal of any dentistry therapy is to facilitate the re-adaptation to a healthy situation that is momentarily damaged. Severely worn dentitions are expressive examples of the loss of vertical dimension. When this situation is associated with missing posterior teeth, the possibility of development of pain in TMJ or muscles is highly increased,[6] but certainly the masticatory function has been already compromised. Thus, the patient needs to return to a healthy functional condition prior to any rehabilitation therapy.

A provisional removable partial prosthesis helps to establish the most suitable vertical dimension of occlusion to which the patient can adapt, and it does not cause muscle or joint problems.[8] "It serves as a guide to the need for correction of preexisting conditions, such as collapsed vertical dimension,"[34] and may also help the patient to relieve his anxiety about the loss of a good facial appearance (see Figure 1). In this way a provisional prosthesis fulfills many functions, but perhaps the most important are the elimination and avoidance of pain and the return to a state of comfort and reasonable function.

This article was written to demonstrate the potential of direct composite resin materials to restore worn anterior teeth to esthetics and function. In this case the patient received a provisional prosthesis to recover the natural vertical dimension of occlusion, creating the necessary space for esthetic restorations and making possible a comfortable and functional situation (Figure 11). Clearly, the long-term results depend on establishing a stable posterior occlusion. This was accomplished with provisional removable partial dentures prior to restoring the anterior teeth, and needs to be finalized with definitive removable partial dentures. The treatment described in this case report is not intended to preclude more definitive treatment to restore the posterior occlusion with osseointegrated implants and fixed prostheses, but it is presented as a relatively cost-effective option for patients who cannot afford complex multidisciplinary restorative therapy.

Figure 10. Final aspect of the restoration of maxillary teeth after finishing and polishing.

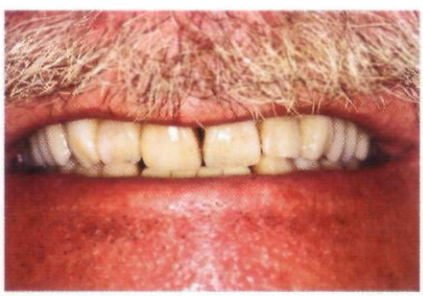

Figure 11. Esthetic restorations and provisional prosthesis after occlusal adjustment, showing thicker lips and the patient's beautiful smile.

DISCLOSURE

The authors do not have any financial interest in the companies whose materials are discussed in this article.

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COMMENTARY

DIRECT RESTORATION OF WORN MAXILLARY ANTERIOR TEETH WITH A COMBINATION OF COMPOSITE RESIN MATERIALS: A CASE REPORT

Terry Donovan, DDS*

Dr. Soares and colleagues have presented an innovative approach to the restoration of extremely worn maxillary anterior teeth associated with the total lack of posterior support. They are to be complimented on their meticulous approach to esthetic restorative dentistry and the beauty and artistry of the direct composite resin restorations provided, as are evident in the photographs accompanying this article.

The selection of resin materials for these extensive restorations is intelligent and appropriate. Use of a total-etch bonding system with slightly elevated etching times is indicated when dealing with significant areas of sclerotic dentin. Building the bulk of the restoration with multiple shades of hybrid composite with a high elastic modulus provides the essential strength required, and veneering the hybrid with highly polishable microfilled composite permits the obvious optimum esthetic result.

The authors recognize that the treatment approach described in the article is essentially a compromise. Patients lacking posterior support are optimally restored by first obtaining multiple bilateral posterior stops using osseointegrated implants. The anterior guidance would then be restored using either direct or indirect restorations.

My major concern regarding the approach described in this article is the questionable ability of removable partial dentures to maintain a stable posterior occlusion. Interim Kennedy Class I removable partial dentures were used in this case to open the occlusal vertical dimension and to provide posterior stops. Assuming these interim removable partial dentures are mucoadhesion partials, their ability to maintain a stable occlusion for any length of time is questionable.

The authors provided what they describe as an "organic" occlusion, in which the anterior teeth are just out of contact when the patient occludes in centric relation. The posterior occlusion for this patient will eventually be provided by definitive removable partial dentures. Many prosthodontists, including me, believe that it is difficult, if not impossible, to maintain a stable posterior occlusion with distal extension removable partial dentures. Thus, the long-term stability of the restorations on the anterior teeth appears to be inherently compromised.

This criticism aside, I believe this article demonstrates the ability of contemporary composite resin materials to restore anterior teeth both to optimum esthetics and to function. A comparison of Figures 2 and 9 reveals the extensive amount of tooth structure lost and restored with direct composite resin. The results are impressive indeed!

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