



Palatal and Facial Veneers to Treat a Case of Severe Dental Erosion: A Case Report Following the Three-Step Technique and the Sandwich Approach

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Abstract

Minimally invasive principles should be the driving force to rehabilitate young individuals affected by severe dental erosion. The maxillary anterior teeth of a patient, class ACE IV, has been treated following the most conservatory approach, the Sandwich Approach. These teeth, if restored by conventional den-

tistry (eg, crowns) would have required elective endodontic therapy and crown lengthening. To preserve the pulp vitality, six palatal resin composite veneers and four facial ceramic veneers have been delivered instead with minimal, if any, removal of tooth structure. In this article, the details about the treatment are described.

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Introduction

Due to the work of several authors, such as Lussi and Jaeggi,¹ Milosevic and O'Sullivan,² Bartlett,³ and Schmidlin et al,⁴ more awareness about dental erosion is finally being raised. Many clinicians are evaluating their patients with a fresh outlook, discovering cases in which treatment has been postponed too long, and cases where it was started but in a too aggressive manner (conventional dentistry).

Since 2006 at the University of Geneva, patients affected by dental erosion are treated as soon as possible after identification of dentin exposure through the Geneva Erosion Study. Only adhesive techniques are implemented, with minimal (if any) tooth preparation (principle of minimal invasiveness). Despite the tendency for adhesive modalities to simplify the involved clinical and laboratory procedures, the therapy of such patients still remains a challenge because of the number of teeth affected in the same dentition.

To simplify the dental treatment and reduce financial costs, an innovative approach termed the "three-step technique" was developed in connection with the Geneva Erosion Study. This article describes the full-mouth adhesive rehabilitation of one of the study patients, who was affected by severe dental erosion (ACE class IV).⁵ Since emphasis should always be placed on removing only the minimal amount of tooth structure when repairing the teeth, the patient's maxillary anterior teeth were restored following the "Sandwich Approach", which consists of reconstruction of the lingual aspect with resin composite restora-

tions (Composite Palatal Veneers), followed by restoration of the facial aspect (Ceramic Facial Veneers). The treatment objective was attained using the most conservative approach possible, as the remaining tooth structure was preserved and located in the center between the two different restorations.⁶⁻⁸

Case presentation

A 30-year-old Caucasian male presented at the School of Dental Medicine at the University of Geneva. His chief complaint was the deterioration of his anterior teeth. Since he could not afford to receive crowns, as proposed by his clinician, over the past seven years he had fractured his incisal edges significantly.

The clinical examination revealed that the patient had severe and generalized dental erosion involving the anterior and posterior teeth. All the teeth were vital and not at all sensitive to temperature. He was not wearing an occlusal guard, and he did not relate his dental problem to dental erosion.

The gastroenterological evaluation used to establish the etiology of the dental erosion confirmed the presence of gastric reflux, and the patient started a medical therapy based on Histamine H₂-receptor antagonists.

According to the ACE classification, the patient was considered ACE class IV,⁵ since the palatal dentin was largely exposed and the loss of length of the clinical crowns was more than two millimeters, while the facial enamel and the pulp vitality were still preserved.

During the first visit, photos, radiographs, and full-arch impressions were



Fig 1 Initial status. **(a)** The four maxillary incisors' incisal edges were much compromised. The severe dental erosion also affected the posterior teeth, especially the maxillary premolars. **(b)** All the teeth, however, kept their vitality.



Fig 2 First clinical step: maxillary labial and buccal mock-up. **(a)** To achieve the harmony between the incisal edge plane and the occlusal plane (correction of the reverse smile), the incisors were lengthened. **(b)** Note how patient's ability to smile improves when the shape of the teeth is corrected by the mock-up.

taken. The initial visit was concluded with a face bow record (Fig 1).

The maxillary and mandibular casts were mounted in maximum intercuspal position (MIP) using a semi-adjustable articulator. Since the patient had a very prominent reverse smile, to determine the lengthening of the anterior maxillary teeth and the related esthetic position of the occlusal plane, a maxillary labial and buccal mock-up visit was planned (first step). The technician waxed up only the

labial and buccal aspect of the maxillary teeth and the information obtained from the maxillary waxup was registered by means of a precise silicone key.

During a second clinical appointment, a maxillary mock-up was fabricated directly in the mouth. The clinician loaded the silicone key with a tooth-colored auto-polymerizing resin composite material (Telio, Ivoclar/Vivadent, Schaan, Liechtenstein) and positioned it in the patient's mouth.



After the removal of the key, all labial and buccal surfaces of the maxillary teeth were covered by a thin layer of resin composite, reproducing the shape defined for the future restorations by the laboratory technician. The reverse smile was corrected lengthening the anterior teeth.

After the clinical validation of the position of the future plane of occlusion (first step), the increase of the vertical dimension of occlusion (VDO), mandatory to restore this patient, was determined arbitrarily on the articulator (Fig 2).

The technician was asked to produce the waxup of the occlusal surfaces of the posterior teeth, the two premolars, and the first molar in each sextant. Four translucent silicone keys were then fabricated, each duplicating the waxup of one posterior quadrant (Elite Transparent, Zhermack, Badia Polesine (RO), Italy).

The patient was then scheduled for a third appointment. Without any anesthesia, the exposed dentin in the four posterior quadrants was roughened and after etching for 30 seconds, the enamel, and a further 15 seconds the dentin, the primer and bond were applied (Optibond FL, Kerr, Orange, CA, USA). Then the clinician loaded each translucent key with nano-hybrid resin composite (Miris, Coltène, Whaledent, Altstätten, Switzerland), positioned the key in the patient's mouth, and light-cured the resin composite. As a consequence, in the single visit, without any tooth preparation, the occlusal surfaces of all the premolars and the first molars were restored with a layer of resin composite, reproducing the respective diagnostic waxup (second step). Since the anterior teeth were

not restored, an anterior open bite was created.

Since the second step of the three-step technique was performed without anesthetizing the patient, there was a patient's full cooperation in checking and adjusting the occlusion (Fig 3).

The protocol of the Geneva Erosion Study recommends an arbitrary observation period of approximately 1 month to assess the patient's adaptation to the newly established VDO. After 1 month the patient felt comfortable with the new occlusion, and two alginate impressions and a new facebow record were taken. In order to mount the casts in MIP, an anterior occlusal bite registration was also required.

Since the interocclusal distance between the anterior teeth was significant, it was decided to restore the palatal aspect of the maxillary anterior teeth with indirect restorations (resin composite palatal veneers).

The interproximal contacts between the maxillary anterior teeth were slightly opened by means of stripping using thin diamond strips, and the incisal edges were smoothed by removing the unsupported enamel prisms. The palatal dentin was also cleaned with non-fluoride-containing pumice, and the most superficial layer was removed with diamond burs. The exposed sclerotic dentin was immediately sealed with Optibond FL and flowable resin composite (Tetric flow T, Ivoclar Vivadent, Schaan Liechtenstein) before the final impression.⁹⁻¹³ For this patient, the preparation of the teeth for the palatal veneers did not require local anesthesia, and the removal of the most superficial layer of sclerotic dentin did not involve any sen-



Fig 3 Second clinical step: **(a)** the provisional posterior resin composite restorations. **(b)** The VDO was increased and an open bite was created to allow restoring the palatal aspect of the maxillary anterior teeth.



Fig 4 Third step: resin composite palatal veneers. **(a)** Note the fracture of the palatal cusp of the provisional posterior resin composite on tooth 24. **(b)** Since the contact point was not missing and a final restoration was previewed anyway, the tooth was not repaired.

sitivity. No provisional restorations were delivered.

After 1 week, the palatal veneers were bonded, one at a time, using the rubber dam. The palatal sealed dentin was sandblasted (Cojet, 3M, Espe, Seefeld, Germany), the surrounding enamel was etched (37% phosphoric acid) for 30 seconds, and the bond (Optibond FL, Kerr, Orange, CA, USA) was applied but not cured. The resin composite veneers were also sandblasted (Cojet 3M, Espe,

Seefeld, Germany) and cleaned in alcohol and with ultrasound, and three coats of silane were applied (Silicup, Heraeus, Kulzer, Germany). A final layer of bond (Optibond FL, Kerr Orange, CA, USA) was used without curing. A warmed-up resin composite was then applied to the restorations (Miris, Coltene, Whaledent, Altstätten, Switzerland) before they were placed on the teeth and light cured.

The open contact points facilitated the bonding procedures, from position-



ing of the veneers to excess removal. Thanks to the presence of a resin composite “hook” at the level of the incisal edges of the veneers, it was easier to achieve correct positioning, even on the “slippery” palatal surfaces. The hooks were subsequently removed during finishing and polishing (Fig 4).

The restoration of the palatal aspect of the maxillary anterior teeth concluded the three-step technique. At this stage, the patient reached a stable occlusion in the anterior and posterior sextants. The VDO was clinically tested, and the anterior guidance was re-established (Fig 5).

The patient was satisfied with the esthetic of the palatal veneers even though the incisal edges were lighter compared to the rest of the teeth, and a translucent band was present at the level of the junction with the veneers, due to the intentional lack of preparation of the facial surface (eg, no facial bevel). It was decided not to rush into the completion of the Sandwich Approach and to bleach the teeth.

However, the patient had a nail-biting habit and fractured the incisal edges of tooth 11 several times. The decision was made to use the ceramic facial veneers, and to push the patient to stop the nail biting habit (Fig 6).

Following the principle of minimal invasiveness, the option of leaving the facial surface of the canines unrestored was discussed with the patient. Since the facial aspect of the canines was perfectly intact, including these teeth in the veneer preparation would have led either to veneer preparation that was too aggressive or to final canines that were too bulky. Although the margins be-

tween the palatal veneers and the tooth structure of the canines were visible at a close view, at a social distance this was completely acceptable, so the patient decided to have only the four maxillary incisors restored.

The veneer preparation was carried out without local anesthesia, due to the minimal removal of tooth structure and the lack of dentin exposure. The interproximal contact areas, already open, were further adjusted with a metallic strip. A light chamfer was prepared at the cervical level, following the curve of the marginal gingiva, with no need to extend the preparation to the gingival sulcus (in contrast to the crown preparation of devitalized teeth), since the color of the underlying tooth structure was ideal. Since the palatal aspects, restored with resin composite veneers, were considered an integral part of the respective teeth, no particular effort was made to place the preparation margins on tooth structure. At the incisal level, all the length created by the palatal veneer was removed, and a flat preparation was performed, paying attention to smoothing all the line angles.

After the impression, a provisional veneer was fabricated with the same silicon key used for the mock-up. The key was loaded with provisional resin composite material (Telios, Ivoclar, Vivadent, AG, Schaan Liechtenstein), and retention was achieved by both the contraction of the product and the presence of minimal interproximal excess.

The bonding of the veneers was carried out after 2 weeks without anesthesia, and followed the protocol developed and published by Pascal Magne (Figs 7 and 8).¹⁴⁻¹⁸



Fig 5 (a) At the completion of the three-step technique the patient had stable occlusion, comprising posterior support at a new clinically tested VDO and anterior guidance. **(b)** The incisal edges added with the palatal veneers presented a lighter shade, since it was previewed to bleach the patient's teeth after protecting the exposed dentin.



Fig 6 (a) Due to the patient's nail biting habit, the incisal edge of one the resin composite palatal veneers was deteriorating at a faster rate. The decision was made to proceed to the fabrication of four maxillary incisor ceramic veneers. **(b)** Patient stated later that he would stop using the incisal edges after the ceramic veneers were bonded.

The patient was clearly satisfied with the overall treatment. The restorations integrated nicely with the rest of the dentition (color and shape), and the soft tissues were healthy (esthetic success). Finally, the amount of tooth structure removed was minimal, and all the teeth retained their vitality (biological success) (Fig 9).

After the completion of the Sandwich Approach (palatal resin composite veneers and facial ceramic veneers), the treatment continued with the replacement of the posterior provisional resin composite restorations. Whereas all the maxillary premolars and first molars were restored with indirect restorations (resin composite onlays), the maxillary



Fig 7 Initial status and after veneer preparation. **(a)** The original tooth length was maintained, since the space necessary for the fabrication of the veneers (1.5 mm) was obtained by removing the length added by the palatal veneers. In fig **(b)** note that the rubber dam is not yet in place, since the veneer try-in with glycerin should be done as quickly as possible to verify the color match before the teeth may become dehydrated.



Fig 8 Intraoral view of the final restorations at one-year follow-up. All the teeth retained their vitality.



Fig 9 Final result of the patient restored with the “Sandwich approach”. **(a)** The esthetic and biological success (all teeth vital) could not have been achieved with any other type of restoration (eg, conventional crowns). **(b)** Note the correction of the reverse smile, which is one of the predictable results of restoring patients following the Three Step technique.



Fig 10 (a) Occlusal view of the maxillary incisors restored with two veneers, and the canines with only one palatal veneers one week after facial veneer bonding. **(b)** Follow-up at 1 year, note that the posterior provisional restorations have been replaced by indirect resin composite restorations (full-mouth adhesive rehabilitation).

second molars and all the mandibular posterior teeth were restored with direct restorations, due to a lack of interocclusal space. Finally, an occlusal guard was given to the patient, who was entered in the Geneva Erosion Study and seen every year as part of the protocol (Fig 10).

Conclusion

Dental erosion is increasing, but the dental community often appears to underestimate the extent of the problem. The frequent lack of timely intervention is related not only to the slow progression of the disease, which can take years be-



fore becoming evident to patients, but also to clinicians' hesitation to propose restorative treatments based on non-invasive adhesive procedures in asymptomatic patients.

In this article the treatment of a 30-year-old ACE class IV patient was successfully completed. The two main goals – minimal tooth preparation and tooth vitality

preservation – were achieved, showing that early intervention could be a very reasonable solution even for very young patients affected by dental erosion.

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