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COMPOSITE PALATAL VENEERS TO RESTORE A CASE OF SEVERE DENTAL EROSION, FROM MINIMALLY TO NO INVASIVE DENTISTRY: A 3 YEAR FOLLOW-UP CASE REPORT.

Key words: dental erosion, palatal veneers, full-mouth adhesive rehabilitation, gastric reflux, tooth preservation.

ABSTRACT

Minimally to no invasive dentistry should be the driving force in treating patients affected by severe tooth wear. Nowadays thanks to adhesive techniques, tooth and pulp protection could be easily achieved in this type of patients, who has already suffered of conspicuous tooth destruction.

In this article the treatment of a ACE class III patient affected by severe dental erosion is illustrated. His maxillary anterior teeth, supposed to be devitalized and restored with crowns, were simply repaired by means of composite palatal veneers.

The 3-year follow-up confirms the esthetic, mechanical and biological successes obtained.

INTRODUCTION

Frequently patients affected by dental erosion are not immediately treated, since tooth wear still represents an overwhelming challenge.

Some clinicians consider erosive wear as a physiological process related to age, rather than a pathology that should be immediately treated.

Other dentists, instead, recognize the problem, but they are not comfortable to propose a full-mouth rehabilitation to their patients, especially at the early stage of the disease, waiting for more tooth destruction to happen to justify the treatment.

Nowadays thanks to the adhesive techniques, dental erosion could be immediately addresses, the tooth destruction slowed down, with minimal to any additional tooth loss during the delivering of the restorations 1-22.

The key factor that allows this extremely conservative approach is the increase of the vertical dimension of the occlusion (VDO), necessary in almost every case to obtain enough interocclusal space to avoid tooth preparation.

The new philosophy, "add not remove", proposes weak restorations, which may need more frequent maintenance, but which preserve intact the underlying original tooth structure .

In addition, these restorations are cheaper, since they do not require root canal therapy or crown lengthening, and they maintenance is also not expensive (especially when dealing with composite resine).



FIG 1 occlusal view of the posterior teeth of a patient affected by severe dental erosion. The second molar was restored with a direct composite restorations. After 4 year the composite worn down and it was replaced by a new direct restoration. The patient did not complain about this failure, since he considered it as normal part of the maintenance of his restored dentition.

In the authors' opinion, the dental community should stress more the importance of the tooth preservation (biological success), rather than aim for the "10 year guarantee" of their work.

A vital tooth restored for the first time with a crown could last 10 year, but if the same tooth loses the vitality and the remaining tooth structure becomes compromised (insufficient ferrule), can the "10 year deal" still be guaranteed for the new restoration?

The clinician's capacity to communicate the switch in paradigm (biological success versus the mechanical success) is fundamental, before proposing these extremely conservative treatments, because patients must accept that the restorations are now weaker and eventually will fail over time; however, the restored teeth will keep their integrity and a repair or a replacement with a similar restoration will be always possible.

This is not always the case, for example, when a devitalized tooth, restored with a crown, fails because of root fracture.

In this article, the treatment based only on adhesive techniques of a patient affected by several dental erosion is illustrated.

His maxillary anterior teeth were supposed to be devitalized in order to be restored with full-crown restorations. The patient refused this aggressive option and sought consultation in the Geneva Erosion Study.

A new treatment plan was proposed, based only on adhesive technique; six palatal and six facial veneers (Sandwich approach) were considered to restore his maxillary anterior teeth and to preserve to a maximum the remaining tooth structure.

However, the final treatment became even more conservative than previewed, since only six palatal veneers were necessary to restore the very compromised teeth.

The clinical results (esthetic, biological and mechanical success) at the three year follow-up, confirmed that adhesive approach chosen was the most appropriate therapy.

Not only the palatal veneers restorations did not require any tooth preparation, and the teeth kept their vitality, but also the overall treatment was more affordable for the patient.

CASE PRESENTATION

46 year old patient presented to the University of Geneva, school of Dental Medicine, with the chief complaint that "his teeth were deteriorating at a high speed and he finally wanted to something about it".

At the anamnesis, the patient remember that his dentist proposed to restore his dentition by means of crowns and that he was not convinced by this treatment plan.

Since then, he had seek dental treatment on an irregular base.

After several year of neglecting his mouth, he was finally addressed to the Geneva Erosion Study, to investigate if other types of treatments than crowns were available.

During the first consultation, the patient was very uncomfortable to show his teeth, since he felt very guilty about the status of his dentition. He was not fully aware that he was also affected by den-

tal erosion and he thought that the degradation of his dentition was related only to poor oral hygiene. FIG 2

During the investigation for parafunctional habits, bruxism was excluded, but clenching was confirmed, not only by the patient himself, but also by the size of his very developed masseters.



FIG 2 AB Initial status. Patient was very uncomfortable about showing his teeth, and only after several attempts, a forced smile was obtained. Note the accentuated translucency at the level of the two central incisors, indicating the severe thinning of the incisal edges. The patient had been postponing the dental care, since he did not want to restore his teeth by means of crowns.

The patient presented with a deep bite, which, most probably, was aggravated by the loss of contact on the palatal surfaces, damaged by the dental erosion, and the supereruption of the teeth.

Despite the severe tooth structure loss, all the maxillary anterior teeth were still vital, indicating a very slow acid attack, most probably with an intrinsic etiology. FIG 3

Since he also denied any excessive consumption of acidic food or beverages, he was referred to a gastroenterologist to investigate the status of the digestive system. Even though the patient did not complain to this request, his dental treatment started without knowing if the erosion was still active in his mouth.



FIG 3AB Occlusal and lateral views of the initial status. The palatal destruction was very advanced and the teeth undermined, but due to the patients' deep bite, the incisal edges fractured very little. The palatal enamel was present only at the cervical level. Interproximal caries were also weakening the teeth furthermore. Nevertheless, all of teeth were still vital. The posterior teeth were also very compromised and the clinical crowns were very short. Nevertheless all the teeth were still vital.

Considering the maxillary anterior teeth, the patient was an ACE class III, because, even though the incisal edges were extremely thin, the length of the clinical crowns was only reduced of a small amount (less than 2 mm) 23.

Since at the time of the first consultation in the Geneva Erosion Study, however, the ACE classification had not been developed yet, it was planned to restore his maxillary anterior teeth not only with palatal, but also with facial veneers (Sandwich approach).

As a result, the initial treatment plan for his full-mouth adhesive rehabilitation was more invasive and expensive, not only for the additional six facial veneers, but also for the veneer/onlays previously to restore all the maxillary and mandibular premolars. This plan was, however, simplified, while the treatment was progressing.

The case started following a classic 3 step technique approach 24-26. Two alginate impressions were taken and the casts articulated in maximum intercuspitation (MIP), using a face bow. A maxillary vestibular waxup was requested.

Looking at the patient smile, the laboratory technician decided that to achieve a satisfactory esthetic outcome, all the vestibular aspects of the maxillary teeth (excluded the second molars) should have been included in the treatment.

Consequently all the vestibular surfaces were covered by wax and slightly bulked. At the same time, the incisal edges and the occlusal plane were also slightly lengthened (I laboratory STEP) FIG 4.

A silicon key was prepared from this waxed up cast and the patient was scheduled for the maxillary vestibular mock-up visit (I clinical STEP).



FIG4 ABC analyzing the lingualized position of the two central incisors, a additive mock-up was considered possible. The laboratory technician slightly bulked all the vestibular aspects of the maxillary teeth to reduce the need of tooth preparation, while delivering of the facial veneers.



FIG 5 AB following the classic 3 Step technique, a maxillary vestibular mock-up was done, which extended up to the first molars (I clinical STEP). The incisal edges and the occlusal plane were slightly lengthened. The esthetic outcome was of course improved, but the tooth preparation to delivering the facial veneers and the veneer/onlays for the posterior teeth would have required a conspicuous tooth preparation, since the vestibular surfaces were almost intact.

FIG 6 3/4 view of the maxillary vestibular mock-up in place. With the teeth covered by the mock-up the patient did not feel the necessity to hide his smile any longer. Very striking was the difference in color with the antagonistic teeth. External bleaching was considered after the protection of the exposed dentin.

The patient liked his new smile, but the clinician already felt that the patient esthetic request was not the major driving force to seek treatment FIG 5-7.

After the I STEP, the casts, mounted in MIP were analyzed by the clinician. An arbitrary increase of the VDO was decided to obtain an interocclusal space necessary, not only to restore the palatal aspect of the anterior teeth, but also to cover the exposed dentin on the occlusal surfaces of the posterior teeth.

The increase of the VDO was limited by the necessity not to set apart the anterior teeth excessively and loose the possibility to recreate the anterior contact afterwards with a normal-size palatal veneers. Both

the arches, maxillary and mandibular had to be involved in this rehabilitation (double arch distribution). The laboratory technician waxed up the surfaces of the posterior teeth (2 premolars and the first molar in each sextant), and the casts returned to the clinicians who fabricated 4 transparent keys out of them (Elite Transparent, Zhermack, Badia Polesine (RO) Italy) (II laboratory STEP).

After 2 weeks, the patient was scheduled for a 2-hour appointments for the fabrication of the provisional posterior composite restorations directly in the patient's mouth (II clinical STEP).



FIG 7AB the esthetic of the patient was improved, but during a long conversation with the patient, the clinician realized that the patient did not really want to change his look dramatically.

even though he was functioning at an increased VDO and an open bite was present at the level of his anterior teeth FIG 9.

According to the Geneva Erosion Study's protocol, the increase of VDO should be tested for one month. During this time, the patient was seen to remove the caries and to protect the pulp at the level of the palatal aspect of the maxillary anterior teeth.

During this visit, the exposed dentin on the palatal aspect of the maxillary anterior teeth was roughened with a very course diamond round bur, and immediately sealed with Optibond FI (Kerr, Orange, CA, USA), following the manufactures' instructions.



FIG 9 ABC initial status and after the II STEP. Not the improvement of the vertical overlap and the creation of the open bite in the anterior quadrants for the presence of the provisional posterior composite restorations.



FIG 8 AB Four transparent keys were fabricated out of the waxed up casts, loaded with warmed up composite resin and seated in the mouth. After the removal, 9 provisional posterior composite restorations were bonded to the posterior teeth, without any tooth preparation. No anesthesia was necessary (II clinical STEP).

Without anesthesia, the keys were loaded with warmed up composite resin ((Micerium S.P.A., Avegno GE, Italy)) and placed in the mouth FIG 8.

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Since no anesthesia was delivered, the patient was fully collaborating during the control of the occlusion. After 1 week, another control was done, where the patient reported to be comfortable,



To reinforce the hybrid layer, a final application of flowable composite (Tetric flow T, Ivoclar Vivadent, Schaan, Liechtenstein) was placed on the dentin, and polymerized for 40 seconds (20 seconds covered with glicerine) 27-31.

Thanks to the open bite creation, the caries' removal and the dentin sealed, these teeth became mechanically and biologically stronger.

After 1 month from the II step, the patient was scheduled for a 1-hour appointment where a polyvinyl siloxane impression of the maxillary arch was (Express 2 3M ESPE, Seefeld, Germany), to fabricate the palatal veneers.

Since the patient was supposed to receive also the facial veneers, the interproximal contacts between teeth were slightly opened by means of a metallic strips.

No attempt was made to remove the unsupported enamel at the incisal edges, nor to create a margin with the future veneer at the cervical level, since the acid had already created the perfect chamfer and there was no need to weak the band of enamel next to the gingiva FIG 10.

After the impression for the palatal veneers, no provisional restorations were delivered. The reason behind was related to the difficult to eventually cleaning the excesses of the provisional material at the palatal level, which would have inflamed the gingiva, and complicated the moisture control at the time of the bonding of the palatal veneers.

Another reason was the danger of breaking the very thin incisal edges, while removing the provisional restorations, and finally due to the lack of tooth preparation and the immediate sealing of the exposed dentin, the patient was asymptomatic and did not require any tooth protection, as in case of full coverage.



FIG 10 AB After caries' removal and sealing of the exposed dentin, a final impression was taken, without any additional tooth preparation. Note the presence of the enamel at the level of the cervical margins. No provisional restorations were delivered.

The laboratory technician received the maxillary impression and an alginate impression of the mandibular arch. Thanks to an anterior jig, he mounted the two casts in MIP. Six composite palatal veneers were than fabricated (Miris, Coltene, Whaledent, Altstätten, Switzerland) (III laboratory STEP) FIG 11.

The patient was schedule for a 2-hour appointment. No anesthesia was needed. Before the placement of the rubber dam, the palatal veneers were tried in the mouth, to verify the color match at the level of the facial junction.



FIG 11 AB Six composite palatal veneers on the cast (III laboratory STEP). The cervical margins did not need to extend behind the cervical enamel, and thanks to their supragingival margins, the bonding procedures were facilitated.



FIG 12 AB try-in of the palatal veneer before rubber dam's placement. For ACE class III patients, where the facial veneers are not previewed, essential is the color match between the remaining facial surface and the incisal edges added with the palatal veneers.. Note that all the non supported enamel was left intact and no effort was made to make a chamfer on the facial surface. This conservative attitude saved the original length of the tooth, but made more difficult to blend the joint with the palatal veneers.

Surprisingly, the extremely transparent color was very nicely masked by the palatal veneers without giving an opaque aspect to the new incisal edges FIG 11.

FIG 12 AB try-in of the palatal veneer before rubber dam's placement. For ACE class III patients, where the facial veneers are not previewed, essential is the color match between the remaining facial surface and the incisal edges added with the palatal veneers.. Note that all the non supported enamel was left intact and no effort was made to make a chamfer on the facial surface. This conservative attitude saved the original length of the tooth, but made more difficult to blend the joint with the palatal veneers.

The palatal veneers were bonded, one at a time, using the rubber dam. The palatal sealed dentin was sandblasted (Cojet (27µm), 3M, Espe, Seefeld, Germany), the surrounding enamel was etched (37% phosphoric acid), and the bond (Optibond FL, Kerr, Orange, CA, USA) was applied but not cured yet.

The composite veneers were sandblasted (Cojet) and cleaned in alcohol with ultrasound. Three coats of silane were applied (Mondobond plus, Ivoclar Vivadent, Schaan, Liechtenstein). A final layer of bond (Optibond FL, Kerr Orange, CA, USA) was used without curing, the warmed-up composite was then applied to the restoration (Micerium S.P.A., Avegno GE, Italy) before placing them one at a time on the teeth and light cured FIG 13-14.

Thanks also to the presence of a composite "hook" at the level of the incisal edges of the veneers, it was easier to achieve a correct positioning, even on the "slippery" palatal surfaces. The hooks were subsequently removed during finishing and polishing FIG 15.

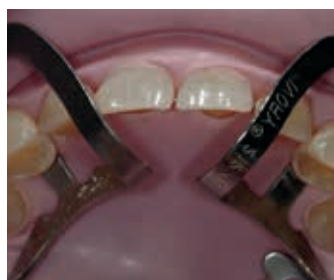


FIG 13 After the rubber dam's placement, the palatal veneers were bonded two at a time. Two hours were necessary to complete the procedure. No anesthesia was delivered (III clinical STEP).



FIG 14 AB the interproximal contacts were adjusted, but there was not an effort to close them tightly, since facial veneers were also previewed. since these latter restorations were not delivered, some of the interproximal contact points were slightly open. Note the incisal hook to stabilize the veneers on the slippery palatal surfaces.



FIG 15 After the bonding of the palatal veneers, the incisal hooks are removed. It is recommended to make the hook in a different color (e.g. dark dentine color) to be more visible, while being removed. in this specific case, it was more difficult, since the technician used a enamel color.

After two weeks, the patient returned to complete the restoration of the maxillary anterior teeth with facial veneers, and he expressed his satisfaction with the result already obtained FIG 16. He verbalized that his wish was to save and strengthen the incisal edges and not to completely change his look.

Even the patient's tooth color was not an issue anymore, and he decided not to bleach his teeth. He did not mind the difference of color at the level of the incisal edges (especially the canines), where the palatal veneers were made lighter to give some luminosity to the patient's teeth from the palatal aspect.

The clinician, who had assumed that whither and bigger teeth were necessary, was surprised, but agreed with the patient that the vestibular aspect of the restored maxillary anterior teeth had already a very pleasing aspect and there was no need to rush to deliver the facial veneers.

Consequently, it was decided to wait, and to see if the composite veneers alone could have strengthened the very compromised incisal edges in this patient, who was used to clench his teeth.



FIG 16 AB when the patient return for the facial veneer preparation, the color match was very pleasing at the level of the incisors, and questions arised on the necessity to restore the patient with the Sandwich approach.

After 1 year of stand-by, the patient was still very satisfied with the palatal veneers, and it was decided together with the patient to change the treatment plan also for the posterior teeth that would have been restored with composite onlays, instead of ceramic veneer/onlays.

This new treatment plan was related to the decision not to deliver the facial veneers on the anterior teeth, which would have bulked these teeth, allowing also to bulk the facial aspect of the posterior teeth.

Keeping the facial surfaces of the the patient as it was, more tooth preparation would have been necessary to deliver the facial/onlays on the posterior teeth.

In agreement with the patient, it was preferred to restore his posterior teeth composite than ceramic onlays, since the occlusal thickness was limited (less then 1.5mm), being a double arch distribution, and tooth preparation to obtain thicker restorations was not considered as an option.

The new treatment plan was very welcome by the patient, also because the cost was reduced.

At the end of the treatment a occlusal guard was delivered to the patient, who entered in the Geneva Erosion Study follow-up program.

At the 3 year follow-up the palatal veneers were aging very well. Not only all the restoration did not present discolorations or sign of mechanical failure, but also all the teeth maintained their vitality FIG 17-19.

17 AB 3 year follow-up, the restorations were aging very nicely. The patient did not want to do the bleaching to match better the color at the level of the canines, and he was very satisfied with the overall treatment. The only negative comment on the aging of the restored teeth was the opening of a diastema between the two central incisors. Most probably the initial contact point was not strong, since facial veneers were also previewed. Nevertheless no food impaction or esthetic problem were reported by the patient.





FIG 18 ABCD initial status and at the 3-year follow-up.



FIG 19 Occlusal view at the 3 year follow-up. No margin discolorations or failure of the palatal veneers were noticed, and all the teeth maintained their vitality.

The clinical unexpected success of the palatal veneers to restore these very compromised dentition confirms the tennis racket's theory. According to this theory, the maxillary anterior teeth affected by dental erosion present a framework of enamel which make them still very strong.

This framework, composed by the cervical, mesial and distal and all vestibular enamel of the remaining tooth structure, is responsible for a tooth rigidity where even very undermined and unsupported enamel could be preserved and strengthened by a very thin composite palatal veneer.

Finally, in case of these compromised teeth, the potential for a vitality loss could be anticipated. The endodontic access could be easily made through the palatal veneer and close afterwards with a direct composite.

DISCUSSION

The treatment of this patient was driven by the maximum tooth preservation's objective, which pushed the clinicians to take several unusual decisions.

One of them was to start the dental treatment before that the cause of dental erosion was discovered. The urgency to start the treatment, even before that the diseases is arrested, is related to the preservation of the pulp vitality and the remaining undermined tooth surfaces.

As often it happens, asymptomatic patients, where an intrinsic cause of dental erosion is suspected, do not complain to clinician's request to look into the functionality of their digestive system, and if they do, after the first consultation and the first year of treatment, they tend to disconnect the relationship with the gastroenterologist.

Thus it difficult for a dentist to determine if the cause of dental erosion is still present or if it will be present again in the future. Especially in case of patients affected by gastric reflux, the authors strongly recommend to start the dental treatment, regardless if the cause of dental erosion will be treated or not.

The initial treatment plan was more complicated and expensive, since facial veneers for the anterior and veneer/onlays for the posterior teeth were also considered.

At the beginning of the treatment, the clinicians was driven by the assumption that the patient wanted to change completely his look. However, after obtaining the preservation and strengthened of the remaining tooth structure, the patient was already very satisfied, and additional treatment was not longer necessary.

Following the classic 3 Step technique, it has been recommended to start with a maxillary vestibular mock-up, to determine the plane of occlusion (I STEP).

This option is, however, reserved to the very compromised cases, where the position of the teeth is particularly altered (e.g. reverse curve of Spee), in order to help the laboratory technician to gain more clinical information before wax up the posterior quadrants.

This patient had a very compromised dentition, but the facial aspect of his teeth were almost intact, except the incisal third, and no major tooth supraeruption was evident. He was a ACE class III FIG 20.

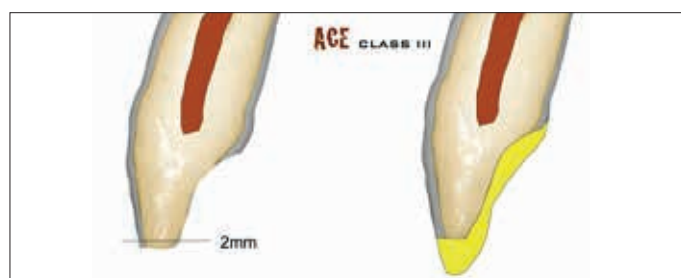


FIG 20 In ACE class III patients the palatal enamel is lost, the palatal dentin exposed extensively, and the incisal edges is fractured. However the clinical crown had lost in length less than 2 millimeters. Palatal veneers are the recommended treatment.

When the tooth destruction is less severe and the anterior teeth could be restored only by means of palatal veneers (ACE class II and III), there is not need to do a mock-up to determine the plane of occlusion; the laboratory technician can, in fact, easily visualizes it in relation to the future incisal edges' position, just looking at the articulated initial models and the photos of the patient's smile.

Consequently after the first consultation, ACE class III patients directly proceed to the II step of the 3 Step technique (increase the VDO and delivering the provisional posterior composite restorations on the posterior teeth). The I step is not necessary. In this patient, the first step, the maxillary vestibular mock-up was unnecessary done.

Another aspect of this case that could have been done better was the delivering of the palatal veneers, thinking that the patient would have also received the facial ones.

When the maxillary anterior teeth are meant to be restored by the Sandwich approach (both palatal and facial veneers), it is not necessary to restore the interproximal contacts with the palatal

veneers, since these contacts will be removed, when preparing the teeth for the facial veneers.

In the specific case, the wrong planning about the facial veneers led to a more superficial adjustment of the contact points between the palatal veneers, which were not so tight. At the 3-year follow-up a diastema between the two central incisors became apparent, may be related to the interproximal instability. No clinical or esthetic consequences were reported by the patient though.

CONCLUSIONS.

Dental erosion is a spreading disease, which could be nowadays immediately addresses with minimally to no invasive treatments. Thanks to the adhesive techniques, such as the composite palatal veneers, maxillary anterior teeth at risk of incisal edge's fracture can be restored and strengthened. These techniques must be simple and economic, since they involve almost the all dentition and few patient can effort to pay a full-mouth rehabilitation with crowns and devitalized teeth. To treat a larger number of patients the total cost of the treatment should be kept accessible.

In this article, a simplified treatment of a patient affected by dental erosion is presented. The patient was supposed to be restored by crowns and all the anterior teeth devitalized. Following the 3 Step technique, instead, the patient received only 6 composite palatal veneers, with no additional tooth removal. The treatment was done without anesthesia.

At the 3 year follow-up, the maxillary anterior teeth were still vital and the restorations did not present any signs of mechanical failure. Nevertheless the patient was very satisfied with the overall treatment.

After several years of clinical experience in restoring patients affected by dental erosion, palatal veneers are becoming a very reliable treatment which should be offered without hesitation to every patient at risk of fracturing his/her incisal edges.

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