



A Minimally Invasive Approach to Restore Function and Esthetics in Periodontally Involved Teeth

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Abstract

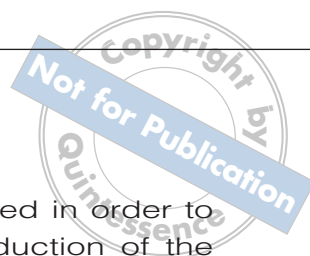
The objective of dental treatment is the elimination of the etiologic factors, the rehabilitation of function and esthetics, and, when possible, the maintenance of vitality and structure of the natural dentition. After the loss of the periodontal support, as a consequence of periodontal disease, it may be necessary to splint the residual teeth in order to improve their stability, and sometimes it is also necessary to modify the morphology to optimize the final esthetic outcome. In many periodontally treated teeth, prosthodontic treatment on the residual dentition will be required with an important loss of tooth structure as an unavoidable consequence. This procedure frequently requires endodontic treatment of the residual abutments in

order to obtain the necessary space for replacement materials.

Similar objectives could however be achieved through an alternative therapy where the esthetic remodeling of the teeth and the closure of the interproximal spaces is obtained with composite resin materials. The objective of this article is to present an alternative protocol to optimize the functional and esthetic result of periodontally treated cases, where the most frequent complication is the increased length of the clinical crown. This is obtained by utilizing a different conservative approach, which has as its main objective the stabilization of the residual teeth, the maintenance of their vitality, and the achievement of the best esthetic result possible.

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Restoration of periodontally treated teeth

Although implant therapy has dramatically changed treatment planning, still today the best therapeutic option for periodontal treatment is to maintain the residual natural teeth that have a good prognosis.

Limiting our considerations to periodontally susceptible patients, the survival of prosthodontically rehabilitated teeth after 10 years is 89%,¹ while in the same patients implant survival is approximately 84%.²⁻⁵ From the literature available it is not possible to conclusively establish if maintenance of natural teeth through periodontal treatment is a more predictable therapeutic option compared to implant therapy.

After periodontal treatment, the most serious esthetic consequences are lengthening of the clinical crown, gingival recessions, teeth migration and flaring, alteration of free gingival margin levels, alveolar crest collapse and alteration of interproximal tissue volume and, as a consequence, the opening of the so-called “black triangles.”

These esthetic problems must be solved by means of a multidisciplinary approach, which in the majority of cases will involve orthodontics, endodontics, operative dentistry, and in many cases prosthodontics.

These treatment approaches require sound know-how of the dentist and a consistent psychological and economic commitment of the patient.

In addition, if the treatment plan includes splinting of the residual dentition by means of a prosthodontic rehabilitation, in most of the anterior teeth endo-

dontic treatment is required in order to obtain the necessary reduction of the abutments to allow proper space for the restorative materials and, as a consequence, adequate emergence profiles. Obviously, these solutions have a very high “biologic price.”

For this reason, an alternative to the prosthodontic rehabilitation of the abutments, in order to obtain the splinting effect and to modify the morphology of the clinical crown, is the use of composite resins. Sometimes in fact it is necessary to present patients simplified treatment planning when physical, psychological, or economic limitations are present. Otherwise, a more conservative approach is preferred to meet the “minimally invasive” philosophy of treatment.

Naturally, in these cases the optimal outcome could be more difficult to achieve as well as predictability and long-term stability.

Adhesive and restorative techniques

Adhesion to tooth structures has been investigated thoroughly in past years, leading to consistent scientific evidence on the possibility of utilizing adhesion between composite resins and natural teeth by means of modern adhesive resin materials.

Different adhesive materials can be utilized during restorative procedures with composite resins, but the “gold standard” is still considered an etch-and-rinse system in three steps (etching, primer, and bond). Otherwise, in order to achieve good results, especially with dentin, a self-etch two-step system



could be preferred (acidic primer and bonding).⁶

As a consequence of periodontal disease, the patient often ends up with altered tooth length that can expose radicular cement to the oral environment. Consequently, adhesion to these structures is often required. It has been demonstrated that the hybrid layer depth that can be obtained in cementum is comparable to dentin.⁷

In the proposed protocol, a three-step bonding system has been preferred (etching, primer, and bonding). In regard to the cervical lesions of periodontally compromised teeth, it is important to underline that hard tooth structure is represented only by radicular dentin, most often without the radicular cementum, due to non-surgical and surgical periodontal procedures that these teeth have been subjected to. In addition, in these areas, a more sclerotic type of dentin can be noticed.

Many studies have demonstrated how bonding systems' resin infiltration into sclerotic dentin is shallower compared to normal dentin.⁸⁻¹¹ As a consequence, this difference between normal and sclerotic dentin has resulted in the reduction of shear bond strength from 45% to 20% with modern bonding systems.^{12,13}

However it must be considered that these types of restorations are not stressed by direct masticatory processes as normal Black Class IV caries, and if a rigid adhesive protocol is followed¹⁴, an excellent clinical outcome can be achieved both for resistance and

microinfiltration, as occurs with Black's Class V restorations.

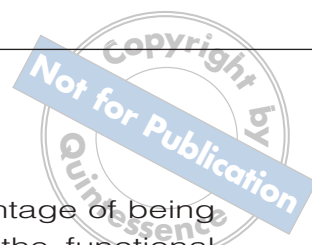
One of the most frequent problems that one can encounter is marginal infiltration due to bonding efficacy, operating technique and material, as it has been well demonstrated in the literature.¹⁵⁻¹⁷ Today there is evidence that an adequate marginal seal can be obtained with different bonding agents.¹⁸

Isolation of the field and absence of moisture is absolutely recommended during adhesive and operative procedures, and for this reason the use of a rubber dam is advisable.¹⁹⁻²¹

Another aspect that has to be considered is that in this type of restoration, if possible, an approach that does not include tooth preparation is preferred. This protocol allows clinicians to approach the case in a real non-invasive treatment but, on the other hand, one does not have a defined finish line and consequently it is more difficult to avoid overhangs on the restoration margins. A good control of composite stratification and finishing of the material is mandatory.

The margin location should be supra-gingival or equa-gingival in order to avoid overhangs that would be very difficult to finish properly and, as a consequence, facilitate plaque accumulation and determine inflammation of the marginal tissues.

The use of magnification systems during the stratification and finishing phase is highly recommended for better control of the margin accuracy.²²



Clinical protocol for non-splinted teeth

After completion of periodontal treatment, it is most likely that the interproximal volume of tissues will have changed, with a consequent appearance of the so-called “interproximal black triangles.” Many times, the morphology of the teeth is not favorable, since the shape is extremely triangular and the interproximal contact point is very incisal. Following Tarnow’s guidelines,²³ the chances of having a complete fill of the interproximal space by the soft tissues is dependent on the distance from the interproximal height of bone and the teeth contact point. Sometimes, also due to the shape of the clinical crowns, this distance is excessive and as a consequence it will be almost impossible to expect filling of the space by the papilla (Figs 1 to 4).

This excessive space can determine phonetic problems as well as an esthetic problem, especially if the patient presents a high smile line. The therapeutic options in this case that allow modification of the shape of the teeth and the interproximal contact point are essentially two: one will require prosthetic treatment, the second an operative approach. Obviously, having an extremely triangular shape, in order to have the required space for an esthetic result with an appropriate emergence profile of the restoration, an endodontic treatment of teeth could be required. There could be also a third option, which is a removable flexible gingival epithesis.²⁴ The gingival

epithesis offers the advantage of being inexpensive and solves the functional and esthetic deficiency with an expedited treatment, but most often needs to be redone every two/three years. Another disadvantage of this option is that it is removable. Today, more and more patients prefer fixed restorations.

The protocol that is described in this article to treat situations with these characteristics is represented by a conservative approach utilizing direct composite resins.

After all the steps necessary to obtain proper adhesion of the bonding agents, the morphology of the teeth is modified without any removal of healthy and sound enamel (Figs 7 to 10).

Following the presented protocol, the shape of the teeth can be modified to transform the contact point into an area with the apical part much closer to the interproximal bone peak, getting as close as possible to the 5 mm suggested in the literature²³ (Figs 11 to 15).

The emergence profiles of the teeth can be much more prominent compared to untouched natural teeth and may interfere with the hygiene procedures, but these can still be successful with appropriate tooth brushing and flossing techniques (Figs 17 and 18).

It is advisable to take post-treatment radiographs in order to better evaluate the appropriateness of the restorations (Fig 16) and the recall appointments are very important to evaluate the restorations and the soft tissue conditions (Figs 19 and 20).



Fig 1 Initial situation after periodontal treatment.



Fig 2 Palatal view.



Figs 3 and 4 Excessive interproximal spaces and the presence of the “black triangles” are noticeable. The objective of the treatment is to improve esthetics and phonetics.

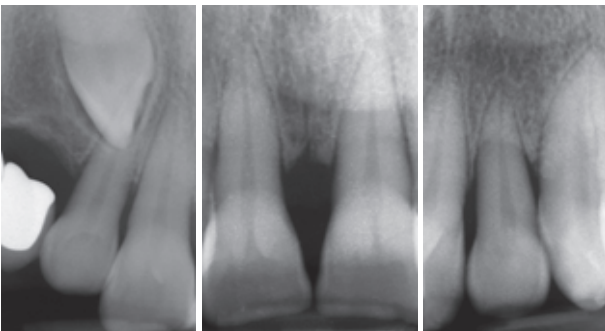


Fig 5 Radiographs before restorative treatment. Reduced but stable bone levels after periodontal treatments can be appreciated. Impacted canine will be extracted and replaced with an implant.



Fig 6 Before restorative treatment it is advisable to make a waxup to visualize the final morphology of the crowns after remodeling.



Fig 7 and 8 The adhesive procedures (etch-and-rinse system) are limited to the cervical and interproximal hard tissues; the use of rubber dam is advisable.



Fig 9 and 10 Tooth-by-tooth remodeling (if necessary with an additional clamp), with dentin and enamel composite materials.



Figs 11 to 14 Different views of final restorations.

Fig 12



Fig 13



Fig 14



Fig 15 Smile after treatment.

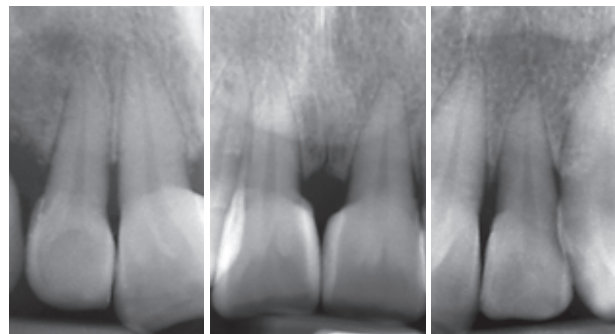


Fig 16 Radiographs after treatment.



Fig 17 and 18 Flossing procedures are guaranteed despite the increased emergence profile.



Fig 19 and 20 Detailed views of 18-month recall after treatment.



Fig 21 Clinical view of pre-treatment. In the case where a patient presents a very compromised periodontal situation one of the possible treatment plans could be the extraction of all the maxillary teeth and the immediate placement of eight osseointegrated implants. The treatment planning for the mandibular arch consisted of a non-surgical periodontal treatment immediately after an extra-coronal splinting with composite resin. The different approach reserved for the maxillary arch compared to the mandibular arch was due to the different mobility of the residual teeth. At the first appointment the maxillary teeth presented a grade 2 mobility, compared to a grade 1 mobility of the mandibular teeth.

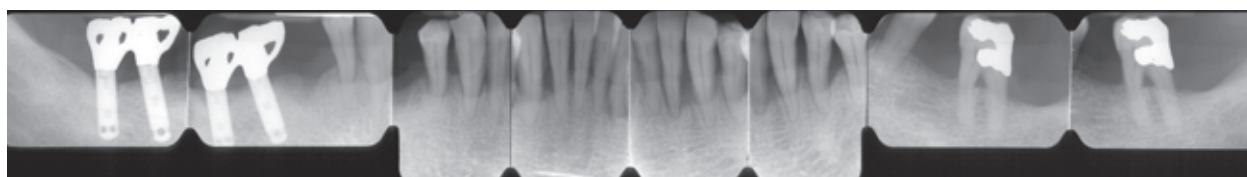


Fig 22 Pre-treatment radiographic examination of the mandibular arch.

Clinical protocol for splinted teeth

When a patient presents excessive mobility of the residual teeth that would impede the ideal masticatory function and limit the patient's comfort, splinting of the dentition is recommended. In fact, frequently, in spite of proper periodontal treatment and occlusal equilibration, periodontal tissues are not able to bear the occlusal functional forces and above all the parafunctional ones.²⁵⁻²⁹ These circumstances can be avoided by splinting the teeth with a composite ligature or with a removable splint.³⁰

The therapeutic options that allow modification of the crown morphology and at the same time splinting the residual teeth, which is critical with severely reduced periodontal attachment (Fig 34), are again essentially two: a prosthetic or operative approach. Due to the root anatomy, in order to obtain the appropriate emergence profile of an eventual fixed partial denture avoiding overhangs, most likely an endodontic treatment of the mandibular teeth could be required to allow appropriate space for dental materials.



Fig 23 Clinical view after perio-prosthetic treatment. After proper perio-prosthetic treatment necessary for the rehabilitation of function and esthetics, the patient is enrolled in a strict supportive periodontal treatment and recall prosthetic program.



Fig 24 and 25 A few months after completion of treatment, the patient may express the desire to close the mandibular anterior interproximal spaces that cause slight discomfort during speech and an altered esthetic smile. Lateral views of smile after perio-prosthetic treatment before mandibular anterior teeth remodeling. The black triangles can be noticed between the mandibular teeth.





Fig 26 Rubber dam application retained by two clamps on distal teeth.



Fig 27 Adhesive procedures on teeth to be re-modeled and splinted.



Figs 28 to 31 Details of step-by-step direct layering phases of composite.



Fig 29



Fig 30



Fig 31



Fig 32 Selection of size of the mandibular teeth fiber-reinforced composite splinting.



Fig 33 Occlusal view of splinted mandibular natural teeth.



Fig 34 Detailed view of unrestored mandibular anterior teeth after non-surgical periodontal treatment.



Figs 35 and 36 Views of completed case after direct composite restorations of mandibular anterior teeth.



Fig 36

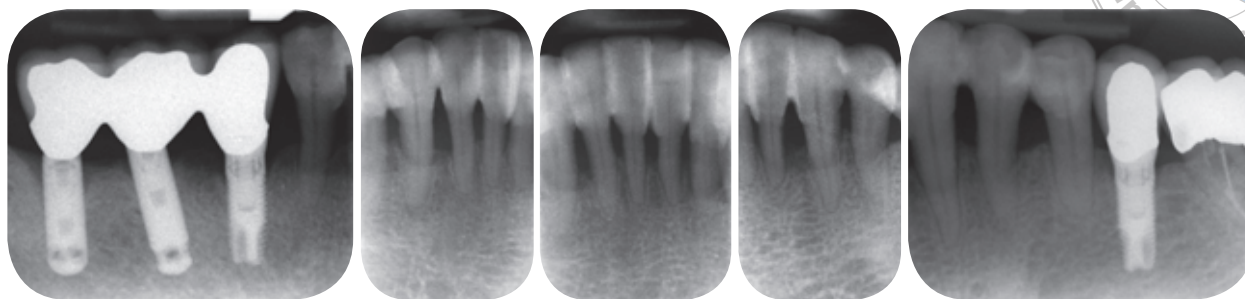


Fig 37 Radiographs of completed composite application. From a radiographic point of view it can be noticed how the splinting of the teeth has been obtained as well as maintaining the vitality of the residual teeth. The improvement of the hard periodontal tissues is evident, compared to the initial situation.

In these types of patients an alternative treatment plan, which allows the alteration of the profiles of the teeth without any reduction of enamel, has been preferred. The material used was composite resin.

After rubber dam application (Fig 26), the treatment is divided in two phases: during the first phase, the shape of the teeth is modified (Figs 27 to 31), and in the second phase the residual teeth are splinted (Figs 32 and 33).

Obviously, the esthetic outcome is less ideal compared to a fixed partial denture, nevertheless it must be remembered that this treatment would have involved a very high biological cost. On the contrary, the preferred therapy does not involve the structure of the teeth and consequently the maximum conservation of teeth can be achieved (Figs 35 and 36).

Conclusions

The present study offers an alternative to prosthodontic treatment to modify the morphology of the teeth that have been treated periodontally and consequently

present an altered interproximal volume with the presence of “black triangles.”

Advantages of the presented approach

- Maximum conservation of residual tooth structure.
- Maintenance of vitality of the teeth.
- Minimum cost and fewer appointments needed.

Disadvantages of the presented technique

- Difficult technique: one of the major problems encountered has been the management of the composite resin in the interproximal areas. In fact, modifying the interproximal emergence profiles of the teeth, maintaining individuality of the teeth and at the same time making a cleanable anatomy require a particular ability in handling the materials.^{31,32}
- Lack of scientific support: especially regarding the adhesion to radicular dentin and to cementum. It would be desirable to have more information regarding the long-term prognosis of

these restorations in the clinical circumstances that have been presented. At present the only data available are related to class V restorations.

- Esthetic results: they can be less ideal compared to fixed partial dentures. In any case, even with conventional approaches, advanced periodontal cases will not allow ideal esthetics. The remodeling of long teeth and the color integration with direct composite resin application require a thorough knowledge of the characteristics of the materials used, as well as good manual dexterity. As a matter of fact, it is not always possible to avoid small imperfections in the adaptation of the material on the unprepared teeth, but these are not recognizable without magnification devices.

All of these disadvantages are widely overcome by the advantages, namely, the maintenance of tooth vitality and residual tooth structure. Predictability will not concern survival of the teeth but a potential replacement of the direct restoration.

The composite resin application by means of direct techniques is a valid alternative, even though the technique difficulty and the longevity of this type of restoration must be noted.

In favor of this approach, on the other hand, are the possibilities of maintaining the natural tooth structures, the ability to esthetically splint the natural dentition as well as maintaining the vitality of the teeth. Last but not least, a very high patient appreciation has been indicated for this type of treatment, where maximum conservation of natural dentition is pushed to the extreme.



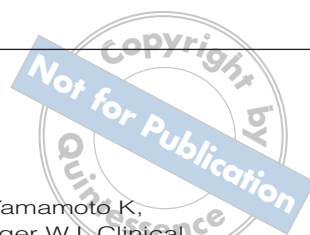
Figs 38 and 39 Lateral views of smile after treatment. The black triangles on the mandibular teeth are resolved.



Fig 39



Fig 40 Detailed view of mandibular anterior teeth at 18-month recall.



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