Guidelines for periodontal prostheses serve esthetic and functional demands: A case report

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Periodontal-prosthesis guidelines have long been defined to specifically address dental reconstructions after moderate to advanced periodontal disease has occurred. More recently, specific dental techniques and materials have shown promise in addressing patients' increasing esthetic demands. However, treatment planning to achieve pleasing results for patients with advanced periodontitis requires a complex, multispecialty approach that is rarely discussed. A case report and literature review illustrate that the original periodontal-prosthesis guidelines not only remain useful today for obtaining esthetic results but also conform to recent understanding of maxillomandibular physiology. (Quintessence Int 2002;33:489-495)

Key words: esthetics, periodontal disease, periodontal-prosthesis guidelines, prosthesis, treatment planning

Advances in esthetic dentistry have allowed the dental profession to master intracoronary and extracoronary restorations, crowns, fixed partial dentures, dental implants, and the management of periodontal tissues. However, isolated esthetic deformities are often addressed in a specialized manner, often requiring a multidisciplinary approach to achieve an esthetic result.

Esthetic treatment planning requires the combination of several factors. First, the esthetic goal must be established. This is the role of the prosthodontic or restorative practitioner, who establishes final objectives before treatment begins. Second, periodontal health and stability must be achieved in a way that provides an esthetic "background" for the prosthesis. Other requirements may involve orthodontic movement for ideal placement of teeth or abutments and optimization of periodontal and occlusal stability. Finally, osseous bases and facial harmony may be corrected through maxillofacial surgeries.

Application of this multidisciplinary approach has been the task of the traditional periodontal-prosthesis discipline. These periodontal-prosthesis guidelines have been discussed elsewhere. The purpose of this case report is to illustrate that the traditional guidelines remain relevant in view of modern research and can provide restorations that satisfy high esthetic demands.

CASE REPORT

A 59-year-old man wanted to obtain a fixed esthetic restoration (Fig 1). He reported irregular dental visits in the past, and all dental restorations and prostheses were at least 10 years old. Missing teeth had been lost progressively, prior to fabrication of a removable partial denture, which he did not wear (Figs 2 and 3).

Findings of the extraoral and intraoral examinations were unremarkable. His smile was wide, showing up to the maxillary first molars and about 5 to 7 mm of gingival tissues in the anterior region. The patient was concerned about his "gummy smile". The buccal concavity and the space between the maxillary left lateral incisor and canine were the result of healing following the extraction of a retained primary canine shortly before fabrication of the fixed partial denture.

Signs of the loss of vertical dimension of occlusion included the loss of posterior support (the loss of teeth and loss of tooth structure), diastemas, and an...
The patient had generalized moderate chronic periodontitis. These findings were correlated with a radiographic survey, which also revealed pulpal pathoses and endodontic failures (Figs 4a to 4c).

A comprehensive treatment plan was designed to first treat infectious diseases and then address esthetic and functional defects by reestablishing a pleasing smiléline while building posterior support at an increased vertical dimension of occlusion, to be established during treatment. To achieve these goals, a complete-arch maxillary fixed prosthesis anchored on all remaining teeth and posterior mandibular single crowns were offered as a desirable option and accepted by the patient.

Treatment was initiated with a periodontal phase (scaling, root planing, and oral hygiene instructions), accompanied by endodontic treatments and re-treatments. After reevaluation, periodontal surgeries for the
entire mandibular arch were performed to eliminate residual pockets and recontour bony architecture.

A diagnostic waxup was performed after casts were mounted on a semiadjustable articulator and the vertical dimension of occlusion was arbitrarily increased by 1 mm in the canine area. Incisal edges were positioned by taking clinical measurements of the projection of the lip during smiling on the anterior teeth and transferring the information to the cast. Positioning the incisal edges more apically also reduced the crown height, consequently decreasing the excessive overbite. The entire plane of occlusion was redefined using the new incisal edges as references.

Contact between maxillary and mandibular incisors and canines was maintained by creating a maxillary palatal platform. This was achieved by enlarging the palatal portion of anterior crowns until a contact was possible with mandibular teeth. However, the width of the platform was limited to avoid impinging on the tongue space. Mandibular posterior teeth were also waxed up to accommodate the new plane of occlusion.

A first set of provisional restorations was processed from the diagnostic waxup and placed in one appointment without consideration of tooth proportions. This was done with the knowledge that further maxillary crown lengthening and clinical testing of the new occlusion and anterior guidance were necessary. The new vertical dimension of occlusion, the occlusal plane, and the positions of the incisal edges in harmony with the smileline were tested and adjusted.

Once these parameters were acceptable, new casts with provisional restorations in place were mounted. A surgical template was prepared from the provisional prosthesis after modification of the study cast to allow ideal canine-to-canine harmony (teeth length and gingival margins). An alginate impression of the satisfactory provisional prosthesis was taken, and the cast was utilized to carve the stone gingivally to obtain ideal crown proportions. Measurements were verified clinically to ensure that gingival margins would be placed so that slight lip coverage would exist when the patient smiled widely. These distances were also evaluated on periapical radiographs to evaluate the amount of future root exposure and to ensure that sufficient bone support would remain after the crown-lengthening surgery. Next, a provisional appliance was processed and relieved to convey incisal edge positions while covering buccal tissues, thus serving as a guide to the surgeon.

The template was positioned in place of the provisional prosthesis at the time of surgery. Its contours were followed and the osseous topology was remodeled accordingly to account for establishment of the biologic width. The pontic area of the maxillary left canine was augmented with a connective tissue roll. This augmentation was performed to compensate for the buccal concavity in the pontic area and to simulate canine root eminence.

During the healing period, labial orthodontic movement of the mandibular anterior teeth was initiated to eliminate crowding and root proximities and to reduce the overjet (Figs 6a and 6b). Splinted provisional mandibular posterior crowns served as anchorage during this 5-month procedure. Incisal adjustment of the anterior teeth was also performed to level the mandibular plane of occlusion and decrease the overbite further, thus obtaining an ideal relationship to the maxillary teeth.

Once all modifications were completed, impressions of both arches without provisional restorations were taken and casts were mounted. Casts of the existing provisional prostheses were also fabricated to duplicate the positions of incisal edges in a new waxup. A second provisional prosthesis was then processed, inserted, and adjusted to assess all functional and esthetic aspects (Fig 7).
For final restorations, a maxillary ceramometal prosthesis, extending from the maxillary right third molar to the left second molar and having a precision attachment between the right first premolar and canine, was placed. In addition, posterior mandibular single porcelain-fused-to-metal crowns were placed (Figs 8 and 9).

**DISCUSSION**

One of the key features of periodontal-prosthesis guidelines is to diagnose posterior occlusal collapse and the accompanying loss of occlusal vertical dimension (OVD). This slow process can be masked by a preexisting orthodontic malocclusion. In addition, previously placed dental restorations may have been adapted to an existing breakdown and therefore may camouflage pathologic changes. The patient described in this case report exhibited both posterior bite collapse and a preexisting malocclusion.

In addition, signs of further occlusal collapse, such as loss of posterior support because of loss of restorations, opening of interdental spaces, and crowding of mandibular anterior teeth, are clearly associated with loss of vertical dimension, although this last sign is also thought to occur in normal conditions. The diagnosis of loss of OVD is often based on clinical signs, but there are no techniques available to obtain an objective evaluation.

The discipline of periodontal prosthodontics often requires the correction of the loss of OVD to recover anterior guidance and to ensure posterior occlusal harmony and long-term stability of the reconstruction. The use of a reversible technique, such as a removable appliance, allows testing of this clinical hypothesis. An occlusal guard, a modified Hawley bite plane, or a Sved appliance may be used when indicated. Alternatively, provisional fixed partial dentures can serve as an irreversible appliance to test a change in the OVD.

Animal and human studies suggest that a reasonable modification of the vertical dimension by prosthetic means triggers an adaptive process, finding that contradicts earlier beliefs. Even the rest position, often utilized as an occlusally independent landmark, may vary with changes in the OVD. Therefore, a range of vertical dimensions may be used to overcome the breakdown process as well as to serve prosthetic and esthetic needs.

Other aspects also must be considered when an OVD is selected; a decision must be made as to whether the lost vertical dimension should be restored, because the patient has already adapted to this slowly established condition. Facial harmony can be of help in the decision-making process and may be evaluated using standards of esthetic proportions.

Another traditional approach, adapted from complete-denture techniques, is the use of speech-based estimations to determine the ideal OVD. Unfortunately, the presence of anterior teeth and the absence of posterior teeth interfere with the sounds, and early evaluation is difficult. Pronunciation of sounds can adapt to limited changes in the OVD, although more extensive changes can impair speech spaces. Speech space may be lost when loss of OVD results from tooth wear. Finally, a great variability exists within the same subject, when repeated measures are taken.

Certain patients, such as those with deep bites (similar to the patient presented in this report), may in fact
be more prone to increased muscular activities and possible discomfort when the vertical dimension of occlusion is increased. Practically, it seems that moderate alteration of the OVD can be introduced as long as a stable and functional occlusal scheme is developed. Therefore, it is recommended that this stage be achieved as quickly as possible and that adjustment visits be scheduled within a short time frame.

There have only been few reports in the literature that provide roadmaps for diagnosis and treatment of occlusal breakdown. One attempt suggested a classification and specific therapeutic schemes, from healthy, stable occlusion to overall (anterior and posterior) occlusal breakdown. The patient described in this report would be in the most advanced category, requiring treatment of the OVD, anterior guidance, and posterior support.

Technical convenience and esthetic considerations may partly determine the appropriate vertical dimension, which can vary within a reasonable range. First, increasing the interarch space may be helpful to provide room for restorative materials. Second, the anterior guidance may be modified while the vertical dimension is changed. For instance, increasing the OVD will move the mandible to a more distal position because of the axes of rotation. Consequently, the overbite will increase and a platform may be necessary on the palatal side of the maxillary anterior teeth. Third, the ideal esthetic placement of incisal edges is often useful in determining anterior guidance and helps in the selection of an appropriate vertical dimension. The positioning of the posterior teeth and cuspal angulations can then be established, according to the anterior and posterior guidance. Therefore, the restorative vertical dimension of occlusion is dependent on functional and esthetic determinants.

Once occlusal determinants have been set up, further crown lengthening may be needed to gain esthetic proportions for anterior teeth. In the present case, part of the esthetic procedure was addressed by pocket elimination alone. Therefore, it is important to predict the extent of the root exposure after elimination of diseased pockets, because it may extend beyond necessary esthetic lengthening.

An estimation of gingival display must take place to establish a proper treatment strategy. A short upper lip would be impossible to treat unless facial surgery is introduced. Another common etiology of the gingival smile is an altered passive eruption, which is accompanied with short clinical crowns in their proper position.

Alternatively, downward positioning of the anterior maxilla may be caused by a primary vertical maxillary excess or a secondary extrusion, often found when loss of OVD has occurred with a Class II malocclusion. Vertical maxillary excess can be diagnosed by analysis of facial proportions to detect a lower face that is disproportionately shorter than the midface (see Fig 1). The findings can be confirmed with cephalometric analysis, and correction may require orthognathic surgery.

Alternative comprehensive measurements of soft tissues have also been proposed to take purely esthetic criteria into account. Overeruption of the anterior maxilla with time can be diagnosed when the gingival line (an imaginary line joining midfacial gingival margins) is concave (see Fig 1). Other signs may be present as well, such as loss of posterior vertical dimension, wear of incisal edges, crowding of mandibular anterior teeth, and the presence of crowns.

It is usually recommended that the gingival margins as well as the alveolar housing be repositioned by means of orthodontic or orthognathic surgery. In the patient described in the present report, both a primary malocclusion and a secondary extrusion were present. This scenario required additional attention, because the original malocclusion was masked by further changes in OVD.

There are few guidelines to determine when these deformities require orthodontic and/or orthognathic treatments rather than compensation with periodontal surgeries alone. This last option may be desirable, because time and surgical involvement are minimized. On the other hand, periodontal surgery may increase interdental spaces when bone is removed and leave "black triangles." Thus, root shape is a critical element: Parallel roots are favorable to periodontal crown lengthening, because apical positioning of tissues will not increase the interdental spaces; in contrast exposure of conical roots will increase the risks of black spaces after healing. Teeth with conical roots also possess more triangular crowns and coronal contact points, thus defining wide interdental spaces, whereas teeth with parallel roots tend to have more squared crowns with wide contact points.

When teeth are splinted with fixed partial dentures, only some compensation of the black triangle deformity is possible by stretching the contact points, thus defining square teeth in a patient who may have had triangular natural crowns. Careful determination of this parameter can lead to the use of only an aggressive periodontal crown-lengthening procedure to compensate for dentoalveolar deformities usually considered to be candidates for orthodontic or orthognathic treatments.

A final reevaluation is possible when the patient is functioning with provisional restorations. All aspects of esthetics and function should be satisfied at this point. For instance, the choice of vertical dimension can be easily verified by the use of speech testing and...
an assessment of the patient's comfort. All other occlusal and esthetic requirements should be achieved in the provisional restorations, and all information may be transmitted to the technician so that the final prosthesis is a replica in a definitive material (see Fig 7).

Although the original periodontal-prosthesis guidelines have remained valid in a more esthetically oriented era in which materials have enabled achievement of finer details, posterior occlusal designs in periodontal prostheses are purposely different from those of natural teeth and therefore are not as esthetic as modern posterior restorations. This is based on the concept that posterior occlusal platforms should be reduced and flattened to concentrate forces in the long axis of the roots and provide freedom in eccentric movements.

The sequence of treatment offered in the discipline of periodontal prosthodontics, which emphasizes reassessment steps, may also be utilized for esthetic adjustments. Blueprints for smile analysis are often described for one specific type of individual, but variations in age, gender, origin, and the patient's desire, which may differ from the provider's vision, must be considered.

For instance, the dentist's limitations in selecting tooth shape according to facial measurements illustrate the importance of reevaluation and calibration of the dentist's and the patient's esthetic goals.

CONCLUSION

The discipline of periodontal prosthodontics has addressed the oral rehabilitation of patients who have been subject to advanced periodontal disease by offering clinical guidelines for diagnosis, design, evaluation, and fabrication of maintainable restorations for nearly half a century. More recent research supports this clinical blueprint. The increasing esthetic demands of patients with advanced cases can also be served in this manner, although they were not addressed specifically as original goals of treatment.

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