Interdisciplinary Collaboration of the Dental Technician, Restorative Dentist, and Periodontal Surgeon in the Treatment of a Complex Oral Rehabilitation

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Abstract: The concept of interdisciplinary collaboration for complex oral rehabilitations embodies precise communication among all members of the treatment team prior to initiating therapy. The present state of the art coupled with the increasing esthetic expectations of patients continually challenges the surgeon, restorative dentist, and laboratory technician. The unique knowledge, skills, and experiences that each member provides are of paramount importance in the evaluation and consultation phase. Precise duplication of the color, contour, and vitality of natural dentition may ultimately result in an esthetic failure if the optimal gingival profile is absent, functional occlusion is improper, or the basic tooth preparation design is ignored.

In this article, the interdisciplinary approach is presented in the examination and treatment planning of a patient with a debilitated dentition requiring a complex oral rehabilitation. Analysis of the patient’s esthetic, functional, and structural problems from the prospective of the periodontist, prosthodontist, and laboratory technician with the specific treatment phases are shown.

Keywords: Interdisciplinary treatment, periodontal surgery, esthetic crown lengthening, provisional restorations, Sinfony™, Authentic™
Introduction

The successful oral rehabilitation requires close collaboration of an experienced and skilled treatment team. Frequently, the dental technician is excluded from the diagnosis and treatment planning stages, and only receives the cast of the prepared teeth with the request to fabricate the definitive restorations. This difficult situation increases the demands upon the technician and needlessly complicates his task. Although it would be inconceivable that the periodontist would perform surgery or the prosthodontist would prepare multiple teeth without having first examined, evaluated, and discussed treatment for the patient; often the same is not true for the equally integral part of the team—the dental technician.

The concept of interdisciplinary treatment embodies precise communication among all members of the team prior to initiating therapy. Each team member examines and evaluates the patient independently from his or her own unique perspective. Together, the treatment team discusses the patient’s esthetic goals with the presenting structural and/or functional complicating factors. Therefore, the final plan becomes a compilation of the most productive and cost effective path to the final rehabilitation.

The Concept of Esthetic Treatment Planning

A common mistake that many dentists make is initially focusing on the teeth without regard to the surrounding soft tissue frame.¹ Esthetic analysis should begin with the relationship of the teeth with the smile line at normal speaking distance.² The treatment team evaluates the midline, incisal positions, gingival display and contours, interproximal papillary height, tooth proportions, buccal corridor, and vertical dimension of occlusion.

The clinical presentation demonstrating the interdisciplinary approach is of a 58–year–old male patient with a debilitated dentition (Figs. 1a to 1f). The patient’s diagnostic casts are mounted on the
articulator using facebow and centric relation records. Digital photographs also aid in the formulation of the treatment plan. It is important that the camera and the facebow are parallel to the horizon while the patient’s head is perpendicular for proper orientation of the articulator mounted casts (Fig. 2).

The initial examination of the patient begins with analysis of the facial esthetics, the occlusal function, and finally the structure of the dentition. The incisal position of the maxillary central incisor teeth is optimal both in relationship to the midline and apical–coronal, anterior–posterior orientation. However, the deficiencies include excessive gingival display during full smile, uneven gingival contours, tooth proportion discrepancies, and multiple maxillary and mandibular facial exostoses. Structural problems include severe loss of occlusal surfaces caused by a chronic bruxism habit and inadequate existing restorations with active caries. The functional complications are an uneven occlusal plane and multiple occlusal contacts in all mandibular border movements.

The prosthodontist and laboratory technician initially determines the proper maxillary anterior incisal and posterior occlusal positions. Next the normal length for each tooth is recorded on the duplicated casts (Fig. 3a). The casts are further modified by eliminating the facial bony overgrowths and selectively removing the facial, coronal, and gingival portions in preparation for the diagnostic wax-up (Fig. 3b).

The diagnostic wax-up is an especially valuable communication and planning aid for the restorative dentist, surgeon, and laboratory technician. The final appearance and occlusal morphology of the definitive crowns can be closely simulated prior to treatment. In addition, the diagnostic wax-up is used to determine the need for preprosthetic surgical procedures. Colored waxes (YETI Dentalprodukte, Engen, Germany) enable the technician to closely duplicate the porcelain layer technique (Figs. 4a to 4d). Therefore, the patient can better visualize the proposed provisional crowns and provide essential feedback, which improves communication and understanding.
Once the patient has approved the wax–up, the casts are duplicated in die stone material (Fig. 5a). Surgical guides are fabricated on these casts using a 0.02” thick, translucent polypropylene coping material (Buffalo Dental Manufacturing, Syosset, NY) using a vacuum form machine. The guide is trimmed to the facial gingival margins and retains palatal coverage for proper intraoral orientation during the periodontal surgery (Figs. 5b and 5c). Based upon the diagnostic wax–up, alteration of the gingival and osseous contours surrounding the dentition is necessary for an optimal esthetic result.

Esthetic Crown Lengthening Surgery

Esthetic crown lengthening is a periodontal surgical procedure that results in the apical placement of the marginal gingivae. This technique is used to correct excessive display of facial gingival tissue,\(^3\)–\(^7\) crown height/width discrepancies, \(^8\) and uneven gingival contours.\(^9\)–\(^11\) The underlying bone serves as the scaffold for the soft tissues. Therefore, the apical positioning of gingiva requires that the underlying bone be reduced at least 2 to 3 mm from the desired facial margin, which allows formation of proper biologic width.\(^12\) The surgery is depicted in figures 6a through 6f. A horizontal incision is made that maintains the blood supply to the interdental papillae and a full thickness flap is reflected facially exposing the bone (Fig. 6b). This type of incision prevents the loss of interproximal papillary height.

The surgical guide is inserted. Note the relationship of the facial bone to the gingival margins of the guide (Fig. 6c). This guide enables the periodontal surgeon to remove bone in a precise and predictable manner. The facial exostoses are reduced and the proximal bone is scalloped (Fig. 6d). The flap is sutured (Fig. 6e) with at least six weeks of healing required prior to the restorative phase (Fig. 6f).
Fabrication of the Provisional Crowns

Following adequate healing, impressions are taken for casts to fabricate the provisional crowns (Fig. 7a). The individual stone teeth are prepared and reduced approximately 2 mm (Fig. 7b). A laboratory polysiloxane (Lab–Putty, ColtÈne, Mahwah, New Jersey, USA) impression is made of the wax–up cast. This serves as a matrix for the acrylic resin core of the provisional crowns. The casts of the prepared teeth are lubricated with a separating medium. A self–curing acrylic resin (SR Ivocron, Ivoclar AG, Schaan, Liechtenstein) is placed into the matrix which is then positioned on the casts. The acrylic resin is cured in warm water under 20 psi until final set is achieved (Fig. 8a). The acrylic core is reduced on the facial and incisal surfaces approximately 1 to 1.5 mm to allow sufficient room for the composite resin veneering material (Figs. 8b and 8c). The acrylic is treated with Rocatec (ESPE America, Inc, Norristown, PA) to improve bonding13–15 and then veneered with Sinfony™ (ESPE America, Inc, Norristown, PA), a light cured composite resin. The composite resin veneer gives the prosthodontist and dental technician precise control of the color, translucency and surface characterization (Figs. 9a to 9c).

Delivery of the Provisional Crowns

The restorative dentist prepares all of the teeth for full coverage porcelain crowns (Fig. 10a). Hydrocolloid (Optiloid–GmbH, Postfach, Germany) impressions are taken following tooth preparation. Facebow transfer and centric relation position records at the proper vertical dimension of occlusion allow articulation of the casts (Fig. 10b). The dental technician reseats the composite resin veneered acrylic provisional crowns into the polysiloxane putty matrix (Fig. 11a). The matrix has been trimmed on the palatal side to allow visual confirmation of complete seating (Fig. 11b). Self–curing acrylic resin is poured into the provisional crowns and reseated onto the cast. The excess is cleared with a cotton applicator soaked with monomer liquid (Fig. 11c). Curing is completed under 20 psi as described
previously. The casts are removed and the relined provisional restorations separated (Figs. 12a to 12c). Notice that the excess acrylic resin is minimized by judicious removal prior to setting. In this case, the interim restorations are separated at the midline because of the diastema (Fig. 12c). Connection of multiple units at this stage reduces the frequency of intraoral unseating once the restoration is cemented with a temporary luting agent. The provisional restorations are placed on the casts and any occlusal adjustments are completed on the articulator (Figs. 13a and 13b). The dentist then cements the interim restorations on the teeth with a temporary luting agent (Fig. 13c). Generally, only slight intraoral occlusal adjustments are needed.

The importance of the provisionalization stage of treatment cannot be overemphasized. Critical evaluations of phonetics, function, occlusal morphology, vertical dimension of occlusion, esthetics, and gingival health are possible prior to delivery of the definitive restorations. This affords the dentist and technician a high degree of predictability in the fabrication of the final crowns. Furthermore, the transition for the patient from the interim to the definitive restorations is far less problematic, therefore, more efficient and productive for all.

**Fabrication and Delivery of the Definitive Restorations**

Final impressions of the prepared teeth using hydrocolloid are taken. Note the excellent tissue health of the surrounding gingivae (Fig. 14a). Placement of gingival margins that are no more than 0.5 mm apical to the gingival crest, the absence of soft tissue inflammation and bleeding, and the use of a hydrocolloid impression material facilitates the fabrication of a cast with precise representation of multiple tooth preparations (Fig. 14b). The soft tissue contours are preserved using Gi–Mask™ (ColtÈne, Mahwah, New Jersey, USA), which is a removable, resilient material specifically for this application (Figs. 15a and 15b). The technician can develop the appropriate emergence profile in addition to proper cervical and proximal contours.
The final restorations consist of Authentic™ (Ceramay, Stuttgart, Germany) full coverage crowns for the maxillary and mandibular anterior teeth and ceramometal crowns using Creation porcelain (Klema Meiningen, Austria) for the posterior teeth (Figs. 16a to 16h). A group function occlusion† with broad contacts in lateral and protrusive mandibular movements† was developed for this patient. This minimizes the potential risk of porcelain fracture of the restorations caused by excessive forces applied to a small contact point.

It must be remembered that each individual may be comfortable with different occlusal morphologies. No single occlusion is applicable for every patient. The determination for the patient's adaptive capabilities is made during the provisional phase of treatment and duplicated in the final crowns. Although the risk of porcelain failure would have been high, the knowledge gained from the long–term interim crowns greatly reduces this possibility. The radiographs of the definitive crowns show the margin integrity (Fig 17).

**Conclusion:**

The current state of dental science and art coupled with the ever increasing esthetic demands from our patients dictate that an interdisciplinary treatment approach consisting of skilled clinicians and dental technicians become the standard. This concept begins with the evaluation of the prospective patient by each team member prior to formulating a treatment plan or the initiation of therapy. Frequently, the dental technician is not involved with the initial discussion of the patient's care. This oversight can lead to undesirable planning decisions and ultimately an increase in effort to achieve a less than optimal result.

Although the presence of a skilled technician within the prosthodontist or restorative dentist office is not typical, a close relationship and sharing of diagnostic casts, digital photographs, pretreatment wax–ups, and meeting the patient to discuss esthetic goals are generally possible to
arrange. Undeniably, the time and effort spent in careful planning and coordination of therapy is repaid several fold in the reduction of effort and stress to achieve a mutually satisfying result.

References:


Fig 16c               Fig 16d                 Fig 16e

Fig 16f               Fig 16g                 Fig 16h

Fig 17
Legends to Figures 1–17:

Figs. 1a to 1f: The patient is a 58–year–old male with a debilitated dentition caused by chronic bruxism. In full smile he displays excessive gingiva and uneven gingival contours. Complicating factors include multiple maxillary and mandibular facial exostoses, an uneven occlusal plane, and several tooth size discrepancies.

Fig. 2: The diagnostic casts are mounted on the articulator using the facebow to properly orient the midline of the patient’s head perpendicular to the horizon.

Figs. 3a and 3b: The normal length for each tooth is recorded on the duplicated casts, which is then modified by removing the marginal gingiva and the facial bony overgrowths. The facial and occlusal surfaces of each tooth are reduced 2–3 mm to allow sufficient room for the wax–up.

Figs. 4a to 4d: The full diagnostic wax–up of the maxillary and mandibular casts is shown. The technician can use colored waxes to simulate the porcelain layer technique—thus improving the visual presentation to the patient.

Figs. 5a to 5c: The casts are duplicated in die stone material. Surgical guides are fabricated on these casts and are trimmed to the facial gingival margins, leaving the palatal coverage for proper intraoral orientation during the periodontal surgery.

Figs. 6a to 6f: The crown lengthening surgery is completed using the surgical guide, which is based upon the initial diagnostic wax–up.
Figs. 7a and 7b: The casts are fabricated following initial healing from the periodontal surgery and the die stone teeth are prepared for the provisional restorations.

Figs. 8a to 8c: The acrylic resin core is reduced on the facial and incisal surfaces approximately 1 to 1.5 mm to allow for sufficient room for the application of the Sinfony™ composite resin.

Figs. 9a to 9c: The completed composite resin veneered provisional restorations.

Figs. 10a and 10b: The upper and lower teeth are prepared, hydrocolloid impressions are taken, and the casts are mounted using the facebow and centric relation position record. The acrylic resin reline is completed on these casts.

Figs. 11a to 11c: Using the polysiloxane matrix, the self-curing acrylic resin is poured into the crowns, reseated on the casts, and the excess material is removed.

Figs. 12a to 12c: The relined provisional crowns are shown. Note that there is minimal excess of acrylic resin and that the gingival margins are clearly visible.

Figs. 13a to 13c: The relined provisional crowns are shown on the casts and in the mouth. Typically, only slight intraoral occlusal adjustment is needed.

Figs. 14a and 14b: Proper margin placement and well fitting, properly contoured provisional crowns result in optimal gingival health. Fabricating a resilient removable tissue replica preserves the gingival contours.
Figs. 15a and 15b: Using the resilient gingival contour replica, the ceramist develops each crown's proper embrasure form and emergence profile.

Figs. 16a to 16h: The final restorations consist of Authentic™ cores with porcelain layering crowns for the maxillary and mandibular anterior teeth, and ceramometal crowns using Creation™ porcelain for the posterior teeth.

Fig. 17: The radiographs of the definitive crowns demonstrate the crown fit and relationship of the margin to the alveolar bone, which enhances long–term biologic synergy.