Case Study

TRAUMATIC INJURY RESTORATION

Prosthetic restoration of teeth and pink tissue of the maxillary and mandibular anterior teeth following traumatic injury

Patients that have endured injury as a result of trauma present unique challenges in restorative treatment planning. The goals of the patient are combined with what is technically possible from a prosthetic standpoint, requiring a coordinated effort between the surgeon, the restorative dentist and the laboratory technician. The patient described below presented to our office following significant surgical reconstruction and rehabilitation as a result of a life threatening motor-vehicle accident.

Communication during the initial phase of treatment is critical to achieving a successful prosthetic outcome. The patient had a restorative goal of recreating his smile as an all-important finish-line to years of surgery and rehabilitation. The posterior teeth were maintained in the maxillary and mandibular arches and the patient was missing several teeth (8-11 and 21-27). As a result of the surgical reconstruction, the edentulous space was larger than what could accommodate teeth of natural proportion and as a result, the landmarks identifying the midline provided an important discrepancy (Bidra JPD 2009).

From the examination, it was apparent that the patient wanted an exact replica of his teeth prior to the injury. A diagnostic set-up was made to visually demonstrate the challenges related to the space available for prosthetic teeth relative to the retained natural teeth.

The diagnostic set-up was duplicated in a thermoplastic matrix, and a white bis-acrylic provisional material was added to the matrix to allow for an intra-oral trial.

The goal was to demonstrate in a visual manner that while the spacing looked good on a model, it did not transfer well in the context of his facial features. The diagnostic matrix was evaluated during the follow-up visit during the discussion of restorative treatment options.

The patient returned to our office 13 months later missing teeth 6-11 and 21-27. Teeth 6 and 7 were removed as a result of pulpal necrosis and apical root resorption secondary to trauma and allowed for improved spacing of the definitive restoration. The diagnostic matrix was evaluated intra-orally once again during the discussion of restorative treatment options. Specific plans were discussed that would connect the dental implants to the teeth while providing the soft tissue support and tooth display required of the anterior teeth.

The provisional restoration is made with information provided from a diagnostic evaluation of the anterior teeth to test the appearance and soft tissue support.
A silicone matrix was made on the working model to transfer the arrangement of the teeth and requirements for tissue support to the provisional restoration. Non-indexed titanium provisional abutments were placed on the working model and attached to the teeth held in the silicone matrix using cold-curing acrylic resin.

The provisional was modified on the intaglio surface to create a smooth convex surface in order to allow for hygiene maintenance with dental floss. The goal was to create an optimal shape to allow for the formation of the residual alveolar ridge prior to construction of the definitive restoration. The soft tissue was modified in the areas of the dental implants to accommodate the intaglio surface of the provisional.

The technical plan for the definitive restoration was enhanced by the intra-oral evaluation period of the provisional restoration. The mesial aspect of the maxillary premolars were re-contoured to flatten the convex surface in order to provide an optimal transition between the natural structures and the prosthesis. The tooth shade was lightened and the material selection of the pink tissue aspect of the prosthesis was evaluated in order to provide appropriate hue and tissue health. The overall design of the restoration was re-evaluated due to the anterior cantilever and the supporting framework.

Traditional materials for a dental implant supported prosthesis include a framework made of titanium (CAD/CAM) or castable metal alloy covered by poly-methyl methacrylate to retain either acrylic or porcelain denture teeth. A custom framework can be made for a porcelain fused to metal restoration providing for the opportunity to create a customized result as well as an optimal tissue response at the intaglio surface.

Porcelain fused to metal restorations of this nature increase the overall cost of the prosthesis due to the technical skill and time involved in construction process. The heating and cooling cycles required with multiple firings of the porcelain with a large metal framework will likely result in some distortion of the restoration that can be adjusted as necessary prior to cementation (Karl JPD 2005). A prosthetic recreation of the gingival aspect of the restoration presents a considerable challenge regarding shade matching.

Composite resin available in gingival shades provides the opportunity to characterize the prosthetic tissue with layering techniques if desired. Composite improves the ability to control the contours and color of the gingival aspect especially when the area is large. The advantage is that it minimizes the firing cycles of the restoration to protect the characterized porcelain teeth and allows for repair as necessary (Coachman IJPRD 2010). Composite resin materials available in gingival shades include GC's 'Gardia Gum' and Shofu's 'Ceramage'.

The design for the definitive restoration was a hybrid screw-retained/cement retained prosthesis in the maxillary anterior and a cement retained prosthesis for the mandibular anterior.

The maxillary prosthesis was designed with a significant anterior cantilever in order to create the appropriate tooth arrangement and facial support and therefore it would be impossible to truly remove cement at the abutment/prosthesis junction at the time of insertion (Agar JPD 1997). The soft tissue contours created by the provisional restoration were duplicated to facilitate construction of the convex intaglio surface of the definitive restoration. The definitive abutments retained the indexed internal connection in order to limit the stretching and bending force on the abutment screw. Non-indexed abutments for the Nobel Replace Select dental implant do not have an internal component and therefore the abutment screw would be the 'weak point' of the cantilevered prosthesis (Boggan 1999).

The teeth for both prostheses were made of porcelain fused to the metal framework in order to optimize color, proportion and character of the teeth. Porcelain was also applied to the intaglio surface of
Intra-oral adjustments were made to the definitive prosthesis to allow for broad contacts in protrusive and lateral movements while maintaining bilateral, simultaneous posterior tooth contact at centric contact points. An acrylic occlusal guard was made to fit the upper arch to protect the prostheses when the patient is sleeping. The overall prognosis of the restoration is good due to solid natural tooth support in the posterior and the cleansibility of the prostheses. Recall visits will evaluate oral hygiene and structural integrity of the dental implant supported fixed prostheses particularly in the area of the screw access openings (Karl JPD 2007).

**Technical Reference Sources**

**Bidra AS, et. al.** The relationship of facial anatomic landmarks with midlines of the face and mouth. *Journal of Prosthetic Dentistry* 2009 August;102(2):94-103. "The hierarchy of the anatomic landmarks closest to the midline of the face in smile was as follows: the midline of the oral commissures, natural dental midline, tip of the philtrum, nasion, and tip of the nose."

**Karl M., et. al.** Static implant loading caused by as-cast metal and ceramic-veneered superstructures. *Journal of Prosthetic Dentistry* 2005 April;93(4):324-330. "Conventional procedures were unable to produce superstructures with absolute passive fit. Ceramic veneering appeared to increase the strain development and, thus, the inaccuracy of the fit. The technique of cementing superstructures to prefabricated components directly on the implants may compensate for dimensional errors caused by impression making and superstructure fabrication."

**Coachman C., et. al.** Prosthetic Gingival Reconstruction in Fixed Partial Restorations. Part 3: Laboratory Procedures and Maintenance. *International Journal of Periodontics and Restorative Dentistry* 2010;30:19-29. The gingival composite "preserves the physical properties of the porcelain-fused-to-metal restoration; (2) the shape, shade, and texture of the pink esthetic factors can be controlled; (3) repair and maintenance are facilitated; and (4) the results are predictable. Fabricating the gingiva with composite is also one of the main reasons for the denture to be planned as screw retained; any kind of repair or even a complete replacement can be done in the future without interfering with the ceramic crowns."

**Agar J., et. al.** Cement removal from restorations luted to titanium abutments with simulated subgingival margins. *Journal of Prosthetic Dentistry* 1997;78:43-47. "Six investigators removed zinc phosphate, glass ionomer, and resin cements with explorers, gold coated scalers and rigid plastic scalers with a model simulating clinical conditions. . . A surprising amount of cement remnants and scratching of abutments was observed. Although the six investigators were experienced in prostodontic and implant procedures, there was variation in the results of their cement removal."

**Boggan RS, et. al.** Influence of hex geometry and prosthetic table width on static and fatigue strength of dental implants. *Journal of Prosthetic Dentistry* 1999;82:436-440. "Failure mode for static test samples was bending or deformation of the abutment screw, whereas fracture of the abutment screw was the common failure mode for the fatigue test samples."

**Karl M., et. al.** In vitro effet of load cycling on metal-ceramic cement- and screw-retained implant restorations. *Journal of Prosthetic Dentistry* 2007 March;97(3):137-40. "The investigators found significantly more chipping fractures in the group of screw-retained FPDs" with the conclusion that the screw access hole "of screw-retained implant FPDs forms a weak point in the ceramic layer."