The Multi-Base Abutment for Straumann Bone-Level Implants: An Option for the Screw-Retained, Complete Arch, Metal-Ceramic Fixed Prosthesis.

Introduction

Clinicians have described the advantages of both cement-retained and screw-retained complete arch fixed prostheses. The generally accepted benefits of a cemented prosthesis include passivity of the metal substructure, relative ease of fabrication, adaptability to non-ideal implant placement, and no access holes that may be problematic for managing occlusal contacts. A screw-retained fixed prosthesis is retrievable, allows for extraoral repair or modification, and eliminates the risk of mucositis or peri-implantitis caused by residual subgingival cement.

Unlike the natural dentition, transseptal fibers do not insert into the implant surface. The absence of this biological barrier can lead to residual subgingival cement that is difficult to completely remove, especially as the crown margin is placed more apically. Researchers have recognized the adverse sequelae of retained subgingival cement.

Agar and others showed that even experienced implant clinicians are unable to completely remove residual cement. Wilson found that the presence of subgingival cement was associated with peri-implant disease. Clinical signs of inflammation could occur up to 9 years following cementation of the crown. The study hypothesized that the rough surface of the cement inhibited removal of pathologic microorganisms. Interestingly, the luting agent that was used was not significant, although composite resin cement was most frequently associated with the test cases, while reinforced glass ionomer was present in only one case. Removal of subgingival cement eliminated clinical inflammation.

Based upon these reports, restorative dentists may decide that a screw-retained prosthesis is more efficacious than one that is cement-retained. When Straumann bone-level implants are used, the multi-base abutment offers an option for fabrication of a metal-ceramic, screw-retained fixed prosthesis.

Case Report

A 59 year-old male patient presented with advanced, maxillary attachment loss from chronic periodontitis (Figures 1a-c). The periodontist determined that the prognosis for the maxillary dentition was hopeless. The restorative options were thoroughly discussed and the patient chose an implant-supported, metal-ceramic fixed prosthesis. Diagnostic photographs, casts, facebow, and centric relation position records were taken (Figure 2a). A proposed setup with improved masticatory function and esthetics was presented to the patient (Figure 2b). The setup served as the template for the interim fixed prosthesis.

The provisional prosthesis was fabricated using a laboratory processed composite resin (Sinfony™, 3M ESPE, St. Paul, MN) veneered on a self-curing acrylic resin (Figure 2c). To reduce the risk of fracture, palatal cast metal reinforcement was incorporated in the prosthesis.

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The patient was restored using the staged-extraction protocol. A minimal number of teeth, not at the prospective implant sites, supported the interim fixed prosthesis after the extraction of the remaining teeth. This eliminated the need for a removable prosthesis, increased masticatory function, and prevented potentially adverse loading on the ridge preservation bone grafts.

The restorative dentist completed full coverage preparations of the maxillary first bicuspids and right lateral incisor teeth (Figure 3a). A polyvinylsloxane impression was taken for extraoral relining of the provisional prosthesis (Figure 3b). The periodontist extracted the unprepared maxillary dentition and grafted the extraction sockets to preserve the residual alveolar ridge (Figure 4a).

The laboratory technician removed the teeth scheduled for extraction from the working cast and relined the provisional prosthesis. The interim prosthesis was affixed to the abutment teeth using a provisional luting agent (Figure 4b). During the healing phase, the prosthesis was evaluated for esthetics, function, and phonetics (Figure 4c).

Figures 3a-3b: Using the staged-extraction protocol, teeth #5, 7, and 12 were prepared and an impression was taken (a). The laboratory technician removed the remaining teeth from the cast and relined the provisional prosthesis (b).

Figures 4a-4c: The implant surgeon extracted the non-abutment maxillary teeth and placed bone grafts to preserve the edentulous ridge (a). The relined provisional prosthesis was fixed to the abutment teeth using a temporary luting agent (b). Function, esthetics, and phonetics were evaluated during the healing of the implants (c).
Four months following the tooth extractions, cone beam computed tomography was taken with an acrylic resin radiographic guide duplicated from the provisional prosthesis. The retained maxillary teeth stabilized both the radiographic and surgical guides (Figure 5). Using the In2GuideTM treatment planning software (Cybermed, Irvine, CA), the surgeon, restorative dentist, and laboratory technician determined the optimal implant positions.

Once the implant positions were determined, a stereolithic surgical guide was fabricated. Straumann tissue-level implants were chosen for the first molars sites and bone-level implants for the second bicuspids, cuspsids, and central incisor sites.

The surgical guide was oriented on the remaining maxillary teeth and fixation pins stabilized the guide to the alveolar bone (Figure 6a). The implants were placed using the Straumann guided surgery protocol and surgical kit. The remaining teeth were extracted (Figure 6b) and the provisional prosthesis was converted to an interim screw-retained fixed prosthesis using temporary meso-abutments. The long-term survival of immediate-loaded, cross-arch stabilized implants have been well researched.11

Three months following implant placement, the surgeon confirmed successful osseointegration. The open tray impression technique recorded the implant positions. To ensure accurate transfer to the master cast, the impression copings were affixed to a light-cured indexing base using dimensionally stable self-curing resin prior to the polyvinylsiloxane impression. (Figures 7a,b).

The multi-base abutments for Straumann bone-level implants have 0º (straight) and 25º angled options (Figures 8a,b). The straight abutments have a 30º cone angulation. The two platform diameters for the straight abutment are 3.5 mm and 4.5 mm for the Narrow CrossFit™ (NC) and 4.5 mm and 6.5 mm for the Regular CrossFit™ (RC). The tissue heights are available in 1 mm, 2.5 mm, and 4 mm. The multi-base abutment uses the SCS driver to insert and tighten to a torque of 35 Ncm.

A polyvinylsiloxane laboratory putty matrix was fabricated from the cast of the provisional prosthesis impressed in situ. The matrix was seated on the master cast and the dental technician chose the appropriate abutment options using the Straumann PLAN kit (Figures 10a,b). Angled multi-base abutments were chosen for the cuspid and central incisor implants, and straight abutments for the second bicuspid implants. The wide neck molar abutments were restored with screw-retained metal-ceramic crowns. Temporary meso-abutments were incorporated into a light-cured acrylic resin bite plane, which facilitated recoding of centric relation position and vertical dimension of occlusion. The interocclusal registration material engaged indices on the occlusal surface of the bite plane (Figure 11).

The laboratory technician modified cast-to-gold waxing sleeves according to the laboratory matrix of the provisional prosthesis (Figure 12a). A dimensionally stable, light-cured resin connected the waxing sleeves.
(Figure 12b). The waxup for the metal framework (Figure 13) was invested and cast in a precious metal. The framework was seated on the multi-base abutments in situ to verify the fidelity of the master cast using the “one-screw” technique.12 Acrylic resin interocclusal indices were placed on the metal framework to confirm the accuracy of the interocclusal record (Figures 14a,b).

The metal substructure was finished prior to porcelain veneering (Figure 15a). The definitive fixed prosthesis incorporated the crown form, function, esthetics, and prosthetic simulation of the soft tissue (Figure 15b). The intaglio surface of the gingival porcelain was designed to facilitate home oral hygiene maintenance (Figures 16a,b). The definitive restoration consisted of a screw-retained, metal-ceramic fixed prosthesis supported by implants at sites of the second bicuspsids, cuspids, and central incisors; and individual screw-retained crowns from the first molar implants (Figures 17a,b).

The occlusal screw access holes were closed with gutta-percha and composite resin (Figures 18a,b). The post-delivery panorex confirmed margin integrity (Figure 19). The definitive prosthesis and gingival porcelain are shown (Figures 20a-c). When the hard and soft tissue horizontal defects are apical to the patient’s maximum smile line, the skilled ceramist can faithfully replicate the soft tissue frame (Figures 21a,b).

Conclusion

The Straumann multi-base abutment offers the restorative dentist an option for a screw-retained, complete arch metal-ceramic fixed prosthesis. Several clinicians have reported on screw-retained versus cement-retained restorations. There appears to be advantages and disadvantages with both concepts. Therefore, the prudent clinician must review the available literature to decide the optimal approach for their patients. To date there are no systematic literature reviews that have established a scientific consensus for the optimal connection of a restoration to implants, i.e. screw- or cement-retained. Therefore, continued research is recommended.
Figures 15a-15b: The finished metal substructure (a) and the completed porcelain veneered prosthesis are shown (b).

Figures 16a-16b: The facial and apical views of the definitive restorations are shown. The intaglio surface of the gingival porcelain was convex to facilitate oral hygiene.

Figures 17a-17b: The final rehabilitation consisted of a screw-retained, metal-ceramic fixed prosthesis connecting the implants at sites #4, 6, 8, 9, 11, and 13; and individual metal-ceramic, screw-retained crowns placed on the first molar implants.

Figures 18a-18b: The access holes were closed with gutta-percha and composite resin (a). The definitive prosthesis followed the template of the provisional fixed prosthesis (b).

Figure 19: The post-delivery panorex confirmed the fidelity of fit.

Figures 20a-20c: Intra-oral view of the completed prosthesis. Note the ceramic gingival porcelain.
Figure 21a-21b: When the horizontal defect is superior to the patient’s maximum smile line, prosthetic gingival porcelain can readily simulate natural gingiva.

References


