An Alternative Design to Overcome the Problem of Unfavorable Implant Angulations for a Screw-Retained, Implant-Supported Fixed Prosthesis: Two Clinical Reports

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Abstract
Two clinical reports present an alternative design to address the problem of unfavorable implant angulations if a screw-retained prosthesis is desired. The restorations were designed as screw-retained prostheses, except in the area with the unfavorable implant screw emergence. The frameworks in these areas were customized to receive individual cement-retained crowns. This design offers retrievability and helps to minimize complications associated with excess cement without compromising the functional or esthetic outcome.

Replacing missing teeth in the esthetic zone is a challenging procedure with esthetic and functional requirements being of equal importance. A successful esthetic outcome requires harmony between the white and pink esthetics. Apart from the type of restoration, the prosthesis design is of paramount importance; restorations should have the appropriate contour and emergence profile with convex and smooth surfaces to facilitate cleansability.

The aim of this article is to present two patients demonstrating a prosthesis design to overcome problems with unfavorable implant angulations when a screw-retained prosthesis is desired.

Clinical reports
The first patient, a 51-year-old women suffering from Sjogren syndrome, presented complaining of soreness and discomfort.
from her dentures. She reported losing her teeth gradually over a 10-year period. She received acrylic dentures after losing her anterior teeth, but was unable to wear them. Intraoral and radiographic examination confirmed the diagnosis of xerostomia,
caries in the three remaining maxillary teeth (maxillary right canine, maxillary left canine, maxillary left first premolar), and a fully edentulous mandible and a partially dentate maxilla with soft and hard tissue deficiency.

The second patient, a 25-year-old woman with clear medical history presented complaining of unretentive dentures that negatively affected her confidence. She reported loss of maxillary and mandibular anterior teeth due to serious self-inflicted trauma and expressed a strong desire to replace her dentures with fixed restorations. Intraoral and radiographic examination confirmed a partially dentate maxilla and mandible (missing teeth: from maxillary right lateral incisor to maxillary left first premolar and mandibular anterior teeth) with soft and hard tissue deficiency.

Implant assessment was based on the SAC assessment tool,9 and preoperative treatment planning involved tooth set-ups, diagnostic wax-ups, and cone-beam computed tomography.12 Tooth set-up was performed for both fixed and removable implant-retained prostheses. Diagnostic criteria based on clinical and patient factors (lip line, lip and facial support, tooth display, interarch space, type of mucosa, and hard and soft tissue deficiency) determined the treatment plan, which was to provide maxillary implant-retained fixed prostheses.13,14

The first patient received six SLActive tissue level implants (Straumann, Basel, Switzerland) in the maxilla (bilaterally in the central incisor, canine, and first premolar area) and two intra-foraminal implants in the mandible.15 The treatment plan was to provide a screw-retained fixed prosthesis to replace the maxillary anterior teeth, two distal cantilever screw-retained prostheses to replace the maxillary premolars bilaterally, and an implant-retained overdenture in the mandible.

The second patient received three Straumann® SLActive tissue level implants in the anterior maxilla (right lateral incisor, left central incisor, left first premolar). The treatment plan was to provide a screw-retained fixed prosthesis to replace the missing teeth in the maxilla and a fixed-fixed six-unit adhesive partial fixed dental prosthesis (FDP) to replace the mandibular missing teeth.

The radiographic template substituted as a conventional surgical guide. Prosthetically driven conventional implant surgery based on Type II implant placement protocol was performed.16,17 Simultaneous guided bone regeneration was carried out to regenerate the missing labial bone and augment the ridge contour in the pontic areas with deproteinized bovine bone and porcine collagen membrane (Bio-Oss® and BioGide®; Geistlich Pharma North America, Inc., Princeton, NJ).18

After an uneventful healing period, tooth set-ups, full contour wax-ups, and interim prostheses were used to shape the soft tissues and the emergence profile, and to determine esthetics and occlusion to guide the dental technician during construction of the framework and definitive restorations.19-21 It became evident that the abutment screw for the implant in the maxillary right canine (patient 1), and maxillary right lateral incisor (patient 2) was emerging labially. As a result, the treatment plan was amended to provide either a cement-retained partial FDP or a screw-retained partial FDP with a modified design. The advantages and disadvantages of the two treatment options were discussed with the patients.

The frameworks were designed in wax as screw-retained prostheses, except in the maxillary right canine and the maxillary right lateral incisor area, respectively. The framework in these areas were customized to receive individual cement-retained crowns. The wax frameworks were scanned with CARES® CAD machine (Straumann) using a copy-mill technique and were milled in cobalt-chromium alloy (Coron®; Straumann).22,23 GC Initial MC metal ceramic (GC America, Alsip, IL) was applied to the frameworks to full contour, except in the maxillary right canine and the maxillary right lateral incisor areas, followed by application of pink ceramic to mimic the soft tissues.24 Subsequently, the crowns for the maxillary right canine and the maxillary right lateral incisor were manufactured as individual cemented metal-ceramic crowns (Figs 1–4).

The definitive prostheses were screwed and tightened to 35 Ncm on each implant. The labial screw access holes were sealed, and the crowns were cemented over the customized abutments using soft temporary cement (TempBond®; Kerr Dental, Orange, CA)25,26 (Figs 5–8) for ease of future retrievability. The implant-supported prostheses have been in function for 10 months and 8 months, respectively. The patients reported no problems at the review appointment. They were satisfied with function and esthetics, and the level of plaque control was satisfactory.

**Discussion**

Implant-retained restorations can be screw- or cement-retained. Although both types of restorations are considered acceptable treatment options,2 screw-retained prostheses offer several advantages, such as retrievability and avoidance of problems associated with excess cement, over cement-retained prostheses.3 However, screw-retained prostheses can be technique-sensitive as accurate restoratively driven implant placement, optimal implant position, and passive fit of the prosthesis are imperative.3

Implant-supported partial FDPs show high survival rates (86.7% in 10 years), but their complication rate is high as well (38.7% in 5 years).2 Considering the high rate of complications, prosthesis retrievability is of great value to address technical and biological complications successfully.2,4

These clinical reports illustrate a design that offers retrievability without compromising functional and esthetic outcomes for screw-retained, implant-supported prostheses in situations where labially emerging implants are present. The prosthesis is retrievable once the individual crown is removed, and access to the abutment screw is achieved. The individual crown is cemented with soft provisionalization cement and can be easily removed without damaging the crown, pink porcelain, or the abutment. A dimple could be incorporated in the palatal surface of the individual crown to facilitate its removal.27 Potential complications of this design include visible and unesthetic cement margin in case of poor marginal fit of the individual crown, fracture of the framework if the connector dimensions are below the accepted threshold, and fracture of the marginal pink porcelain during removal of the individual crown if the operator is inexperienced.

A transverse or lingual-access screw design has been reported to overcome the issue with a labially emerging retentive
screw. It is a technically challenging approach with a number of potential complications, including exposure of the cross-pin screw joint to potentially destructive shearing forces in case of inappropriately designed abutment with poor resistance form, a bulky palatal aspect that could adversely affect esthetics and phonetics, and screwdriver access that could be restricted by the surrounding anatomy. In the reported patients, an alternative design was considered the treatment of choice compared to a transverse screw for functional and esthetic considerations.

This report further highlights the importance of optimal implant position to avoid complications as encountered in these two patients. An accurate and a stable surgical guide in conjunction with the surgeons’ ability to adhere to the principles of prosthetically driven implant placement would avoid these undesired outcomes. Alternatively, use of the guided surgery technique could be considered, which, however, has to be balanced against the additional costs.

Conclusion

The two clinical reports describe an alternative technique for the manufacture of screw-retained, implant-supported prostheses in cases where labially emerging screw access holes would have necessitated a cement-retained prosthesis. The definitive restorations were designed as screw-retained prostheses, except in the area with the unfavorable implant screw emergence. The frameworks in these areas were modified to receive individual cement-retained crowns. The labially emerging screw access hole is managed without compromising the functional or esthetic outcome. The prosthesis remains retrievable once the individual crown, cemented with soft cement, is removed, and access to the abutment screws is achieved.

References