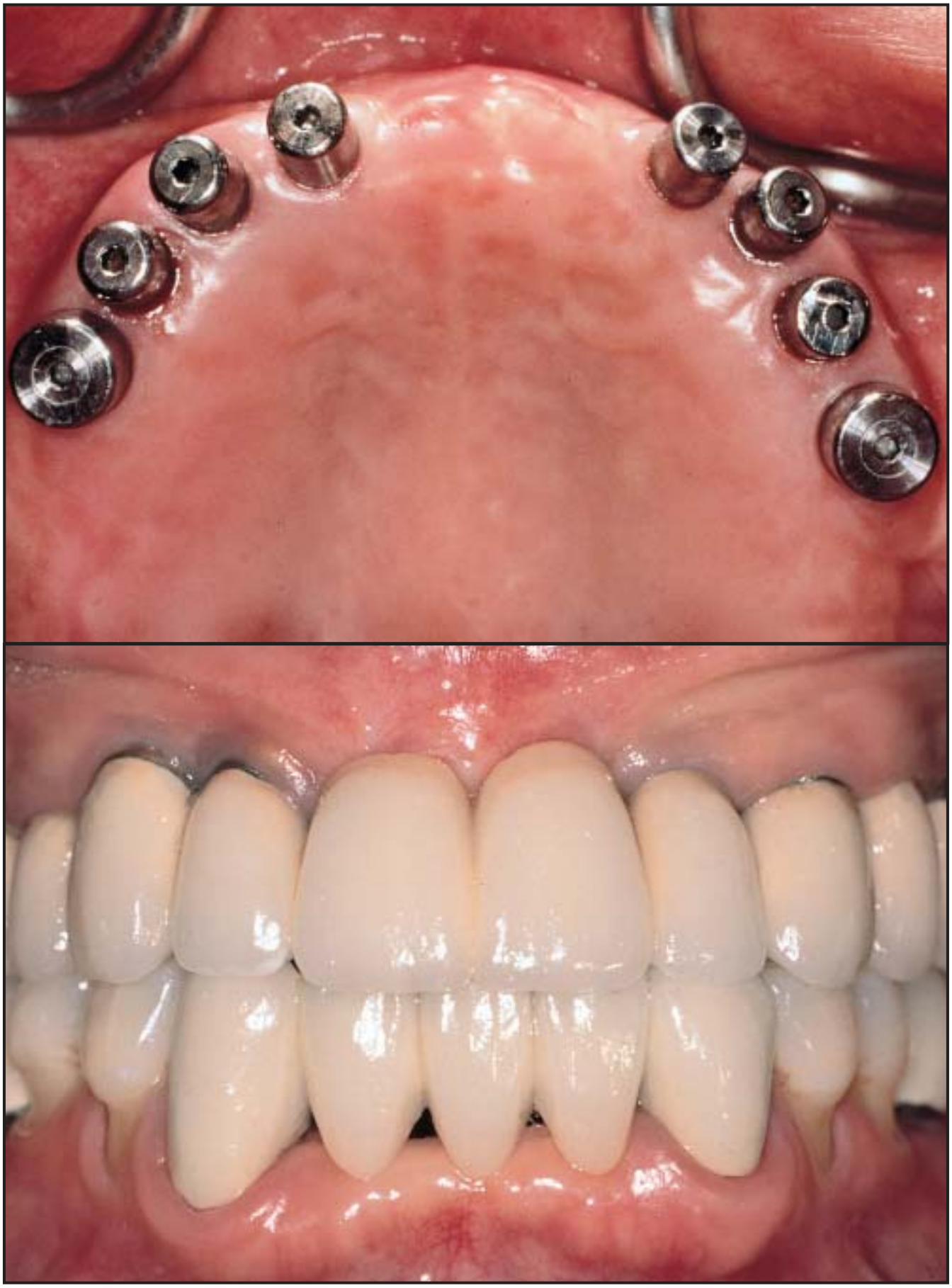

Clinical and Laboratory Steps for the Fabrication of a Fixed, Cement-Retained, Implant-Supported, Complete-Arch Maxillary Prosthesis

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The fabrication of a complete-arch maxillary prosthesis has been associated with several prosthetic complications and difficulties. Although it has been reported that phonetics, esthetics, and proper lip support are difficult to achieve, there is a scarcity of literature on the clinical and laboratory procedures necessary to minimize these complications. The current article provides clinical and laboratory steps that may enable the clinician to achieve more predictable restorative results when fabricating a cement-retained, implant-supported, complete-arch maxillary prosthesis. (Int J Periodontics Restorative Dent 2004;24:344–351.)

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Dental implants have become an established treatment modality for the completely[1,2] and partially edentulous patient.[3,4] Fixed, implant-supported, complete-arch mandibular prostheses have been associated with a 98.9% surgical and prosthetic success rate after long-term function.[5] On the other hand, fixed, implant-supported, complete-arch prostheses in the mandible have been associated with esthetic and/or phonetic difficulties.[6–11] The extent of the maxillary alveolar ridge resorption and the necessity for adequate lip support determine the potential for fabricating a fixed maxillary prosthesis.[7–13] An implant-supported maxillary overdenture appears to offer superior esthetics and/or phonetics in situations with advanced alveolar ridge resorption.[9–12,14] The fabrication of a flange in a fixed maxillary prosthesis can compromise access for oral hygiene.[7–9]

Although it has been reported that the fabrication of a fixed, implant-supported, complete-arch maxillary prosthesis requires careful treatment planning and prosthetic design,[11] there is a scarcity of

Fig 1 *Healing of maxillary implants is uneventful.*

Fig 2 *Screw-retained autopolymerizing acrylic resin bar is fabricated to provide support for diagnostic waxup.*

Fig 3 *Full-contour diagnostic waxup is fabricated and supported by screw-retained acrylic resin bar.*

Fig 4 *Intaglio surface of wax pattern.*

laboratory and clinical guidelines for the fabrication of such a prosthesis in the literature. The current article offers clinical and laboratory steps for the fabrication of a fixed, cement-retained, implant-supported, complete-arch maxillary prosthesis.

Case report

A 52-year-old woman presented at the Center for Prosthodontics and Implant Dentistry, Loma Linda University, seeking treatment for her completely edentulous maxilla. After discussing various treatment options, a decision was made to restore the maxilla with a fixed implant-supported prosthesis. Eight threaded, hydroxyapatite-coated, root-form implants (Steri-Oss, Nobel Biocare) were placed. Before implant placement, a new maxillary complete denture had been fabricated. A duplicate of the new maxillary denture was used as a surgical template during implant placement.[6,11] Implant placement and postoperative healing occurred without surgical complication (Fig 1).

The final maxillary impression was made with the open-tray technique[15] and by using a custom tray and polyvinyl siloxane impression material (Aquasil, Dentsply). Tissue-colored condensation polysiloxane (Gi-Mask, Coltène) was used to simulate soft tissue.[16]

In the laboratory, two nonhexed provisional implant abutments were placed on the most distal implant analogues. The height of

Fig 5 *Waxup is evaluated intraorally to assess proper lip support, contours, and esthetics.*

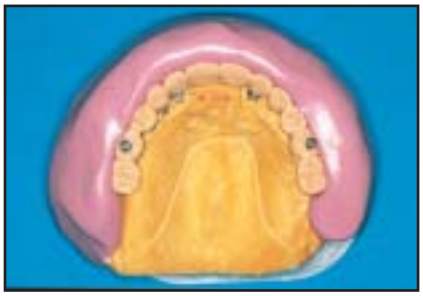

Fig 6 (left) *After esthetics are confirmed, silicone matrix is fabricated based on diagnostic waxup.*

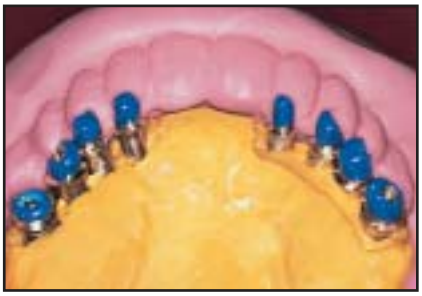

Fig 7 (right) *Custom abutments are cast and die spacer is applied before fabricating metal framework of definitive prosthesis.*

the abutments was reduced according to the available interocclusal space. Autopolymerizing acrylic resin (Pattern Resin, GC) was placed around the provisional abutments and extended around the contours of the maxillary arch to provide a framework for fabrication of the wax pattern (Fig 2).[17] A screw-retained implant-supported wax pattern was fabricated by making a fully contoured diagnostic wax pattern on the acrylic resin bar (Figs 3 and 4). The design involved single-tooth distal cantilevers bilaterally (Fig 4).[18]

The wax pattern was then screw retained intraorally through the provisional titanium abutments (Fig 5). Intraoral evaluation of the diagnostic wax pattern allowed evaluation of esthetics, contours, lip support, and access for oral hygiene.

The diagnostic wax pattern was then transferred to the laboratory and placed on the master stone cast. A silicone matrix (Lab-Putty, Coltène/Whaledent) was then applied along the labial/buccal surfaces of the wax (Fig 6). The silicone matrix offered guidance for the fabrication of the custom abutments (Fig 7).[19,20] With the aim of the silicone matrix, adequate space was provided around the custom abutments for the definitive metal-ceramic prosthesis.

The custom abutments were evaluated intraorally to assess proper marginal placement in relation to the soft tissue. The silicone matrix was then used to provide guidance for a new, fully contoured wax pattern of the definitive cemented prosthesis (Figs 8 and 9). The pattern was fabricated on the custom abutments. It was then cut

Fig 8 *Silicone matrix provides guidance for fabrication of waxup of definitive prosthesis.*

Fig 9 *Final waxup.*

Fig 10 *After performing proper cut-back, metal framework of definitive prosthesis is fabricated.*

Fig 11 (left) *Porcelain is applied on metal framework.*

Fig 12 (right) *Definitive cement-retained, implant-supported, complete-arch prosthesis.*

Fig 13 *Intraoral view in maximum intercuspation.*

Fig 14 *Patient's smile.*

back at 1.2 mm labial/buccal thickness to provide space for porcelain application.

The metal framework was then tried intraorally. The framework was cut and soldered to achieve passive fit (Fig 10).[21] After passive fit was confirmed,[21] the silicone matrix was used to provide guidance for porcelain application in the laboratory. This way, the initially designed and sculptured diagnostic wax pattern that had been intraorally evaluated was duplicated in the definitive prosthesis (Figs 11 and 12).

The cement-retained, implant-supported, complete-arch maxillary prosthesis was evaluated intraorally to confirm occlusion, esthetics, lip support, access for oral hygiene, speech, and contours (Figs 13 and 14). The custom abutments were torqued according to the manufacturer's recommendations, and the prosthesis was cemented with temporary noneugenol cement (TempBond, Kerr).[22]

Discussion

The described steps offer some guidelines to the restorative clinician for fabrication of an implant-supported, complete-arch maxillary prosthesis. Intraoral evaluation of the diagnostic wax pattern[17] offers guidance for the fabrication of the definitive full-contoured wax pattern, the cut-back of the metal framework, and the final porcelain contours. The patient and clinician have the opportunity to evaluate esthetics, phonetics, contours, and cleansibility of the prospective fixed implant-supported prosthesis. The same parameters were evaluated presurgically by using a duplicate of the patient's maxillary complete denture.[6] However, the presence of implants postoperatively enables further diagnostic evaluation.[17] The diagnostic wax pattern can be screw retained on the implants, simulating the design of the definitive prosthesis. Engelman et al[23] describe fabrication of the diagnostic wax pattern preoperatively, before implant placement. This approach offers precise implant placement; however, postoperative diagnostic evaluation is still necessary to confirm the design of the definitive prosthesis.[13]

In the described case, two provisional abutments were used in the area of the first molars. This enabled the fabrication of a full-contoured wax pattern in the anterior area. A third abutment could potentially be used at the anterior area to provide further stability to the wax pattern. However, placement of an additional provisional abutment would interfere with the esthetic zone.

The custom abutments were evaluated intraorally to assess the location of the margin in relation to the soft tissue level. In anterior esthetic areas, the custom abutments need to be milled at or below the gingival level to enhance esthetics.[19,20,24] Intraoral evaluation of the custom abutments is required to identify the areas that need to be milled further apically. Adequate soft tissue thickness is needed in these cases.[9]

Several authors recommend the use of denture teeth placed on an acrylic resin baseplate[6,12,13] to fabricate a diagnostic silicone jig in the laboratory. However, a fully contoured diagnostic wax pattern offers superior precision. The baseplate does not enable the clinician to evaluate the accessibility for oral hygiene and the need for lip support when a flangeless fixed prosthesis is planned. Removable gingival veneers have been proposed[25,26] as a solution for situations in which the necessity for lip support was underestimated during the diagnostic restorative phases.

A cement-retained definitive prosthesis was selected for the described case because of superior esthetics[27,28] and reduced occurrence of abutment screw loosening[28] compared to a screw-retained restoration. It has been shown that retrievability is feasible with a cemented prosthesis.[22] However, if a screw-retained implant-supported prosthesis is planned, implant placement should be done in a way that would allow occlusal screw access though the lingual area of the anterior teeth or the occlusal surface of the posterior teeth. This requires meticulous treatment planning to ensure implant placement at a more lingual/palatal location in the anterior segment as compared to a cemented prosthesis. Buccally or labially misangulated implants preclude the fabrication of a screw-retained definitive prosthesis. In those situations, appropriately modified custom abutments offer the opportunity to correct implant misangulations.[24]

A disadvantage of the definitive prosthesis described is the difficulty of achieving passive fit because of the extent of the metal framework.[29,30] Several cut-and-solder sessions may be necessary, as in the described case. In addition, porcelain fracture may impose technical difficulties. In such a case, an attempt to repair fractured porcelain will necessitate removal of the remaining porcelain and rebaking new porcelain, which compromises metal framework fit.[30] Alternatively, fabrication of several cement-retained, implant-supported fixed partial dentures with smaller spans may offer an advantage.

Intraoral evaluation of a screw-retained wax pattern is essential for the design and fabrication of a fixed, implant-supported, complete-arch maxillary prosthesis. The current article provides clinical and laboratory steps for the fabrication of such a prosthesis.

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