Radiographic and surgical guide for placement of multiple implants

Naseem K. Arfai, DDS,a and Sudarat Kiat-amnuay, DDS, MSb
The University of Texas Dental Branch, Houston, Texas

It is the responsibility of the restorative dentist to fabricate a surgical guide that dictates to the surgeon exact placement of each implant.1 Misaligned implants complicate the clinical and laboratory procedures in the fabrication of definitive restorations.2 The nonparallel placement of implants, especially when multiple implants are placed, can cause nonaxial loading during function, which may compromise the long-term success of the implants.3,4

Several types of surgical guides have been reported.1-3,5-12 Some are designed for placement of a single implant, while other reports present designs for multiple single implants,5 implant fixed partial dentures,4 and implant-retained overdentures.3 Three techniques commonly used for preparing the guide holes and fabricating the radiographic and surgical implant guide are free-hand, milling, and the use of computer-aided design/computer-assisted manufacture (CAD-CAM) technology.10-12

In the free-hand technique5,6,7 an acrylic resin bur is used to mark the cast as a guide for parallel insertion without a fixed apparatus stabilizing the bur. This technique poses risks because parallel implant placement cannot be standardized. Two designs using a free-hand technique have been reported—slot3,6 and individual hole.5,7 The slot design provides neither parallel guidance nor precise position for placement of the implants. With this design, implant position depends primarily on the experience of the surgeon. The individual hole design allows for flexibility in implant angle and position due to the preparation of an oversized hole. These techniques allow for error, which may compromise the success of the implants.

The milling technique is an accurate technique in which a milling machine is used to drill parallel holes in the surgical guide. This technique requires special equipment not commonly available in private dental practices. In addition, the clinician needs a certain amount of experience to use the machine properly.

The computer-guided and CAD-CAM stereolithic models use 3-dimensional images coupled with the appropriate software to allow precise implant placement, especially in situations of inadequate or insufficient jaw bone structure.10-11 This technique requires acquisition of software and special training to convert commonly used computer tomography (CT) images13-16 into data that is recognized by the reformatted CT imaging software. An accurate definitive outcome11-12 can be obtained by providing information regarding the osseous morphology,17 density, and proposed tooth positioning.18 During the scan, the patient must wear a scan prosthesis, which indicates the position of the teeth and gingival tissues. The clinician, however, must have access to such a facility, and the patient must be able to afford the extra cost.

A simplified technique for fabricating a radiographic and surgical guide for optimum placement of multiple implants that is suitable for most situations with adequate osseous structure is presented. This technique combines the accuracy of an implant milling machine with the practicality of a cost-efficient, user-friendly procedure, using the aid of a conventional dental surveyor commonly available in most private practices.

PROCEDURE

1. Complete a diagnostic waxing of missing teeth to full contour with proper occlusion.
2. Duplicate the diagnostic waxing using irreversible hydrocolloid (Alginate; Patterson Dental; St Paul, Minn) and pour the impression with type III dental stone (Microstone; Whip Mix Corp, Louisville, Ky). Use the duplicate cast to prepare the surgical guide.
3. Trim the duplicate cast to include 2 teeth adjacent to the waxing.
4. Use clear surgical tray thermo-forming material (0.06-inch, 5 x 5 inches) (Henry Schein, Melville, NY) to make a vacuum-formed clear template of the trimmed duplicate cast.
5. Trim the surgical guide to allow for coverage on the incisal third of the adjacent teeth and full coverage of the waxings.
6. Block out the undercuts on the teeth adjacent to the edentulous area with either mounting stone (Whip Mix Corp) or with all baseplate wax (#2 pink baseplate wax; Patterson Dental), and lubricate the edentulous space of the diagnostic cast with white petrolatum USP (Ultraseal Corp, New Paltz, NY).
7. Pour a mixture of clear acrylic resin (Dentsply Caulk, Milford, Del) in the tooth areas of the surgical guide and place the surgical guide onto the diagnostic cast.
8. Place the diagnostic cast with surgical guide in place on the surveyor (Dentsply Ceramco, Burlington, NJ) table. Tilt the surveying table so that the
occlusal table of the cast is parallel to the floor. Use tongue blades to visualize parallelism. Use the periapical radiograph to assist in determining the path of insertion.

9. When the acrylic resin has polymerized, use a tungsten carbide cutter (H295EL; Brasseler USA, Savannah, Ga) or similar bur to drill down the center of the teeth where the implants are to be placed, leaving at least 1.5 mm of acrylic resin circumferentially.

10. Use a separating disk to precut a brass rod 3/32” (K&S Engineering, Chicago, Ill) or a similar metal round rod with an approximate diameter size to the implant into a 15- to 20-mm segment (to use as a pilot rod) and 7- to 10-mm segments (to use as radiographic rods). Alternatively, the opposite end of the undercut gauge could also be used as the pilot rod.

11. Attach the pilot rod into the surveyor mandrel and lubricate the rod with white petrolatum USP (Ultraseal Corp).

12. Again, mix the orthodontic acrylic resin (Dentsply Caulk) and allow it to polymerize almost to the doughy stage. Using a brush, fill the acrylic resin into the drilled opening(s) of the surgical guide until the hole(s) are full.

13. Use the surveyor to pierce the acrylic resin with the pilot rod to create parallel guides (Fig. 1, A). Take care not to move the survey table or the surveying pilot rod until the acrylic resin is almost polymerized. Once the acrylic resin is almost polymerized, remove the rod and repeat the process with the next guiding hole.

14. Remove the excess acrylic resin flash with an acrylic resin bur (UC251E 060L; Axis Dental Corp, Coppell, Tex) and smooth and polish the acrylic resin on the tissue surface of the surgical guide.

15. Place the radiographic rods into the guiding holes (Fig. 1, B). Use sticky wax (Kerr, Romulus, Mich) to retain the radiographic rods before placing the surgical guide intraorally. Make a radiograph with the radiographic guide and rods in place to determine correct positioning of pilot holes (Fig. 2, A).

16. Remove the rods to use the radiographic guide as a surgical guide.

17. Use the same technique described above to prepare a multiple-implant radiographic and surgical guide for an overdenture (Fig. 2, B).
REFERENCES

Reprint requests to:
DR SUDARAT KIAT-AMNUAY
DEPARTMENT OF RESTORATIVE DENTISTRY AND BIOMATERIALS
THE UNIVERSITY OF TEXAS DENTAL BRANCH AT HOUSTON
6516 M. D. ANDERSON BLVD, SUITE #493
HOUSTON, TX 77030
FAX: 713-500-4108
E-MAIL: Sudarat.Kiat-amnuay@uth.tmc.edu


doi:10.1016/j.prosdent.2007.03.002