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Stabilization of a Computer-Aided Implant Surgical Guide Using Existing Dental Implants with Conversion of an Overdenture to a Fixed Prosthesis

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Abstract

This clinical report describes a technique to stabilize a computer-aided dental implant surgical guide to existing implants. A patient requested conversion of her existing mandibular implant-assisted overdenture into a fixed complete denture. The surgical procedure was planned virtually, and the two existing dental implants were integrated into the surgical plan as a means to fixate the surgical guide. The implants were placed, and the patient's prosthesis was converted into an interim fixed complete denture.

Surgical guides fabricated by computer-aided design/computer-assisted manufacturing (CAD/CAM) in conjunction with cone-beam computerized tomography (CBCT) have enhanced the ability of the clinician to facilitate dental implant treatment planning and surgical treatment. CAD/CAM surgical guides allow for accurate and predictable implant placement around vital structures and proximity to teeth and other dental implants by controlling position, angular deviation, and depth.[1-3] The use of computerized surgical guides has been recommended by some for use in the majority of implant surgeries due to increased precision of implant placement in relationship to the interim and final prosthetic goals.[2,4] Proper and adequate intraoperative stabilization of implant surgical guides has been reported as a significant factor for proper use of these guides, which may be a challenge in edentulous patients.[5] This report describes a procedure to use existing dental implants to stabilize a computer-guided implant surgical guide for the purposes of fabricating an immediately loaded full-arch mandibular prosthesis.

Clinical report

A 60-year-old woman with an existing mandibular implant-assisted overdenture requested conversion of her overdenture into a fixed complete denture (Fig 1). She had her mandibular teeth extracted 2 years previously, and two dental implants were placed in the anterior mandible. These two implants were placed in positions and with sufficient prosthetic space to allow for additional implants to be placed in anticipation that she may wish to have a fixed prosthesis. At the time, she indicated that she was unable to financially afford more than two implants. At initial presentation to the author's clinic, she was interested in additional implants and conversion of her removable prosthesis into a fixed restoration.

A replica of her mandibular overdenture was fabricated with poly(vinyl siloxane) putty (Aquasil; Dentsply, York, PA) and clear orthodontic resin (Jet; Lang, Wheeling, IL) with 2.3 mm fiducial spheres (Suremark; Qfix, Avondale, PA) attached to various parts of the replica denture (Fig 2A). Complete adaptation and seating were achieved by relining the guide with soft-tissue conditioning material (Lynal; Dentsply).

A CBCT scan (i-CAT; Imaging Sciences International, Hatfield, PA) was made of the patient with a replica of her denture held in place by her maxillary interim denture. A second scan was made of the replica denture to allow for segmentation of the prosthesis from the soft tissue and alveolar structure.

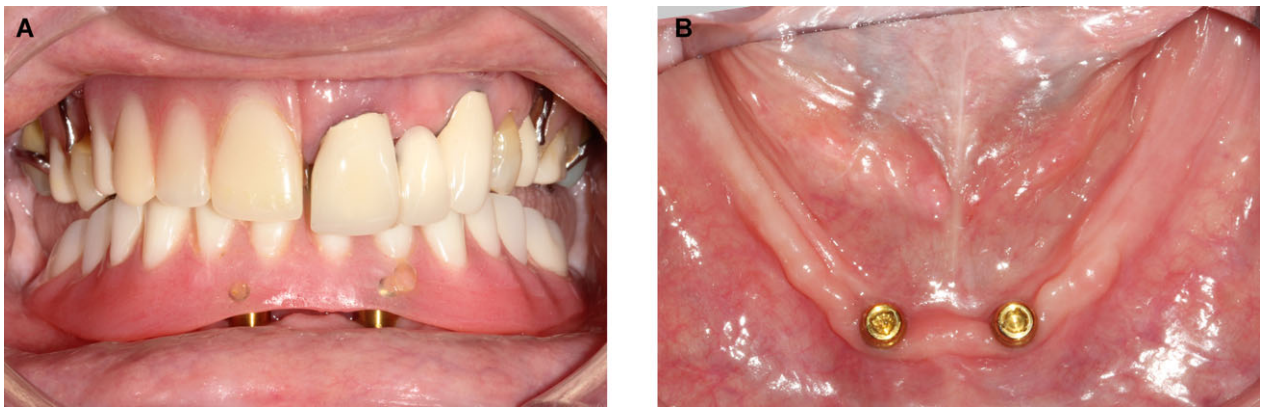

Figure 1 Pretreatment view. (A) The patient requested conversion of her implant-assisted implant overdenture into a fixed prosthesis. (B) Implants were previously placed in positions favorable for the placement of additional implants.

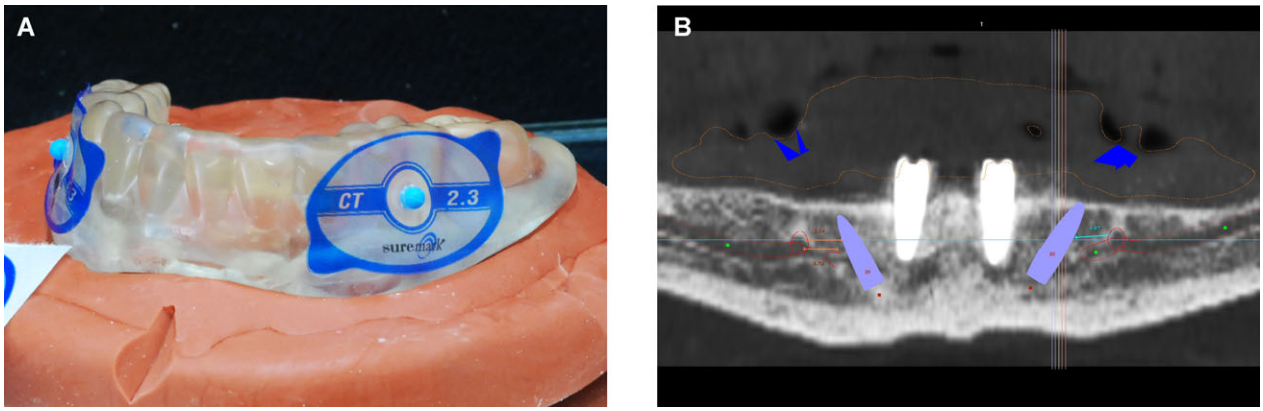

Figure 2 Laboratory and computer planning. (A) 2.3 mm fiducial spheres attached to a duplicate of the existing implant overdenture. (B) Additional implants virtually placed, and a surgical guide planned to incorporate the existing anterior implants as fixation/stabilizers.

Implant planning was done on virtual planning software (Blue Sky Plan; Blue Sky Bio LLC, Grayslake, IL). The radiographic images indicated that the patient had favorable bone height and volume, allowing the placement of two additional implants according to a tilted implant protocol.[6] During computer planning of the surgical guide, space was created around the anterior implants to allow for space between prosthetic components and the guide (Fig 2B). Two 4.3 mm wide × 13 mm long implants were planned (NobelActive; Nobel Biocare, Yorba Linda, CA) to be terminal support for the fixed prosthesis while the existing two implants (SPI Contact; Thommen Medical AG, Grenchen, Switzerland) would be the anterior support.

A computer-aided surgical guide was thermoplastically printed, and metal inserts were incorporated, allowing for angulation and depth-limiting capabilities. The patient was seen prior to the surgical appointment, and complete adaptation of the surgical guide was verified with disclosing media (Pressure Indicating Paste; Keystone Dental, Cherry Hill, NJ).

The patient was anesthetized for surgery, and the surgical guide placed into the mouth. Relief holes above the overdenture attachments were fabricated to ensure the passive seating of the impression posts (Fig 3A).

The overdenture stud-type attachments (Locator; Zest Anchors LLC, Escondido, CA) were removed and replaced with screw-retained abutments (VARIOmulti; Thommen). A radiograph verified intimate fit, the abutments were torqued (15 Ncm), and an impression coping was placed on each abutment. The surgical guide was placed over the impression copings, verifying that no binding occurred, and the same fit to the soft tissues was determined (Fig 3B).

A light-cured acrylic resin was applied (Triad Gel; Dentsply) incrementally (Fig 4A) and cured with a curing light (Bluephase; Ivoclar Vivadent, Schaan, Liechtenstein) while firmly holding the surgical guide in place (Fig 4B). The guide was removed, additional light-cured acrylic resin was applied, and the guide replaced, verifying intimate fit to the abutments and soft tissues.

Conservative crestal incisions were made, and mucoperiosteal flaps were elevated to expose the implant sites. Implant drills were used through the guide sequentially with the use of keyed inserts to enlarge osteotomies. Two 4.3 mm wide × 13 mm long implants (NobelActive; Nobel Biocare) were placed through the surgical guide until depth stops were reached, and the guide was removed (Fig 5A). Primary stability was achieved with insertion torque values >35 Ncm.

The alveolar prominence was reduced around the implants, allowing room for prosthetic components. Healing abutments were placed, and 3-0 Chromic gut sutures (Surgical Sutures;

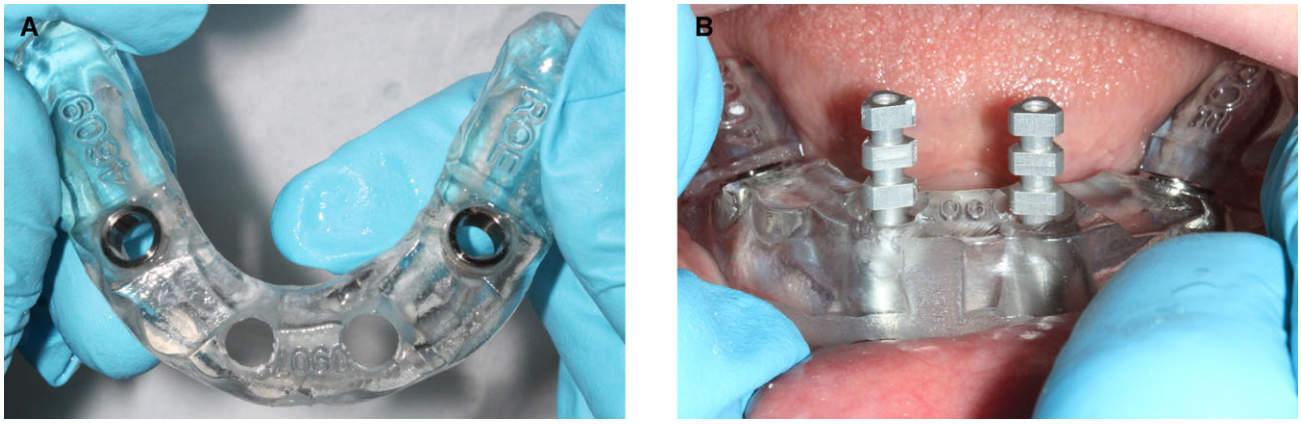

Figure 3 Guide fixation. (A) Surgical guide prior to connection to anterior implants. (B) Stud-style overdenture abutments replaced with screw-retained abutments and impression posts.

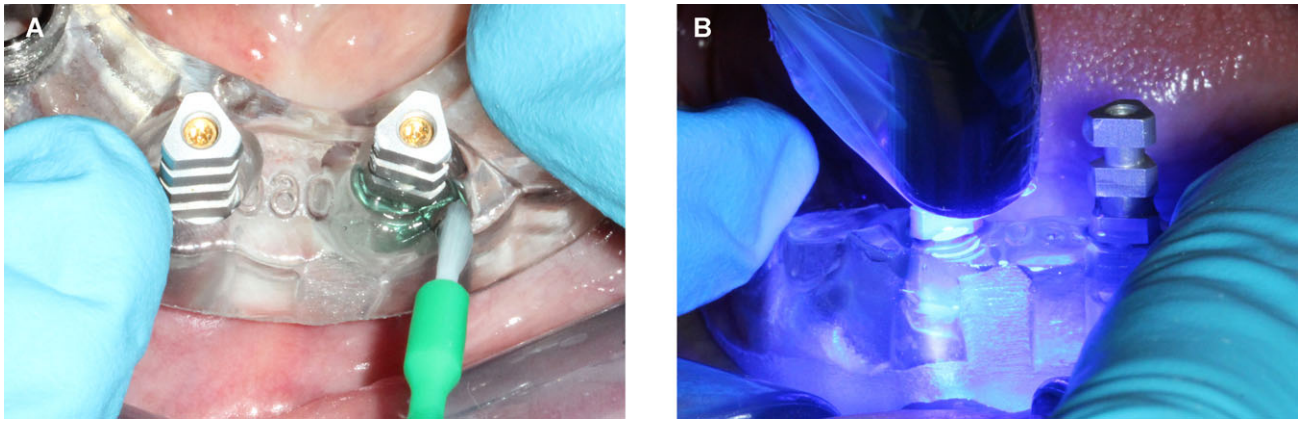

Figure 4 Guide fixation. (A) Light-cured resin placed and (B) cured, rigidly attaching the surgical guide to the impression posts.

Henry Schein, Raleigh, NC) were used to close the flap (Fig 5B).

The healing abutments were removed, and screw-retained abutments were placed on the terminal implants (Multi-Unit; NobelBiocare) and torqued (15 Ncm) after confirming angulation and radiographic fit (Fig 6A). Rapid-set occlusal registration material (Blu-Mousse; Parkell Inc., Edgewood, NY) was injected into the intaglio side of the overdenture and seated, illustrating the positions of the abutments. Openings were created with an acrylic bur (Laboratory Bur; Henry Schein), modified titanium provisional posts were placed (Temporary Coping, NobelBiocare; VARIO Multi, Thommen Medical, Grenchen, Switzerland) (Fig 6B), and the denture was placed back in the mouth verifying passive adaptation (Fig 7A).

Adhesive was applied, bis-acryl resin (Secure Hard Pick-Up, 3M ESPE) was injected into the openings, and the patient instructed to close at the appropriate occlusal vertical dimension and centric position. After complete polymerization, the prosthesis was removed, and additional bis-acryl applied. The prosthesis was sectioned distal to the second premolar, minimizing the cantilever, finished and polished, and attached to the implants (Fig 7B).

Abutment screws were torqued (15 Ncm), occlusion adjusted, and postoperative instructions reinforced. The patient reported little pain and discomfort throughout the procedure and indicated that she was very satisfied with the result.

Discussion

A fully adapted and stable surgical guide is important for clinical outcomes of dental implant surgical procedures.[5,7,8] In edentulous implant surgical procedures, traditional prosthodontic principles have historically been advocated to achieve stability of surgical guides, including the use of the maxillary hard palate and the mandibular retromolar pads.[9] Resorption of the mandibular alveolar support or interference of mucoperiosteal flap elevation contributes to lack of stabilization during the surgical procedure.[5] Additionally, relieving the lingual flanges is often necessary to allow accessibility to the mandibular surgical site.[9] As a result, authors have advocated the use of various methods to stabilize guides during surgical procedures, including acrylic resin occlusal overlays,[10] vacuum-formed matrices,[11,12] wire occlusal stops,[13] wire clasps,[14] acrylic resin connection to a maxillary duplicate

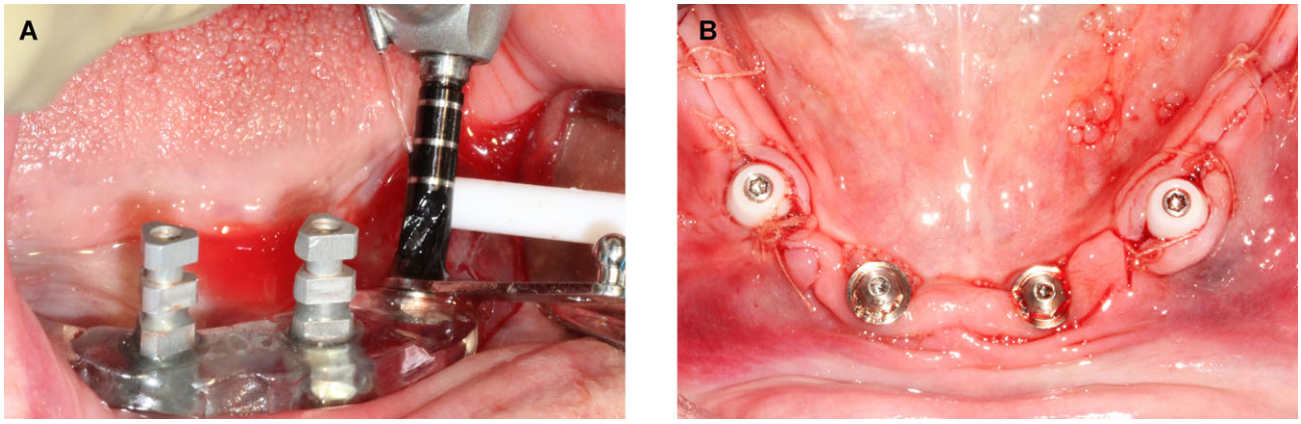

Figure 5 Implant placement. (A) Implant surgical drills used through surgical guide sequentially to enlarge osteotomies; implants were placed through the guide. (B) Healing abutments placed, minor flap elevation closed with sutures.

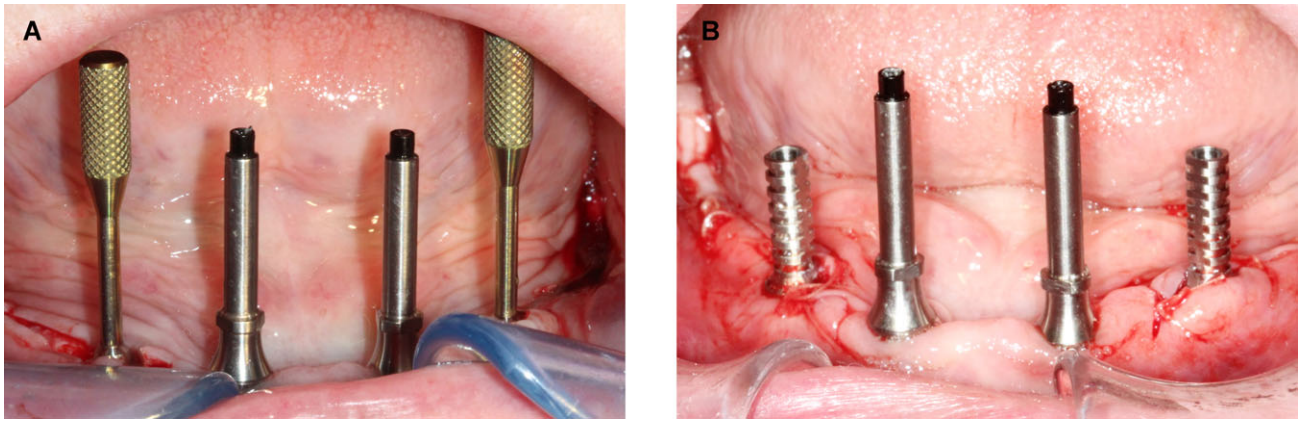

Figure 6 Angled abutments. (A) 30° angled abutments placed and torqued on the distal implants. (B) Temporary titanium abutments placed on abutments.

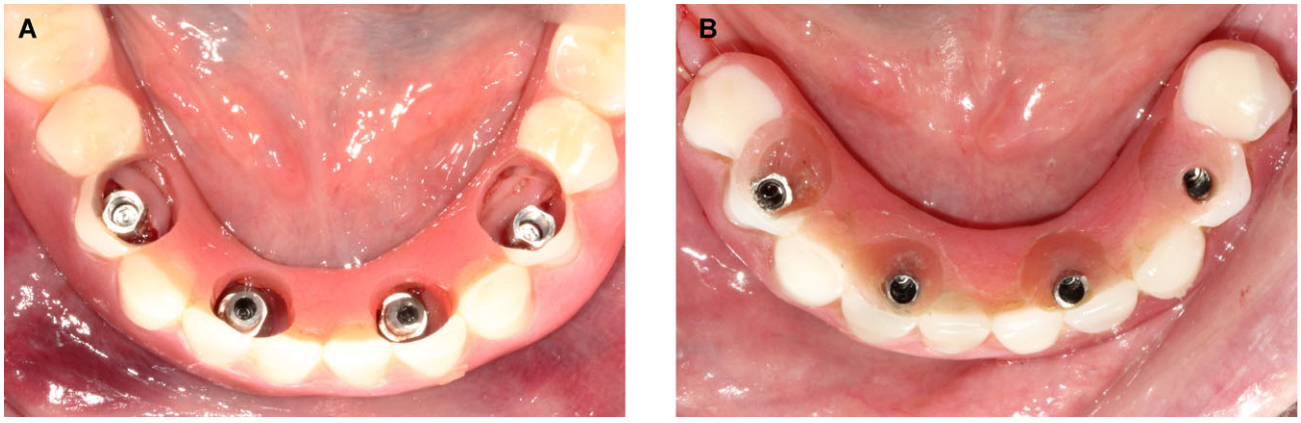

Figure 7 Prosthesis conversion. (A) Space created between existing overdenture and provisional abutments to allow for bis-acryl to have enough rigidity. (B) Final interim prosthesis in place.

denture,[5] transitional implants,[7,9] trans-alveolar stabilization with pins/screws,[15-21] and the first one to two implants in a multi-implant surgical plan.[22]

Immediate loading in the edentulous mandible is a predictable treatment modality with success and survival rates comparable to those seen in delayed loading protocols.[23-26] Immediate conversion of a patient's existing prosthesis after implant placement from a removable to a fixed prosthesis allows the clinician to use the existing restoration in an effective manner.[27,28] Immediate loading with computer-aided

guides, however, can be problematic due to a relatively high incidence of radiographic bone defects and infection attributed to the use of trans-alveolar anchor pins/screws.[29] In patients with substantial advanced alveolar resorption, existing dental implant therapy, and proximity to vital structures, the use of stabilization pins could potentially compromise the osseointegration of dental implants.

Conclusion

This clinical report describes an approach to achieve stability of a computer-aided implant surgical guide using existing dental implants. Furthermore, this report illustrates that when implants are placed for implant-assisted overdentures in positions with sufficient prosthetic space, the placement of additional dental implants facilitates conversion to a fixed prosthesis.

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