Use of SIG Device to Accurately Place Permanent Miniature Dental Implants to Retain Mandibular Overdenture

A Case Report


Abstract
A case of mini-dental implant insertion for retention of a mandibular overdenture in a hospitalized patient has been documented. The additional use of the SIG (drill guide) directional device at the implant placement protocol gave the practitioner more confidence and resulted in the proper alignment of the three ball-top, one-piece fixtures. The three implants were inserted exactly 1 cm apart and parallel to each other. The distal fixtures were approximately 1 cm away from the mental foramina, thereby eliminating the risk of lip paresthesia. Keeper caps were placed in the denture's intaglio after one month. The keeper caps allowed for proper retention of the overdenture. The caps also enabled the patient to easily insert and withdraw his denture, even though he displayed limited manual dexterity. The tissue response was excellent, and oral hygiene was made easier with adequate spacing of the exposed ball-tops. The overall experience for both the operator and the patient was very positive. General dentists should be able to readily master this technique and add it to their armamentarium for the benefit of all their patients.

Complete maxillary and mandibular dentures have been the standard of care for totally edentulous patients for the past century. However, many people are unable to masticate food properly because of the inherent instability of the lower denture. Currently, two endosseous implants have each been recommended to help retain a mandibular overdenture. In order to place these implants, crestal bone is usually exposed. If the anterior ridge is thin, the superior aspect of the ridge can be removed until adequate ridge width is reached. However, when resecting surface bone to achieve an accommodating measurement, the result may be placement of the implants inferior to the level of strong lip muscle attachments. These situations often create restorations that are more difficult to maintain.

To avoid excessive bone removal, small-diameter implants have been recommended. There has been a report of endosseous implants that were immediately loaded with the fabrication of a simple acrylic, resin-fixed denture. The results showed that all 54 implants placed in that study survived.

Another system for retaining a lower denture has been proposed. In this system, the type of fixture employed has a protocol that calls for a ball-top mini-dental implant (MDI) to be placed through the gingival tissues into the subjacent bone. Immediately after implant insertion, the denture intaglio can be altered with keeper caps and placed on top of these implants. The metal housing and O-rings within the keeper caps can tolerate a divergence of 15 to 20 degrees of the individual implant ball-tops.

A prior study reporting on prosthetic complications of implant-supported overdentures with ball-top attachments concluded that this treatment was an acceptable option for edentulous patients. However, frequent maintenance was required to ensure successful long-term outcomes.

A prefabricated implant guide (the Sussman Implant Guide, or SIG) that would also act as a surgical stent has been developed. It ensures perpendicular placement of the fixtures, along with parallelism and consistent 10 mm spacing. The following case report documents the placement of three MDI fixtures (Semedex M.D.L. IMTEC Corp., Anaheim OR) in a hospital patient, using the SIG directional device. The result demonstrated adequate denture retaining ability. An additional benefit to the patient was the fact that implant placement was approximately 1 cm shy of the mental foramen, thereby eliminating the possibility of surgically induced lip paresthesia.

Case Report
In December 2003, a 50-year-old Hispanic male was admitted to Coler-Goldwater Specialty Hospital & Nursing Facility on Roosevelt Island in New York City. In June
2004 he was referred to the dental clinic at the Goldwater campus. His chief complaint was a loose fitting lower denture.

The 6-foot-tall, 200-pound ambulatory patient appeared alert. The medical history revealed that the patient was an alcoholic, who smoked up to two packs of cigarettes a day. He had been diagnosed with diabetes mellitus, hypertension, hepatitis A and C, chronic osteomyelitis and cirrhosis of the liver. His presenting medication regimen included methadone, morphine (a slow-release narcotic), klonopin (a benzodiazepine), atenolol (a beta-blocker), folic acid, prevacid and heparin. He had been placed on a 2-gram sodium, 1800-calorie and diabetic diet. Clinical and radiographic examinations revealed an edentulous patient with normal oral mucosa but a very shallow anterior mandibular vestibule (Figure 1).

After completion of the oral examination and consultation with the staff prosthodontist, Dr. Morton Schnur, it was determined that a surgical deepening of the labial anterior mandibular vestibule was medically contraindicated. The treatment of choice for this patient was the placement transdermally of mini-dental implants to achieve denture retention and stability for the patient, using a minimum of surgical trauma.

The width of the attached gingiva at the mandibular crest was 2 mm; the depth of the crestal gingival was 1.5 mm; and the width of the anterior mandible, just below the bone crest, was 4 mm when measured with tissue calipers. In addition, a strip of lead-foil film was adapted to the denture and with the denture in place, a lateral symphyseal radiograph was taken using an occlusal film. This view showed that the angle from the crest of the bony ridge to the incisal edge of the denture was approximately seven degrees (Figure 2). It was decided to use only three mini-implants, one plated in the symphysis and one on either side of the symphysis 1 cm distally, thereby minimizing surgery for the patient.

Medical clearance was obtained from the patient's treating physician, and the patient signed an "Informed Consent for Invasive,
Diagnostic Medical and Surgical Procedures™ and a “Consent for Photographs.” A week prior to the surgery, his dosage of heparin was lowered and an INR reading obtained.

The morning of the procedure, the patient was given 2 grams of amoxicillin orally, one hour preoperatively. The midpoint of the mandibular crest, directly below the tip of his nose, was marked with a surgical skin-marking pencil. Bilateral mental infiltration anesthesia was administered and additional infiltration anesthesia to the lingual ridge crests in the anterior jaw region. Using one carpule of 2% lidocaine containing 1:100,000 epinephrine, was given.

The SIG device was removed from its sterile wrapping and dental tape was threaded through the handle and tied to prevent accidental swallowing. The handle end of the device was placed over the center blue marking with the guide end placed over the ridge in the area of missing tooth #22 (Figure 3). The SIG device was then inclined about 7 degrees to the labial, as pre-determined from the lateral occlusal film (Figure 2). This resulted in a 1 cm distance from the center point to where the first implant would be placed.

The handpiece was set to rotate at 1200 rppms using a 1.1 mm twist drill. The drill penetration of the bone was approximately 6 mm (Figure 4). This created a pilot starter hole of about 5 mm into bone (Figure 5). A mini-dental implant was inserted into the pilot opening with the attached plastic transfer mount. The mount was then removed and a finger driver was used to obtain a firm grip of the MDI fixture in the bone. The MDI was then auto-advanced into the medullary cancellous bone with a winged thumb wrench (figure 6).

The implant was inserted so that no threads were above the bone crest and approximately 1.5 mm of the square neck showed supragingivally (Figure 7). The handle end of the SIG device was then placed over the exposed part of the first implant, where it engaged the ball-top (Figure 8). The second MDI was inserted in the mandibular symphysis following the same protocol as with implant number one (Figure 9). The rotation of the drill was raised to 2,000 rppms because of the increased bone density in this site. The distance between the first two implant fixtures was exactly 1 cm.
The SIG device handle was then positioned over the ball-top of implant number two, with the guide end-ring now over the ridge in the area of missing tooth #27 (Figure 10). The third MDI was placed following the same steps used in the first two fixtures (Figure 11). The distance between the last two implants was also 1 cm.

All three implant fixtures were parallel to each other and perpendicular to the bone crest over a 2 cm arc, as evidenced in the postoperative radiograph (Figure 12). The slight anterior labial inclination was made intentionally to ensure keeper-cap placement within the body of the mandibular denture (Figure 13). The corresponding intaglio of the denture was then relieved for a distance of 25 cm in length, 6 mm in width and 5 mm in height. This area was filled in with soft-cure reline material and placed over the exposed ball-tops.

The patient left the clinic wearing his lower denture (Figure 14). There were no postoperative complications or any discomfort to the patient. Healing was uneventful.

He returned in one month to have the soft-reline material removed from the intaglio and permanent keeper-caps inserted with Dura-lay acrylic, and again in six months for a check-up. The gingival tissue around the mini dental-implants appeared remarkably healthy. At this visit, the patient requested placement of implants for his upper prosthesis since he was so pleased with the stability of his lower prosthesis.

Figure 10. Handle of SIG device placed over ball-top of #2 MDI with guide end over #27 site.

Figure 11. Third MDI in place. (Note they are each 1 cm apart and parallel to one another.)

Figure 12. Postoperative periapical X-ray demonstrating parallelism and equidistance between three 1.8 mm x 15 mm long fixtures within mandibular bone.

Figure 13. Postoperative lateral occlusal film demonstrating angulation of fixtures to allow keeper caps to be placed in widest part of denture base. (Refer to Figure 2.)

Figure 14. Lower denture re-inserted over MDI ball-tops after drilling holes in denture intaglio and filling them in with soft-cure denture reline material.

Discussion

Miniature dental implants with diameters around 2 mm provide the practitioner with an option for obtaining retention for an overdenture that benefits the patient. They are simpler to use since there is a limited insertion protocol. It is a less-invasive procedure because no bone is exposed. There are no Imparts on the implant that might unscrew, as there are with standard implants. They are also less expensive to purchase since three mini-implants would cost less than half the price of two standard implants. Less chair time is needed to place mini-implants, so this should translate into a lower charge to the patient, provided a guide such as the SIG is used.

The use of a placement stent device is extremely advantageous. Factors to be considered in such placement would include the following:

- It instills in the practitioner the confidence necessary to prepare the pilot starter hole.
- It achieves accuracy of placement of the fixtures. Since parallelism is obtainable, only three implants are needed instead of four or more to achieve good retention of the overdenture.
- If the implants are placed free hand and misaligned, the silicone rings inside the keeper caps have to be relieved to enable the patient to insert and withdraw the overdenture. This procedure is eliminated with the SIG directional device, so there is no reduction in retention. Having only three implants makes it simpler for the patient to manipu-
late the overplurure. It also makes oral hygiene easier for the patient since there is adequate ridge space distance between the exposed ball-tops.

The use of mini-dental implants provides many advantages over standard fixtures. The ridge crest need only be 3 mm wide for insertion of a 1.8 mm wide mini-implant. A standard implant of 3.3 mm to 4 mm diameter would need up to twice that width to obtain adequate labial and lingual bone support. The mini-dental implant calls for a pilot starter hole of 1 mm by 5 mm deep. This reduces the chance of overheating the bone. Standard implant placement uses sequential burs of increasing diameters to prepare an osteotomy site. As the depth increases, the likelihood of burning the bone at the apex of the bur becomes more of a possibility. The mini-dental implant also acts like an osteotome. As it is screwed into place in the jaw, it laterally condenses the cancellous bone, thereby ensuring thread fixation in denser bone. Standard implant osteotomy sites are prepared by removing bone, and fixation is usually obtained by about 0.5 mm of lateral thread engagement into the bone. It should also be noted that mini-dental implants have an easily removed plastic transfer mount. Standard implants have metal mounts that are sometimes difficult to remove from the implant fixture. This impediment can create unnecessary complications for the practitioner.

The mini-dental implant placement protocol presented here used a directional device. Since it is a minimally invasive procedure, it has other significant benefits, such as reduced bleeding, decreased postoperative discomfort and shortened healing times.

REFERENCES

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