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Case Report Open Access

A Guided Surgical Technique for the Use of Small Diameter Implants in the Anterior Mandible: Report of a Case

Kory Grahl[1*], Brittany Rich[2] and Andrew P Ingel[1*]

[1]*Department of Clinical Sciences, University of Nevada, School of Dental Medicine, Las Vegas, Nevada, USA*

[2]*Private Practice, Las Vegas, USA*

[*]**Corresponding author:** Kory Grahl and Andrew P Ingel, Department of Clinical Sciences, University of Nevada, Las Vegas - School of Dental Medicine, 1001 Shadow Lane, Las Vegas, Nevada 89106, USA, E-mail: korygrahl16@gmail.com, Andrew.Ingel@sdm.unlv.edu

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Abstract

Introduction: Over the last five years 3,276 implants have been placed at the University of Nevada Las Vegas School Of Dental Medicine. Of those, 55 have been small diameter implants (SDI), accounting for less than 2% of all dental implants. Nine SDI's were placed for fixed restorations. This case report demonstrates the use of SDI's for a fixed, splinted restoration, utilizing a surgical guide for both the osteotomies and implant placement.

Methods: Two 2.0 mm × 15 mm SDI's (Shatkin F.I.R.S.T.) were placed in the location of teeth #23 and #24. A surgical guide (Shatkin F.I.R.S.T Laboratory) was used for initial osteotomies to ensure proper angulation and for final placement of the SDI's. A laboratory fabricated splinted acrylic temporary (Shatkin F.I.R.S.T.) was placed during the healing phase.

Results: Both SDI's displayed successful integration, based on the Health Scale for Dental Implants. The SDI's displayed no mobility, no pain or tenderness upon function, <2 mm of radiographic bone loss from initial surgery, and no exudates. The final splinted Porcelain-Fused-to-Metal (PFM) restoration was fabricated using conventional crown and bridge techniques and was cemented using FujiCEM.

Conclusion: SDI's are indicated in cases where bucco-lingual bone width is limited and bone and soft tissue grafting are not possible. A surgical guide can be used to ensure proper placement and angulation of SDI's. Placement of a single traditional implant with cantilever prosthesis has an increased chance of prosthesis failure in five years. SDI's, in this application, have a success rate comparable to traditional implants. This case demonstrated a guided surgical technique for SDI's without extensive bone or soft tissue grafting procedures.

Keywords: Clinical research; Clinical trials; Diagnosis; Clinical assessment; Patient centered outcomes; Prosthodontics; Surgical techniques

Introduction

Small diameter implants (SDI) were cleared for long term use by the FDA in 1997. Previous implant "systems" diameters typically varied from 3 mm to 6 mm. In cases with inadequate bone height and width, numerous adjunctive procedures were required such as bone grafting, sinus augmentation, socket preservation, ridge splitting, and ridge augmentation. These additional procedures can add cost, healing time, and surgical complications. In 1976, Sendax developed a one piece implant with diameters ranging from 1.8 mm to 2.4 mm for denture stabilization [1-3]. Placement involved minimal soft and hard tissue manipulation resulting in less surgical time and fewer post-operative complications. Based on success rates similar to larger diameter implants, uses for SDI's can include single implant supported crowns, larger fixed prosthesis (bridges), orthodontic anchorage (TADs), implant-tooth-tissue supported removable partial dentures, and implant supported over dentures [4,5]. Indications for use of SDI's include insufficient bone (Inter-proximally or bucco-lingually), insufficient space between teeth (crown, roots or both), narrow cervical diameters, poor bone volume and thin or narrow ridges. Additional indications can include the patient's medical history and financial situation. SDI's are not applicable in all clinical situations, but can offer valuable treatment options for clinicians in fixed or removable situations. This clinical case highlights the replacement of two anterior mandibular teeth with two SDI's and a splinted fixed prosthesis in which a "traditional" diameter implant was too large for the bone volume without extensive on lay grafting procedures.

Clinical Report

A 54 year old Caucasian female presented to the UNLV School of Dental Medicine with a chief complaint of "I want to get these teeth out so the space can heal for implants". Clinical and radiographic examination revealed internal and external resorption of tooth # 23 and external resorption of tooth # 24 (Figure I-A). Endodontic therapy was attempted on tooth # 24 but therapy failed due to external resorption (Figure I-B).

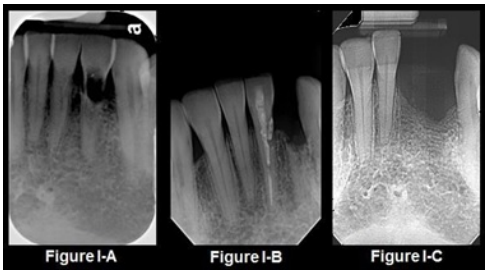

Figure 1: Radiographic examination. A) Radiographic examination revealed evidence of internal resorption of #23 and external resorption of #24 B) Endodontic treatment of #24 was unsuccessful due to external resorption C) Site post-extraction and graft procedure.

These two teeth (#23 and 24) were deemed non-restorable and planned for a traumatic extraction with immediate implant placement. A periotome was used to sever the periodontal ligament and a rongier was used to remove both root tips. However, the extractions required bone removal and it was determined at the time of surgery to graft the surgical site without immediate implant placement. Zimmer Demineralized Bone Matrix was placed into the surgical area and a Conform Resorb able Collagen Membrane was placed over the ridge to shape the ridge and maintain bone graft. Silk sutures (4-O) were used to close the surgical site in order to achieve primary closure (Figure I-C). Approximately nine months after the extractions and graft procedure, the ridge displayed adequate healing but with significant bucco-lingual and vertical bone loss (Siebert Class III) (Figure II-A and II-B). A cone beam (CBCT) radiograph was taken and *in vivo* software (Anatomage) was utilized to virtually position and place dental implants at the # 23 and # 24 sites (Figure II-C).

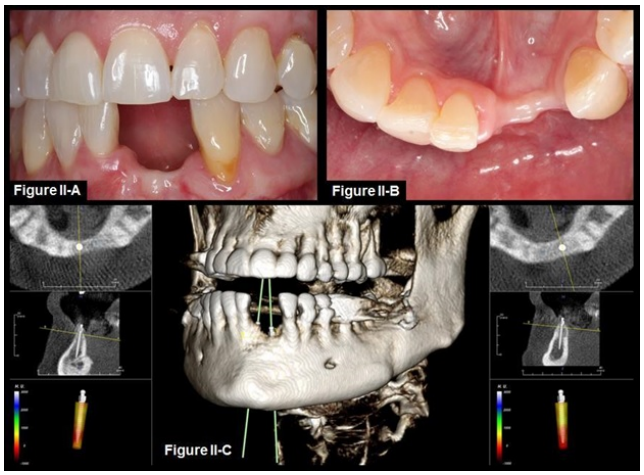

Figure 2: Pre-operative presentation and CBCT. A) Facial View: Healed site, post-extraction and bone graft; B) Occlusal View: Healed site, post-extraction and bone graft; C) Cone beam (CBCT) radiographs and *in vivo* software were used to position implants at the extraction sites.

The surgery was planned to include a modified full flap reflection. A laboratory fabricated surgical guide (Shatkin F.I.R.S.T.) was used for the osteotomy procedure and initial placement of the implants (Figure IIIA-IIIC). Two 2.0 mm × 15 mm Shatkin F.I.R.S.T mini dental implants were placed in the osteotomy sites using a surgical engine to drive the implants to approximately two millimeters above the crest of the bone. A hand torque driver was used to drive the implants to the final position at the crest of the bone (Figure III-D). The final torque reading at tooth site # 23 was 30 Ncm and tooth site # 24 was 25 Ncm.]

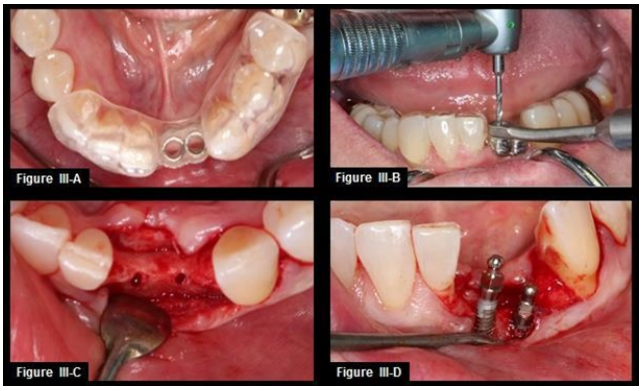

Figure 3: Surgical guide and Initial placement of mini implants. A) Laboratory fabricated surgical guide in place. B) Laboratory fabricated surgical guide used for initial osteotomy. C) Osteotomy created using the laboratory fabricated surgical guide. D) Placement of implants to crest of the bone. (Final torque was measured at 30 Ncm and 25 Ncm for tooth 23 and 24, respectively).

A laboratory fabricated acrylic temporary (Shatkin F.I.R.S.T.) was secured to the adjacent teeth using resin based composite and was taken completely out of occlusion. At six months post implant placement, clinical evaluation indicated the implants were successful according to the Health Scale for Dental Implants [1]. Upon examination prior to the final impression, both of the implants displayed no mobility, no pain or tenderness upon function, no exudate (Figure IV-A), and minimal radiographic bone change from the initial surgical post placement radiograph (Figure IV-B).

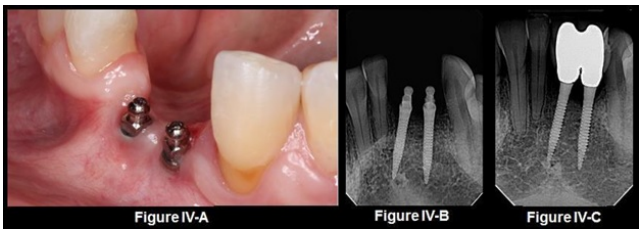

Figure 4: Clinical six month evaluation. A) Clinical examination revealed no mobility, no exudate, and no pain or tenderness. B) Radiographic examination revealed minimal bone change from initial surgical placement C) Radiographic appearance of final splinted PFM restorations.

A final impression was taken with Aquasil medium and light body polyvinylsiloxane material utilizing two impression copings (Shatkin F.I.R.S.T.). Implant analogs (Shatkin F.I.R.S.T.) were placed in a stone

model and a final splinted porcelain-fused-to-metal (PFM) restoration was fabricated. At the cementation appointment, the splinted PFM implant restoration was evaluated for shade, contacts, contour, and occlusion. Prior to cementation, complete seating was verified by clinical visualization, the use of an explorer to feel for marginal fit, Fit Checker Vinyl Polyether Silicone (VPES) material, and an anterior periapical radiograph (Figure IV-C). The final porcelain-fused-to-metal restoration was cemented using FujiCEM II (according to the manufacturer directions and recommendations). The final restoration displayed a good clinical appearance. The patient was pleased with the final appearance (Figure V-A and V-B).

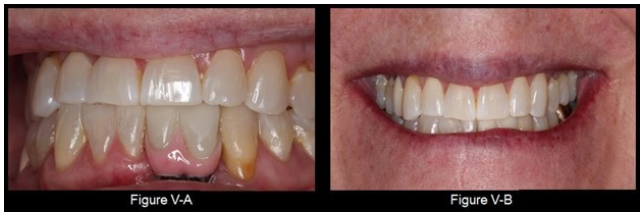

Figure 5: Final implant and clinical evaluation of mini implant. A) Clinical appearance following cementation B) Final appearance on recall.

Discussion

This case demonstrates that the use of SDI's can be a practical treatment alternative to conventional crown and bridge or removable dental prosthetics. Treatment options for this case could include 1) tooth-borne removable partial denture (RPD), 2) resin-bonded fixed partial denture (Maryland bridge), 3) tooth-supported fixed partial denture (FPD) or 4) grafting procedures followed by placement of a traditional diameter implant with a cantilever prosthesis. In a case where the patient declines a removable partial denture (RPD), the treatment of choice would be the placement of a tooth supported fixed partial denture (FPD). However, the adjacent teeth in this case are vital with no previous restorations and require no additional treatment. Furthermore, traditional crown and bridge preparations in the mandibular anterior region are clinically challenging for retention, stability, parallelism and pulpal considerations and, in this case, four teeth (#'s 22, 25, 26 and 27) would likely be indicated for sufficient support, stability and strength of restoration. Another alternative for this case would be a resin bonded fixed partial denture (Maryland bridge) which could replace teeth # 23 & # 24. While a Maryland bridge may be a simple and cost-effective solution, the procedure is technically demanding, esthetics can be compromised via metal show through, and cement failures are common. A tooth-borne removable partial denture, which would be a simple and cost-effective solution, was rejected by the patient as a treatment option. The use of the implant-supported fixed partial denture carries an improved prognosis compared to a tooth supported alternative as it allows the preserve healthy abutment teeth, allows adequate access for oral hygiene, and avoids increased functional loading and preparation of tooth # 25 (the smallest tooth in the oral cavity). The small diameter implant allows greater flexibility in the placement location which could be a significant consideration with the use of a traditional diameter implant that may require a custom abutment. The use of a single traditional diameter implant with cantilever prosthesis can lead to increased unfavorable loads on the implant, especially in the mandibular anterior area. These increased loads can lead to early prosthesis failure and possible abutment and implant failure [6,7]. This case demonstrates an osteotomy technique using a surgical guide that, along with extraction and bone grafting techniques, allowed the placement of SDI's in an area of significant loss of bucco-lingual width and vertical height (Siebert Class III) [8,9]. Small diameter implants are gaining an increased acceptance for greater clinical use in fixed applications. Predictable success with SDI's requires the same treatment planning and clinical and surgical skills as "traditional" implants.

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