

# Implementation of Digital Dentistry to Rehabilitate a Mutilated Dentition With Implant Fixed Prosthesis: A Clinical Report

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## INTRODUCTION

**T**ooth loss can adversely affect esthetics and function and can lead to multiple complications.<sup>1-3</sup> Drifting and/or tipping of teeth adjacent to edentulous spaces, overeruption of opposing teeth, bone loss, irregular occlusal plan, and loss of a restorative space are common complications of partial edentulism.<sup>1-3</sup> Subsequently, functional and esthetic rehabilitation will be complicated and may require invasive procedures such as crown lengthening, orthodontics, full-mouth extraction of remaining teeth, alveoplasty, and restorations with implants to support removable or fixed prostheses. Anatomical limitations such as narrow ridges and an inferior alveolar nerve present a challenge for ideal implant placement. Certainly, the introduction of computerized tomography (CT) scan and 3-dimensional planning software facilitates treatment planning and guided surgeries for predictable implant placements in relation to tissue structures and prospective prostheses.<sup>4,5</sup> Preprosthetic surgeries can help overcome anatomic limitations such as irregular and/or narrow alveolar ridges prior to or at the same visit as implant placement.<sup>6</sup> This case report demonstrates the use of computer-assisted treatment planning and computer-aided fabrication of surgical guides for alveoplasty and proper implant positions at the same visit to rehabilitate a mutilated dentition with cementable segmented implant fixed prostheses.

## CASE REPORT

A 52-year-old African American man presented for treatment with a chief complaint of "I heard about implants and I want to

fix my teeth." A review of the patient's medical history revealed no significant findings. He avoided dental treatment until he heard about dental implants because he was fearful that the only option to replace his missing teeth was a removable prosthesis. The patient had a low lip line, reversed smile line, an excessive display of the mandibular incisors, and very compromised esthetics (Figure 1a and b). He had congenital missing maxillary lateral incisors, irregular occlusal plane, multiple carious teeth, defective restorations, supraeruption of the posterior maxillary teeth, limited interarc space, and resorption of the alveolar mandibular ridge posteriorly. Radiographic examinations showed multiple radiolucencies around the restored teeth and multiple carious lesions (Figure 2). Assessments of the incisal edge position and vertical dimension of occlusion were performed. Maxillary and mandibular preliminary impressions were made in stock metal trays with irreversible hydrocolloid impression material (Jeltrate, DENTSPLY, York, Penn). The impressions were poured with type IV dental stone (Microstone, Whip Mix, Louisville, Ky). A record base was fabricated on the mandibular cast with acrylic resin (Triad Tru Tray, York, Penn), and occlusion rims were added using baseplate wax. A tentative vertical dimension of occlusion was established. A face-bow transfer was made using the Hanau Spring-Bow (Hanau/Denar, Anaheim, Calif) to mount the maxillary diagnostic cast on a Hanau wide view articulator (Hanau/Denar) with a type III mounting stone (Mounting Stone, Whip Mix). A centric relation record was made using Aluwax (BencoDental, Pittston, Penn) to mount the mandibular cast. Ivoclar ortholingual teeth (Amherst, NY) were used to develop a nonbalanced, lingualized occlusal scheme. A surgical template for alveoplasty was fabricated on the modified maxillary cast. Maxillary and mandibular immediate dentures were fabricated. A full-mouth extraction and a maxillary alveoplasty were performed. The immediate dentures were delivered. After 3 months of healing, the immediate dentures were duplicated in a mixture of orthodontic acrylic resin (Caulk Orthodontic Resin, DENTSPLY) and 20% barium sulfate to fabricate radiographic guides, and a CT scan for the maxilla and the mandible was obtained. The mandibular CT scan revealed insufficient bone height posteriorly and width anteriorly for implant placements. Mandibular alveoplasty as well as implant sizes and positions were planned digitally (Simplant, Materialise Dental Inc, Glen

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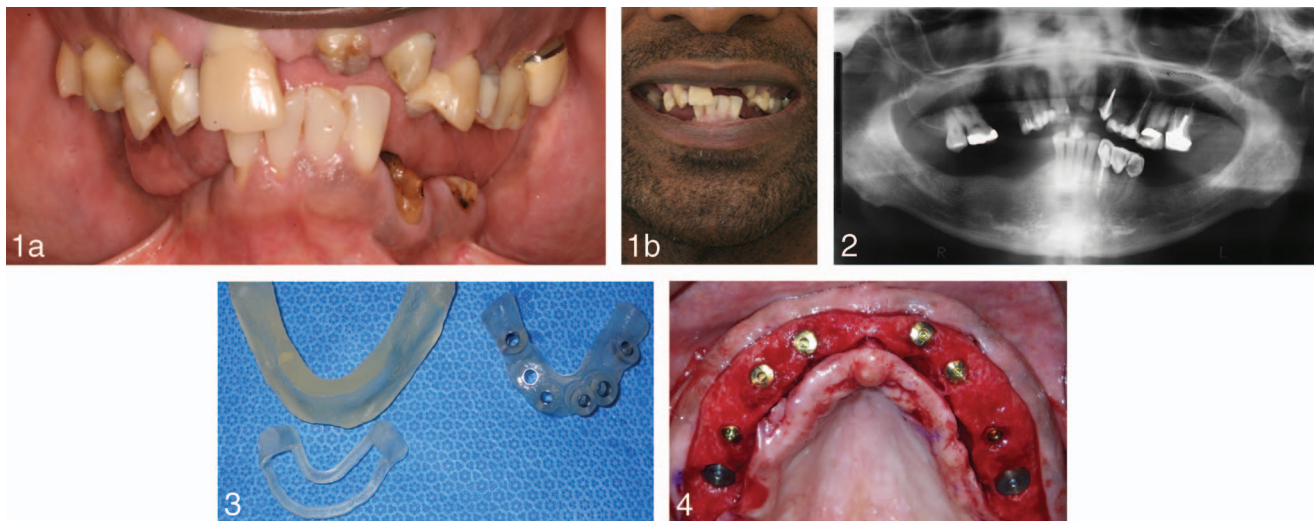
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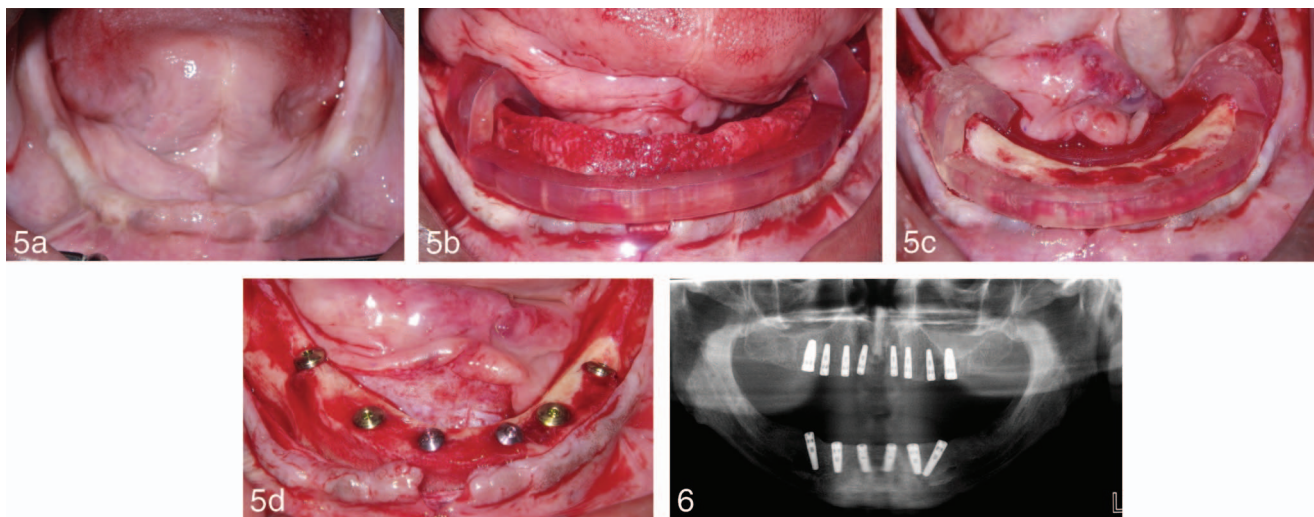
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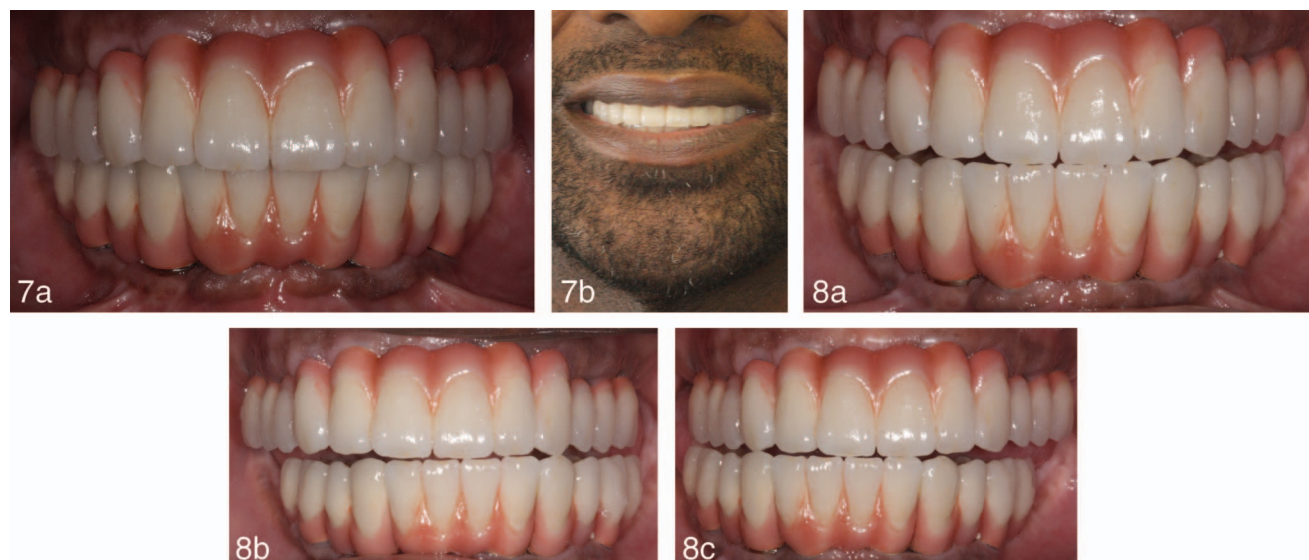
**FIGURES 1–4.** **FIGURE 1.** (a, b) Failed restorations, missing teeth, and irregular occlusal plane were present and contributed to compromised esthetics. **FIGURE 2.** Radiographic examination showed supereruption of the mandibular anterior segment, proximity of the inferior alveolar nerve canal to the alveolar crest, and defective restorations. **FIGURE 3.** Mandibular alveoplasty reduction guide and mandibular bone-supported surgical guide for implant (Surgiguide) were fabricated by Materialise Dental Inc. **FIGURE 4.** Eight implants were surgically placed in the maxilla using a bone-supported surgical guide (Surgiguide).

Burnie, Md) and sent to Materialise Dental Incorporation to fabricate a reduction guide for the mandibular alveoplasty and bone-supported surgical guides for implant placements (SurgiGuide; Figure 3). Eight implants (4.3/5.0 × 13 mm; Replace Select, Nobel Biocare, Yorba Linda, Calif) were surgically placed in the maxilla using the SurgiGuide (Figure 4). Internal sinus lift was performed in area No. 14 before the implant was placed. The mandibular anterior alveoplasty was performed using the mandibular reduction guide, and 6 implants (4.3 × 13/16 mm, Replace Select) were surgically placed using the SurgiGuide (Figure 5a through d). The mandibular distal implants were angled distally to avoid the inferior alveolar nerve and minimize

the cantilever (Figure 6). Uncovery of implants was performed after 4 months of healing, and the existing immediate dentures were converted into screw-retained fixed provisional prostheses. Open-tray fixture-level impressions were made in a medium body polyether impression material (Impregum, 3M, ESPE, Seefeld, Germany) using stock trays. Implant analogs were connected to impression copings, and the impressions were poured with type IV dental stone (Silky Rock, Whip Mix). The screw-retained provisional prostheses were screwed onto the master casts and mounted on the articulator with a face-bow and CR records. Labial/occlusal indices (Putty, Coltene, Pearson Dental, Sylmar, Calif) of the screw-retained prostheses



**FIGURES 5 AND 6.** **FIGURE 5.** (a) Preoperative view of the mandible. (b) The reduction guide showed the amount of bone that needed to be removed. (c) The mandibular anterior alveoplasty was performed using the mandibular reduction guide. (d) Six implants were surgically placed using the SurgiGuide. **FIGURE 6.** Panoramic radiograph showed the implants after placement. The mandibular distal implants were angled distally to avoid the inferior alveolar nerve and minimize the cantilever.



**FIGURES 7 AND 8.** FIGURE 7. (a, b) Intraoral and extraoral views of the finished prostheses. FIGURE 8. (a–c) Intraoral views of excursive movements. An anterior guidance occlusal scheme was developed.

were obtained, and full wax ups were made on the master casts. The master casts with the full wax up were sent to the Atlantis Incorporation (Cambridge, Mass) to fabricate custom titanium abutments. The abutments were tried in to verify the margins of the abutments relative to the soft tissue and modified accordingly. The margins were kept no more than 1 mm below the tissue margin to facilitate complete removal of any excess cement. Segmented cementable metal frameworks, 3 maxillary and 3 mandibular, were fabricated and tried in. The fit of the frameworks was verified with a disclosing material (Fit Checker, GC Corp, Tokyo, Japan). Porcelain was applied to the frameworks, and ovate pontics were designed for proper hygiene and fired to the bisque bake stage. Esthetics, phonetics, incisal edge position, vertical dimension of occlusion, and centric relation were confirmed. Gingival-colored porcelain was required to ensure proper tooth proportions (Figure 7a and b). The abutments were torqued down to 35 N/cm. The fit of the prosthesis was confirmed with a disclosing material (Fit Checker). The occlusion was verified and refined intraorally for an anterior guidance occlusal scheme (Figure 8a through c). The prostheses were cemented using temporary implant cement (Premier, Plymouth Meeting, Penn). Instructions on how to use and maintain the prostheses were given to the patient. The use of super floss and a waterpick to clean underneath the prostheses was demonstrated to the patient. A night guard was fabricated and delivered to the patient. It was explained to the patient that the use of the night guard is important to prevent chipping of the porcelain. Recall was scheduled biannually. The positive attitude of the patient, satisfaction with the treatment that addressed his chief complaints, and desire contribute to a good prognosis.

#### DISCUSSION

Preprosthetic surgeries are often required to functionally and esthetically rehabilitate mutilated dentitions.<sup>6,7</sup> The maxillary

alveoplasty was performed to create a restorative space for an ideal teeth setup and proper occlusal plane. The mandibular alveoplasty was performed to eliminate the thin alveolar ridge and gain sufficient bone width for implant placement. The maxillary surgical template for alveoplasty was fabricated conventionally on the modified cast.<sup>8</sup> The mandibular reduction guide was constructed digitally and sent to Materilaise Dental Incorporation for fabrication to ensure proper seating of the SurgiGuide and predictable implant placements at the same visit. The 2 most distal mandibular implants were angled distally to avoid the inferior alveolar nerve and minimize the length of cantilevers.<sup>9</sup> Metal frameworks were fabricated to reduce the frequency of chipping of veneering porcelain.<sup>10</sup> Cementable frameworks were fabricated because of convenience with regard to laboratory and clinical procedures. Furthermore, Nissan et al<sup>11</sup> showed that cement-retained prostheses have superior clinical performance when compared with screw-retained prostheses. The prostheses were segmented into 3 segments for each arch to minimize the distortion resulting from degassing and porcelain firing.<sup>12</sup> Also, a remake of a smaller segment is less demanding than a full-arch prosthesis. Gingival-colored porcelain was used for proper tooth proportions. The patient has a low smile line, and the tissue-restorative junction was not visible.

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