

CLINICAL REPORT

Immediate implant placement and complete mouth rehabilitation with CAD-CAM titanium frameworks and cemented crowns for a patient with severe periodontal disease: A clinical report



Pei Wang, MDS,^a Chunbo Tang, DDS, PhD,^b Yi Tang, MDS,^c and Yunong Wu, DDS, PhD^d

The conventional approach to treating periodontally compromised teeth involves placing implants into noninfected sites after the patient has received periodontal therapy. Alternatively, surgeons may insert implants in healed sites after extracting some or all teeth with a poor periodontal prognosis.¹ With either approach, patients need to undergo at least 6 months of complex and extensive treatment. In addition, a history of periodontitis and/or severe alveolar ridge atrophy exacerbates the treatment complexity, especially when an implant-supported fixed prosthesis is chosen to restore function and meet esthetic needs.^{2,3}

This clinical report describes a treatment option for a patient with generalized chronic periodontitis accompanied by severe alveolar ridge atrophy. It demonstrates how restored function and satisfactory esthetics can be achieved with immediate implant placement and implant-supported fixed complete prostheses, including computer-assisted design and computer-assisted manufacturing (CAD-CAM) titanium frameworks and cemented zirconia ceramic crowns.

ABSTRACT

The technique of immediate implantation has been widely used to reduce treatment time and bone loss after extraction. However, immediate implant placement in infected extraction sockets is generally contraindicated. This clinical report describes a treatment protocol for immediate implantation after the extraction of teeth with generalized chronic periodontitis. The technique used for the oral rehabilitation used computer-assisted design and computer-assisted manufacturing (CAD-CAM) titanium frameworks and cemented zirconia crowns. The titanium frameworks overcame suboptimal implant position and the cemented crowns provided excellent function and esthetics despite the locations of screw-access openings. No clinical complications occurred during a 13-month follow-up. (*J Prosthet Dent* 2018;119:511-5)

CLINICAL REPORT

A 63-year-old Asian man visited the Implant and Prosthodontics Department, Stomatological Hospital of Nanjing Medical University with the complaint of difficulty in mastication. The patient expressed a wish to have a fixed prosthesis and a single surgical intervention. Intraorally, the patient presented with pathologic tooth migration (Fig. 1A). Clinical and panoramic radiographic examination revealed moderate to severe resorption of the alveolar ridges in the remaining teeth, with a severe bony defect in the posterior maxillary region (Fig. 1B). Cone beam computed tomography (CBCT) images indicated maxillary sinus pneumatization. Therefore, maxillary sinus floor elevations were planned in the posterior region.

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^aGraduate student, Graduate Prosthodontics, Department of Dental Implantology, Nanjing Medical University, Jiangsu, PR of China.

^bAssistant Professor, Department of Dental Implantology, Affiliated Hospital of Stomatology, Nanjing Medical University, Jiangsu, PR of China.

^cGraduate student, Graduate Prosthodontics, Department of Dental Implantology, Nanjing Medical University, Jiangsu, PR of China.

^dProfessor, Department of Oral and Maxillofacial Surgery, Affiliated Hospital of Stomatology, Nanjing Medical University, Jiangsu, PR of China.

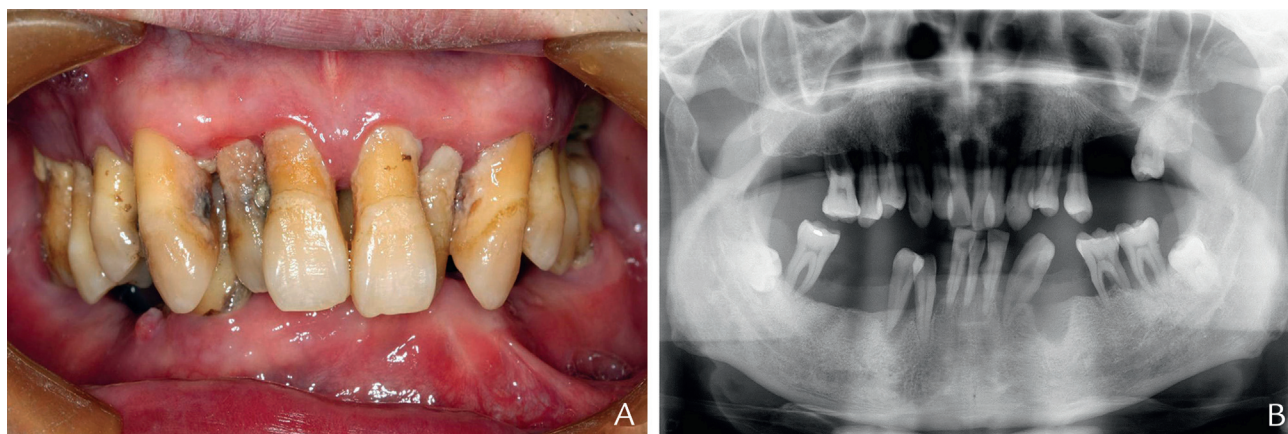


Figure 1. Preoperative condition. A, Intraoral. B, Panoramic radiograph.



Figure 2. Panoramic radiograph immediately after implant placement.

Generalized chronic periodontitis and partial edentulism was diagnosed in this patient. After an analysis of the clinical situation and the patient's expectations, a treatment plan that included the extraction of all remaining teeth (except for the mandibular third molars), immediate implant placement, and complete-mouth reconstruction was established.

Diagnostic impressions were obtained and used to fabricate an interim heat-polymerized poly(methyl methacrylate) (PMMA) immediate complete denture. This denture was then replicated in clear autopolymerizing acrylic resin as a surgical guide.⁴

All remaining teeth (except for the mandibular third molars) were extracted under general anesthesia. Then, 18 implants (ITI; Institut Straumann AG) (10 maxillary, 8 mandibular) were placed in the planned positions, with healing abutments (Sterile Healing Cap; Institute Straumann AG) exposed in the oral cavity (Fig. 2).

The maxillary sinus floor was elevated in the left posterior region, and vertical bone was augmented with a mixture of autogenous cancellous bone (harvested intra-orally from the mental region with a bone scraper) and spongy bone substitute (Geistlich Bio-Oss; Geistlich



Figure 3. Interim heat-polymerized acrylic resin immediate complete dentures relined with soft liner.

Pharma AG). An autologous concentrated growth factor (CGF) membrane and collagen (Bio-Oss; Geistlich Bio-Gide) resorbable bilayer membrane (Geistlich Pharma AG) were used to accelerate the wound healing process.^{5,6} The acrylic resin denture was relined with soft lining material (Sofreliner Tough; Tokuyama Dental Corp) after the surgery (Fig. 3).

One month later, a preliminary impression was obtained to create Co-Cr alloy splints (Implanteeth Medical Technology Co Ltd) and customized open trays. After the removal of all healing abutments, implant impression transfer posts (Institute Straumann AG) were placed on the implants. The Co-Cr alloy splints were connected to the transfer rods with autopolymerizing resin (GC Pattern Resin; GC Corp), improving the accuracy of the impression (Fig. 4). Definitive impressions were made with polyether impression materials (Impregum; 3M ESPE). An arbitrary facebow (Artex Facebow; Amann Girrbach AG) was used to mount the maxillary cast on the articulator. After impressions were obtained, the healing abutments were replaced.

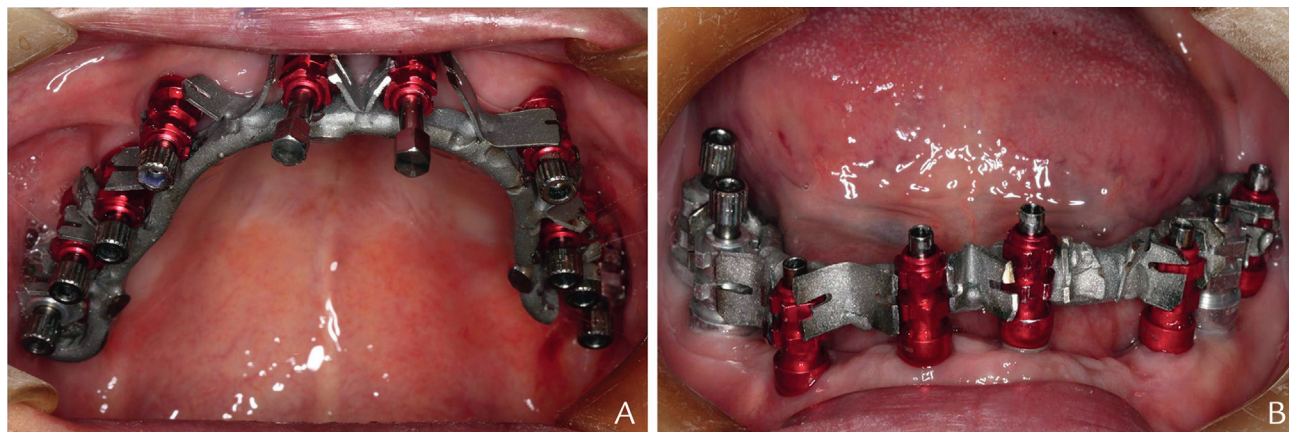


Figure 4. Transfer copings splinted with Co-Cr alloy splints. A, Maxillary view. B, Mandibular view.

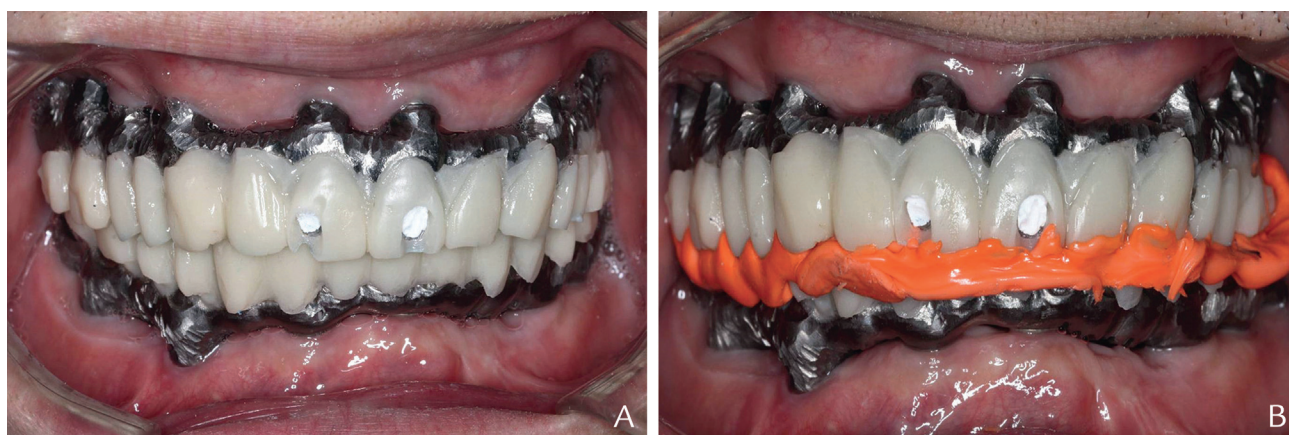


Figure 5. A, Intraoral evaluation of titanium frameworks and acrylic resin teeth. B, New interocclusal relationship obtained.

Titanium frameworks (Implanteeth Medical Technology Co Ltd) were then manufactured using a CAD-CAM technique (AccuFrame IC; Cagenix Inc), with an adequate passive fit.⁷ Initially, acrylic resin teeth were arranged on the frameworks and clinically evaluated (Fig. 5A). At that appointment, the interarch distance-jaw relationship was reconfirmed both at rest and during function, and a new interocclusal record was made (Fig. 5B). Facial esthetic, lip support, and gingival color as well as the size, color, and shape of individual teeth were assessed. With the patient's approval, they were returned to the laboratory for fabrication of the definitive prostheses.⁸

CAD-CAM-fabricated frameworks were then placed intraorally and evaluated for passivity of fit. The frameworks were then veneered with gingiva-colored porcelain (Bredent GmbH & Co KG) to mimic soft tissue, with a space left between the porcelain and the residual alveolar ridge for oral hygiene.^{8,9} A total of 28 cement-retained zirconia ceramic crowns (Ceramill Zirconia; Amann Girrbach AG) were then fabricated for both arches. The implant abutments were placed intraorally (Fig. 6), and the CAD-CAM screw-retained titanium

frameworks were secured to the abutments at a torque of 35 Ncm (Fig. 7). All screw-access holes were sealed with silicone (Fit Checker; GC America, Inc) and composite resin (Fermi N; Ivoclar Vivadent AG). The crowns were then individually cemented over the titanium frameworks with interim cement (TempBond; Kerr Corp) (Fig. 8), and a panoramic radiograph was acquired to verify the accuracy of crown placement (Fig. 9A). Furthermore, occlusion was evaluated, and any necessary adjustments were implemented. The patient was given instructions regarding oral hygiene and periodontal maintenance. No clinical complications occurred within the 13 months of follow-up. The prostheses restored lost function and exhibited good retention and stability. The patient reported no problems and was highly satisfied with the esthetics of the restoration (Fig. 9B).

DISCUSSION

Conventionally, immediate implant placement requires the absence of infection. However, certain studies have revealed that immediate implantation in infected sockets can also exhibit good efficacy if the sockets are

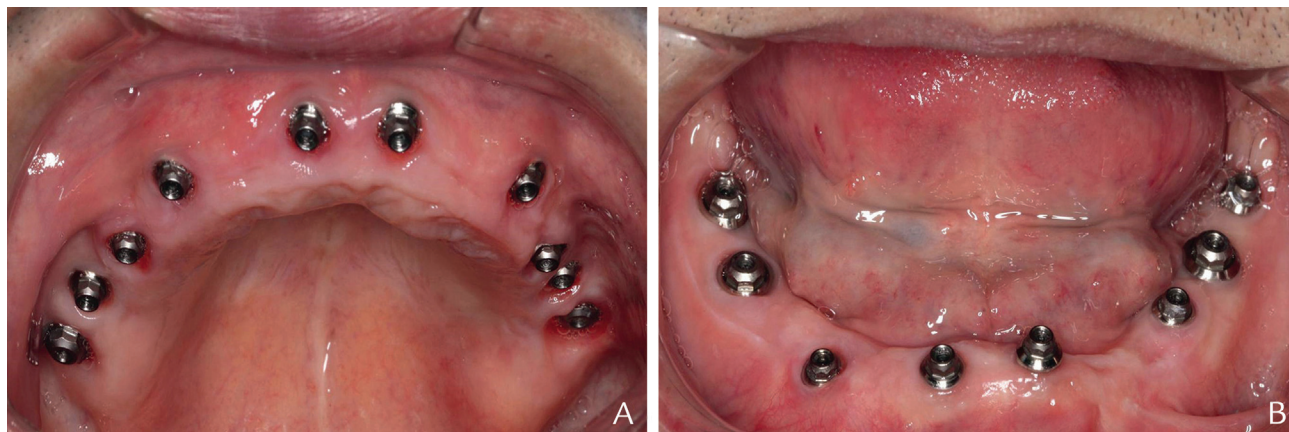


Figure 6. Implant abutments in place. A, Maxillary view. B, Mandibular view.

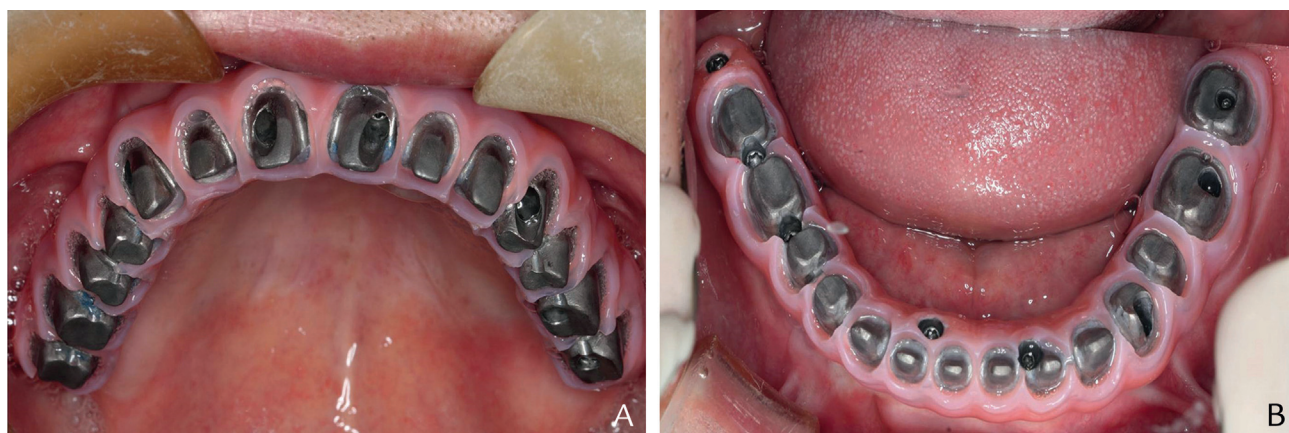


Figure 7. Screw-retained frameworks in place. A, Maxillary view. B, Mandibular view.

thoroughly debrided.^{1,10-13} Bone grafts were needed for this patient, and autologous cancellous bone was chosen for ridge preservation because of its excellent osteogenic and osteoinductive properties and its biocompatibility.¹⁴ An autologous CGF membrane and collagen (Bio-Oss) were also used to enhance osteogenesis and wound closure. An autologous CGF membrane may help bone grafts integrate with surrounding bone tissue.^{3,15,16}

The implant-supported fixed complete prostheses contained screw-retained titanium frameworks and cemented zirconia crowns, as previously described. This design combined screw and cement retention and therefore exhibited the advantages of both approaches.^{17,18} Screw-retained frameworks can act as splints and are easy to disassemble and repair; moreover, they are not subject to restrictions associated with unfavorable implant position or angulation.^{17,19} Titanium frameworks veneered with gingiva-colored porcelain can mimic soft and hard tissue defects well, particularly in patients with severe alveolar ridge resorption. Zirconia crowns were individually cemented to the titanium frameworks, ensuring that the designed



Figure 8. Intraoral view of definitive prostheses in occlusion.

prosthesis could provide optimal esthetics regardless of where the screw access openings were located.^{18,19} This approach is beneficial for prosthesis maintenance and repair and permits the relatively easy cleaning of excess cement.

The accuracy of every component and step in the process is essential. CAD-CAM-fabricated frameworks

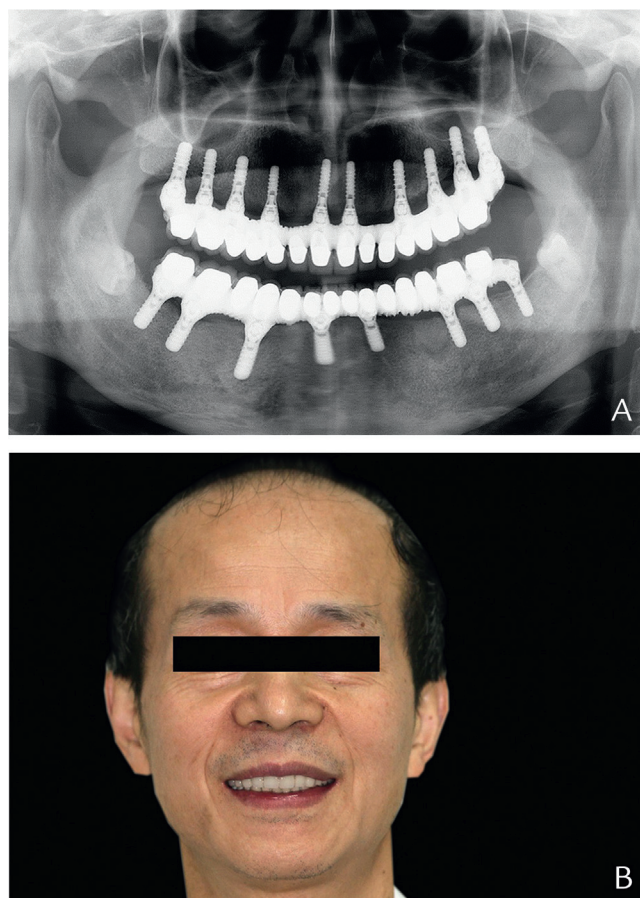


Figure 9. A, Panoramic radiograph after treatment. B, Patient's smile 1 year after treatment.

have been shown to be more accurate than conventional cast frameworks.⁷ CAD-CAM software (Cagenix) can be used to design frameworks and crowns in a single step, which may decrease the time and cost of clinical treatment.²⁰ When definitive restorations must be repaired or refabricated, redesign is not required because data preserved in the software can be used. However, additional long-term studies are needed to verify the advantages of the approach described in this clinical report.

SUMMARY

This clinical report demonstrated that immediate implant placement in infected extraction sockets could be successful if a treatment protocol that includes thorough debridement and ensures primary stability of the implants is used. This patient treatment involved complete mouth rehabilitation using screw-retained titanium frameworks veneered with gingiva-colored porcelain and individually cemented zirconia ceramic crowns. No clinical complications occurred during the 13-month follow-up, and the treatment's esthetic and functional outcomes fulfilled the patient's expectations.

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Corresponding author:

Dr Chunbo Tang
Department of Dental Implantology
Affiliated Hospital of Stomatology
Nanjing Medical University
136 Hanzhong Rd
Nanjing, Jiangsu 210029
PR OF CHINA
Email: cbtang@njmu.edu.cn

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