

## The pre-surgical modification of the provisional over-denture through 3-dimensional image analysis supports the mini dental implant treatment: A clinical report

Seicho Makihira, DDS, PhD,<sup>a</sup> Wataru Mizumachi, DDS,<sup>b</sup> Kae Harada, DDS, PhD,<sup>b</sup> Saiji Shimoe, BA, PhD,<sup>c</sup> Shinsuke Sadamori, DDS, PhD,<sup>b</sup> and Hiroki Nikawa, DDS, PhD<sup>a</sup>

<sup>a</sup>Department of Medical Design and Engineering, School of Oral Health Science, Hiroshima University Faculty of Dentistry, <sup>b</sup>Department of Prosthetic Dentistry, Graduate School of Biomedical Sciences, Hiroshima University, and <sup>c</sup>Department of Oral Basic Science, School of Oral Health Science, Hiroshima University Faculty of Dentistry, Hiroshima, Japan

Mini implants have been improved and established as an immediate-loading implant system to retain edentulous mandibular denture for short and long term. A 3-dimensional imaging is a useful computer analysis based on the computed tomography data for implant pre-surgical planning. This clinical report describes: 1) Mini implant system enhanced support the stability of edentulous mandibular denture. 2) Preparation of the provisional over-denture together with the accurate diagnosis by 3-dimensional image could shorten the surgery and fixing time. 3) While the patient used the provisional over-denture, the proper holes for housings in the final denture could be formed at the minimum of size in the dental laboratory. (Int Chin J Dent 2008; 8: 39-41.)

**Key Words:** mini implant, provisional denture, 3-dimensional image.

### Introduction

Dental implant systems have been developed. Recently, implant-retained over-denture has been a standard option of prostheses in fully edentulous jaw. Mini implant system was developed to provisionally support the stability of the edentulous mandible denture by immediate-loading.<sup>1</sup> However, improved system, which surface can acquire osseointegration, has been used as fixtures for long-term prosthesis stabilization.<sup>2</sup>

The software such as Simplant and Dentascan can show reformatted image with 3-dimensional reconstructions of computed tomography data, which is helpful to precisely diagnose the positions, the numbers and the length of implants.<sup>3</sup> In mini implant treatment, this 3-dimensional image enables the preparation of the housing holes in the final or provisional over-denture before surgery, leading curtailment of postoperatively prosthetic follow-up.

### Clinical Report

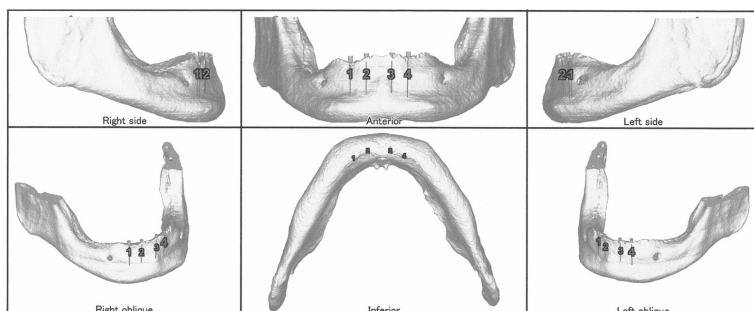
An 81-year-old male patient desired more durable mandible dentures. Edentulous denture, which included the metal-reinforced framework, was newly fabricated (Figs. 1 and 2).



**Fig. 1.** Intra-oral view of the mandible. No inflammation was observed on the alveolar ridge.

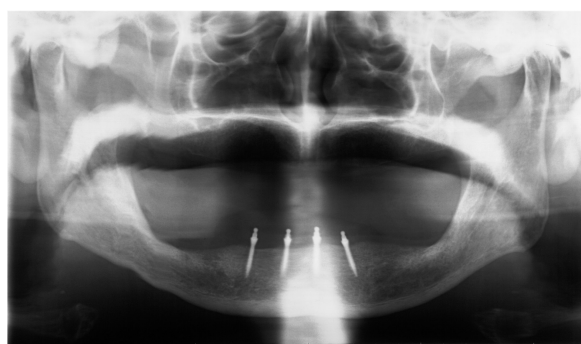
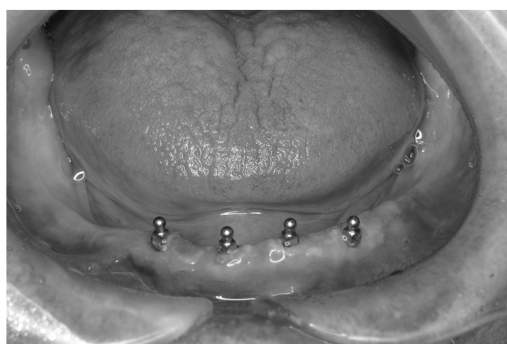
**Fig. 2.** Edentulous mandible denture. Conventional edentulous denture including metal-reinforced framework was newly fabricated, instead of the acrylic resin denture previously fabricated in the same hospital.

The patient was satisfied with durability of new dentures, and with the mastication and articulation. However, in meanwhile, the patient desired more stability of mandible denture, since the opportunities of the speech in public increased. We proposed mini implant-retained over-dentures, utilizing the present dentures, to enhance the stability of mandible denture. The position replaced for four replacements were accurately diagnosed by the 3-dimensional image analysis (Fig. 3).



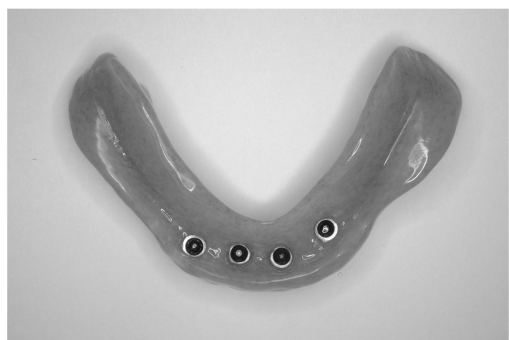
**Fig. 3.** A 3-dimensional image analysis. The positions replaced for four mini implants were accurately diagnosed through the 3-dimensional image analysis. The DICOM data obtained by CT was reformatted by Simplant software (Materialize, N.V., Leuven, Belgium) to 3-dimensional reconstruction.

The provisional acrylic resin denture was fabricated, in which the housing holes were prepared in advance. The four implants were replaced close to the predicted positions (Figs. 4 and 5) and the housings with O-rings were retrofitted to the provisional over-denture in less time (Fig. 6).



**Fig. 4.** Intra-oral view after mini implant insertion. The operation of mini implant replacements was performed under the local anesthesia. Pilot drills were carried out with external irrigation of normal saline for osteotomy of the mini implants insertions between left and right mental foramen in the mandible ridge. In this case, Mandibular Sendax IMTEC mini dental implants (IMTEC, Ardmore, OK, USA, diameter; 1.8 mm, length; 13 mm) were used for all replacements.

**Fig. 5.** Panoramic X-ray photograph after mini implant replacements. No fractures of mini implant were observed.



**Fig. 6.** Provisional edentulous mandible denture with the housings. The provisional denture was fabricated with the acrylic resin alone except the artificial teeth, based on the present denture. The housings with O-rings were retrofitted to the provisional denture in which the housing holes were prepared in advance. To add these four housings with O-ring into the holes in the provisional over-denture, the composite resin was used (Unifast, GC, Tokyo, Japan).

**Fig. 7.** Modification of edentulous mandible denture including metal-reinforced framework for prosthetic fixation. Four weeks later, stable mucosa and alveolar ridge were observed. The final denture was modified to form the minimum housing holes in the dental laboratory, and then was fixed as well as the provisional denture was done just after surgery.

The final denture with the minimum housing holes formed in the dental laboratory was fixed in order to add the housing with O-ring (Figs. 7 and 8).



**Fig. 8.** Definitive prosthesis in the oral cavity. The stability of the new prosthesis retained by four mini implants was more favorable than the previous denture without retainers, during speech for the patient.

## Discussion

The 3-dimensional image can provide to the preoperative planning information, which inspect the bony anatomy and quality of the alveolar ridge, leading the decision of the proper position, length and diameter of the implants, and additionally the following prosthetic treatment.<sup>4,5</sup> However, unexpected changes to do on the numbers and locations of implants may be rarely required in operation. By fabricating the provisional denture, dentists can not only cope with the unexpected changes of surgery procedures scheduled, but also exploit the pre-treatment outcome analysis by 3-dimensional image for postoperative prosthetic follow-up of mini implant to the full.<sup>6</sup>

## Acknowledgment

This study was supported in part by a Grant-in Aid for Scientific Research Research (No. 18689046, 2006-2008) from Japan Society for the Promotion of Science.

## References

1. Balkin BE, Steflik DE, Naval F. Mini-dental implant insertion with the auto-advance technique for ongoing applications. *J Oral Implantol* 2001; 27: 32-7.
2. Bulard RA, Vance JB. Multi-clinic evaluation using mini-dental implants for long-term denture stabilization: a preliminary biometric evaluation. *Compend Contin Educ Dent* 2005; 26: 892-7.
3. Mupparapu M, Singer SR. Implant imaging for the dentist. *J Can Dent Assoc* 2004; 70: 32.
4. Rosenfeld AL, Mandelaris GA, Tardieu PB. Prosthetically directed implant placement using computer software to ensure precise placement and predictable prosthetic outcomes. Part 1: diagnostics, imaging, and collaborative accountability. *Int J Periodontics Restorative Dent* 2006; 26: 215-21.
5. Nishimura M, Sadamori S, Suehiro F, Sekiya K, Nishimura H, Hamada T. Importance of diagnosis by computer tomography for mini dental implants planning: A clinical report. *Int Chin J Dent* 2007; 7: 31-4.
6. Cho SC, Shetty S, Froum S, Elian N, Tarnow D. Fixed and removable provisional options for patients undergoing implant treatment. *Compend Contin Educ Dent* 2007; 28: 604-8.

## Correspondence to:

Dr. Seicho Makihira  
 Department of Medical Design and Engineering, Division of Oral Health Engineering,  
 School of Oral Health Science, Hiroshima University Faculty of Dentistry  
 1-2-3 Kasumi Minami-ku, Hiroshima 734-8553, Japan  
 Fax +81-82-257-5797 E-mail: seicho@hiroshima-u.ac.jp

Received July 30, 2008. September 5, 2008.

Copyright ©2008 by the *International Chinese Journal of Dentistry*.