

Oral rehabilitation with orthognathic surgery after dental implant placement for class III malocclusion with skeletal asymmetry and posterior bite collapse

Seigo Ohba, DDS, PhD, lecturer

Department of Regenerative Oral Surgery, Unit of Translational Medicine, Graduate School of Biochemical Sciences, Nagasaki University
1-7-1, Sakamoto, Nagasaki 852-8588 Japan

Yuya Nakatani, DDS, senior resident

Department of Regenerative Oral Surgery, Unit of Translational Medicine, Graduate School of Biochemical Sciences, Nagasaki University
1-7-1, Sakamoto, Nagasaki 852-8588 Japan

Takako Kawasaki, DDS, assistant professor

Department of Regenerative Oral Surgery, Unit of Translational Medicine, Graduate School of Biochemical Sciences, Nagasaki University
1-7-1, Sakamoto, Nagasaki 852-8588 Japan

Nobutaka Tajima, DDS, PhD, fellow

Department of Regenerative Oral Surgery, Unit of Translational Medicine, Graduate School of Biochemical Sciences, Nagasaki University
1-7-1, Sakamoto, Nagasaki 852-8588 Japan

Takayoshi Tobita, DDS, PhD, fellow

Department of Regenerative Oral Surgery, Unit of Translational Medicine, Graduate School of Biochemical Sciences, Nagasaki University
1-7-1, Sakamoto, Nagasaki 852-8588 Japan

Noriaki Yoshida, DDS, PhD, professor

Department of Orthodontics and Dentofacial Orthopedics, Graduate School of Biomedical Sciences, Nagasaki University
1-7-1, Sakamoto, Nagasaki 852-8588 Japan

Takashi Sawase, DDS, PhD, professor

Department of Applied Prosthodontics, Unit of Translational Medicine, Graduate School of Biochemical Sciences, Nagasaki University

1-7-1, Sakamoto, Nagasaki 852-8588 Japan

Izumi Asahina, DDS, PhD, professor

Department of Regenerative Oral Surgery, Unit of Translational Medicine, Graduate
School of Biochemical Sciences, Nagasaki University

1-7-1, Sakamoto, Nagasaki 852-8588 Japan

*Corresponding author:

Seigo Ohba DDS, PhD

Department of Regenerative Oral Surgery,

Unit of Translational Medicine,

Graduate School of Biochemical Sciences,

Nagasaki University

1-7-1 Sakamoto, Nagasaki 852-8588 Japan

Tel: +81 95 619 7704

Fax: +81 95 819 7705

e-mail: sohba@nagasaki-u.ac.jp / seigoohba@gmail.com

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Abstract

Increasing numbers of older patients are seeking orthognathic surgery to treat jaw deformity. However, orthodontic and orthognathic surgical treatment is difficult in cases without occlusal vertical stop.

A 55-year-old male presented with class III malocclusion and mandibular protrusion including esthetic problems and posterior bite collapse. He underwent dental implant treatment to reconstruct an occlusal vertical stop prior to orthognathic surgery. His occlusal function and esthetic problems improved after surgery, and his skeletal and occlusal stability has been maintained for 6 years.

Dental implant placement at appropriate positions could help to determine the position of the proximal segment at orthognathic surgery, and could shorten the time required to restore esthetic and occlusal function. This case demonstrates how skeletal and dental stability can be maintained long after surgery in a patient with jaw deformity and posterior bite collapse.

Key words: appropriate position; jaw deformity; older patients

Introduction

Combined dental implant and orthodontic therapy¹⁻⁴ can provide satisfactory results for patients by accurately planning the placement of dental implants before initiating orthodontic treatment. For instance, orthodontic treatment may be completed with a space where a dental implant is planned to be placed, or dental implants may be placed before orthodontic treatment and used as anchors to move natural teeth.^{5, 6}

The number of older patients who seek orthognathic surgery to treat jaw deformity has increased in recent years.⁷ Pre-surgical orthodontic treatment is sometimes complicated because of tooth loss due to deep caries or periodontitis. Although the acquisition of an ideal occlusion is the first priority in the treatment of jaw deformity, it is difficult to plan the post-surgical occlusion before surgery in cases where the occlusal vertical stop in the molar region is lost because of posterior bite collapse.

We previously reported a case in which a temporary denture, fabricated on the cast model after a model surgery, was used to stabilize the occlusion after setback of the distal segment of the mandible following sagittal split ramus osteotomy (SSRO).⁷ This temporary denture was also used for immediate oral rehabilitation after surgery. Although the outcome was satisfactory, use of a denture created some problems such as instability of the vertical stop and esthetic problems because the denture was not completely stable on the alveolar mucosa and its clasps and denture plate were visible. To avoid these problems during treatment of jaw deformity, we applied dental implants at the beginning of the orthognathic treatment.

We report a unique case of a patient with esthetic and occlusal dysfunction accompanied by dental problems and jaw deformity, for whom we placed dental implants prior to orthognathic surgery. His dental and skeletal stability was maintained for more than 6 years after the surgery.

Case report

A 55-year-old male was referred to the Department of Regenerative Oral Surgery, Nagasaki University Hospital, complaining of mandibular protrusion, occlusal dysfunction and missing teeth with esthetic problems. He requested total oral rehabilitation including orthodontic and orthognathic surgery and dental implant treatment. His frontal and lateral facial appearance featured mandibular protrusion with deviation to the left (Fig. 1AB).

Intraorally, his overbite was 1 mm and his overjet was -4 mm. The lower midline was deviated to the left by 4 mm compared with the upper midline. He also had deep caries at 27, which was an abutment tooth for a bridge prosthesis. The bridge prosthesis was

ill-fitting in the left anterior region and the metal was visible around the margin of the appliance (Fig. 1C). He had no significant medical history or family history. Routine imaging examinations were undertaken for treatment planning. The orthopantomograph (OPG) revealed that 15, 17, 22, 25, 26, 36, 45, 46 and 47 were missing, and a well-defined radiolucent area was found at the apex of 21. Deep caries were observed at 27 (Fig. 2). According to clinical findings and cephalometric analysis (Table 1), he was diagnosed with asymmetric class III malocclusion with esthetic disturbance caused by ill-fitting prosthetic appliances, apical-periodontitis of 21, deep caries of 27, and loss of 15, 17, 22, 25, 26, 36, 45, 46 and 47. The residual teeth in both jaws were crowded.

Treatment Procedure

A treatment schedule was planned as follows:

- 1) Root canal treatment of 21
- 2) Extraction of 27
- 3) Alignment of the residual teeth
- 4) Dental implant placement at 45, 46 and 47
- 5) Dental implant placement at 25, 26 and 27 with simultaneous sinus floor augmentation
- 6) SSRO to correct the skeletal deformity and improve the anatomical maxilla-mandibular relationship
- 7) Occlusal reconstruction by prosthetic treatment of the whole mouth

Treatment process

Following root canal treatment of 21 and extraction of 27, leveling of the residual teeth was initiated. Because bimaxillary crowding was mild, three dental implants measuring 3.75×13 mm, 3.75×13 mm and 5.0×8.5 mm (Brånemark TiUnite Mk-III[®], Nobel Biocare AB, Göteborg, Sweden) were placed at the original positions of 45, 46 and 47, respectively, during pre-surgical orthodontic treatment. Following healing of the extraction socket of 27, three dental implants measuring 3.3×11.5 mm, 3.3×11.5 mm and 3.75×11.5 mm (Brånemark TiUnite Mk-III[®]) were inserted at the original positions of 25, 26 and 27 with a sinus floor augmentation. Placement of provisional restorations on the lower implants provided a vertical stop (Fig. 3). Thereafter, SSRO was performed with 7.5-mm and 5.0-mm setback at the right and left sides, respectively. The bone segments were fixed with titanium plates and screws (Matrix Mandible[®], DePuy Synthes, Warsaw, IN). The surgery was performed according to a conventional technique. An implant was lost and reinserted in the 27 region 12 months after the

orthognathic surgery. The final restoration was completed 20 months after the orthognathic surgery (Fig. 4). Skeletal and occlusal stability had been maintained at the 3-year follow-up following the final restoration (Fig. 5, Table 1).

Discussion

A satisfactory outcome was achieved in a patient with jaw deformity and posterior bite collapse who underwent dental implant treatment to acquire an occlusal vertical stop prior to orthognathic surgery. His presenting complaints of esthetic problems and occlusal dysfunction were resolved, and his skeletal and occlusal stability has been maintained over the long term.

The loss of the teeth at the posterior region elicits the loss of occlusal vertical stop, resulting in inducing eruption of the opposite teeth,⁸ flaring the anterior maxillary teeth,⁹ pathological teeth moving,¹⁰ or occlusal interferences.¹¹ These harmful situation changes the dental arch and occlusal plane.^{11, 12} According to these previous report, the posterior occlusion must be extremely important for stability of the mandibular position. Balshi et al.¹³ advocated that the importance of posterior occlusion during occlusal reconstruction. Therefore, the condition of the molar region is considered to be an important factor in determining the position of the distal segment and in acquiring the stability of the occlusion after SSRO. In previous case,⁷ we fabricated the temporary denture before surgery to determine the position of the distal segment after mandibular osteotomy in patients with no vertical stop in the molar region due to posterior bite collapse. However, a temporary denture can be unstable in cases where the alveolar bone is highly resorbed or where there are few residual teeth. Sadat et al.¹⁴ fixed the denture with an arch bar and established maxilla-mandibular fixation (MMF) during and after surgery. This method is considered to be highly invasive and stressful for patients because the upper denture is fixed in the maxilla with screws and the lower denture is wired to the mandible and the MMF. Instead of a denture, we used dental implants to stabilize the occlusion in the present case, so that management during and after surgery was the same as for conventional SSRO. Moreover, the provisional restorations on the implants helped to manage malocclusion caused by relapse after surgery.

Some reports describe combination therapy with orthognathic surgery following dental implants to improve esthetics and create an ideal occlusion in patients with jaw deformity.^{4, 15, 16} However, this is the first case report in which dental implant treatment was performed prior to orthognathic surgery to acquire a vertical stop in the posterior occlusion to assist in determining the distal segment position and to achieve occlusal stability during and after SSRO. The importance of posterior teeth and their occlusal

vertical stop was reported in the previous reports.^{11, 12} It was considered that the occlusal stability could be obtained because of implant restoration at the posterior region in this case. In fact, according to table 1, SNB, gonial angle and occlusal plane were completely stable after surgery. Moreover, the prosthesis had not had any trouble for 3 years since the final restoration was completed. These meant that the outcome of the present case shows that both skeletal and dental stability can be maintained over the long term (six years after orthognathic surgery and four years after final prosthetic restoration).

The treatment strategy outlined in this report allows treatment to be completed in a shorter time frame than in conventional treatment. In the present case, dental implants were placed instead of a temporary denture, and osseointegration was acquired during the pre-surgical orthodontic treatment. This meant that the whole-mouth prosthetic procedure could be started soon after the orthognathic surgery. In conventional treatment, dental implants cannot be placed until bone healing associated with orthognathic surgery has occurred. Moreover, in our technique, the dental implants can be used as anchors to move natural teeth if necessary, as shown in previous reports.^{5, 6}

The position of dental implants should be carefully planned because unfavorable positioning may cause problems for subsequent orthodontic and prosthetic treatment. Recent progress in computer-assisted planning makes it simpler to place the dental implants in the optimal position.¹⁷

In conclusion, we advocate the placement of dental implants prior to orthognathic surgery for the treatment of malocclusion associated with jaw deformity. The treatment strategy can minimize treatment time, and can provide an esthetic outcome and restoration of an ideal functional occlusion with long-term skeletal and dental stability in patients with jaw deformity and posterior bite collapse.

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Figure legends

Figure 1. Frontal (A) and lateral (B) facial and intraoral (C) appearance at the first visit. The overbite was 1 mm and the overjet was -4 mm. The lower midline was deviated 4 mm to the left of the upper midline.

Figure 2. Pretreatment orthopantomograph (OPG).

Figure 3. Intraoral appearance after provisional restorations in the lower-right premolar and molar region.

Figure 4. Intraoral and OPG appearance after the final restoration.

Figure 5. Facial (A and B), intraoral (C) and OPG (D) appearance 3 years after the final restoration. No problems were observed, and functional occlusion was maintained.

Table 1. Cephalometric analysis

T0; before treatment, T1; before surgery, T2; after surgery, T3; 6 months after surgery, T4; 6 years after surgery (3 years after final restoration)

Figure 1

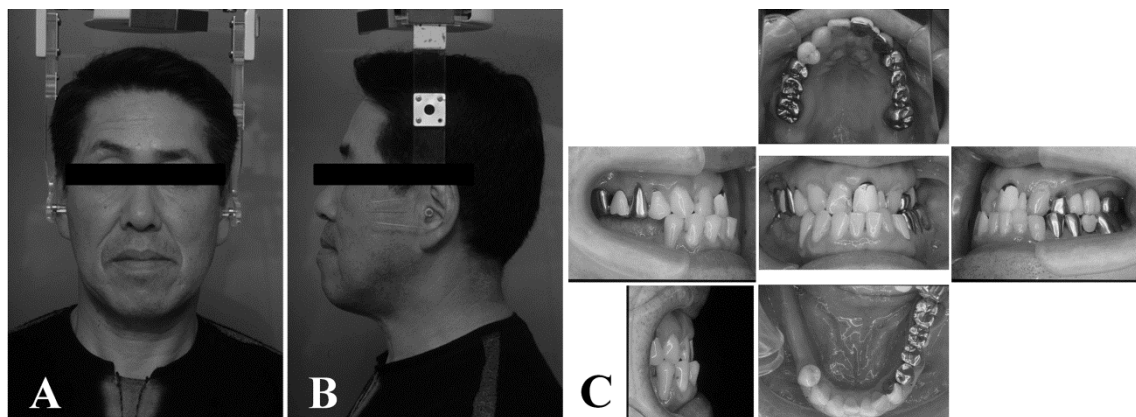


Figure 2

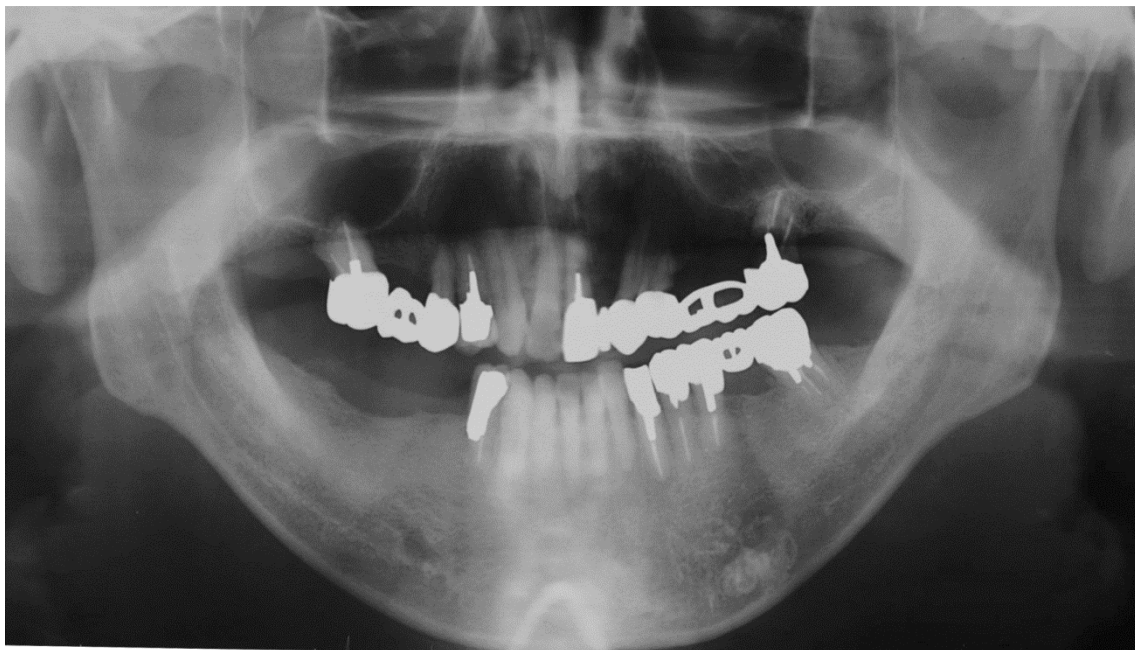


Figure 3

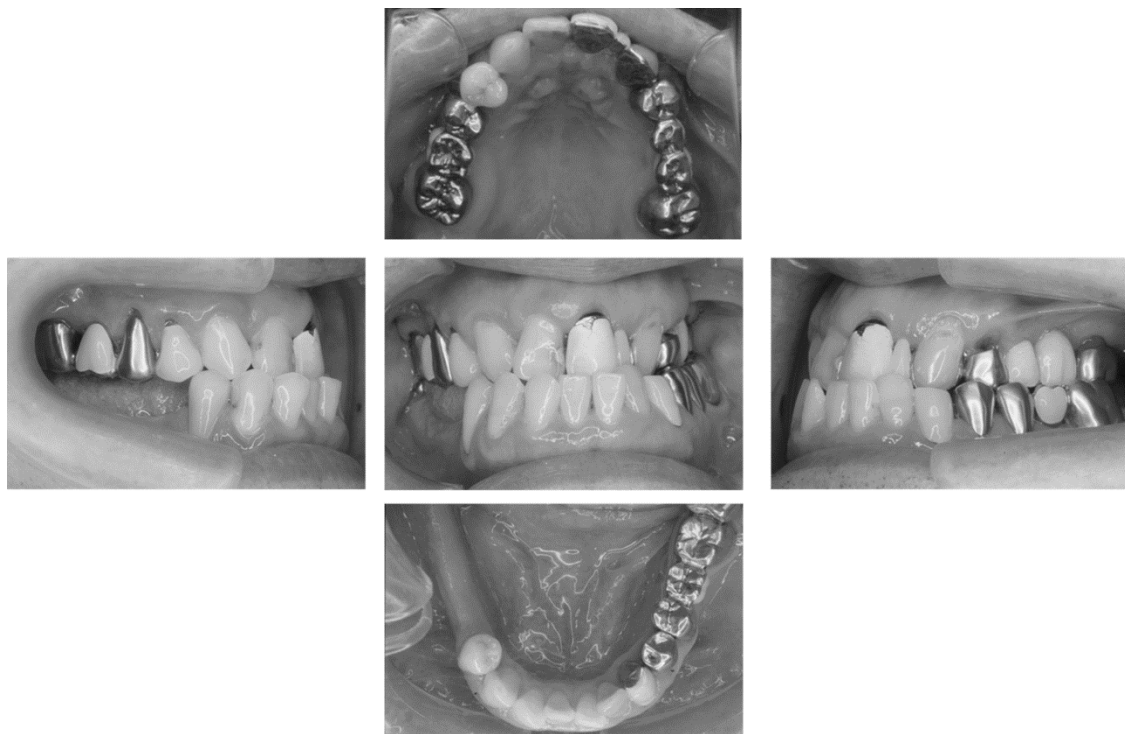


Figure 4

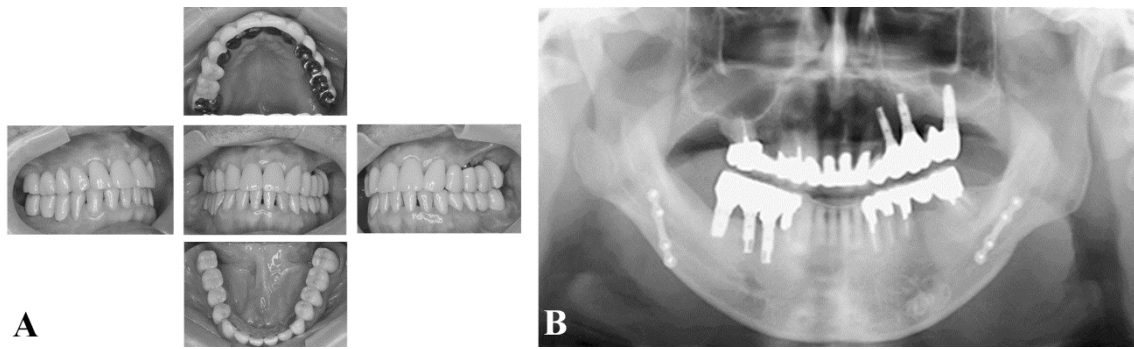


Figure 5

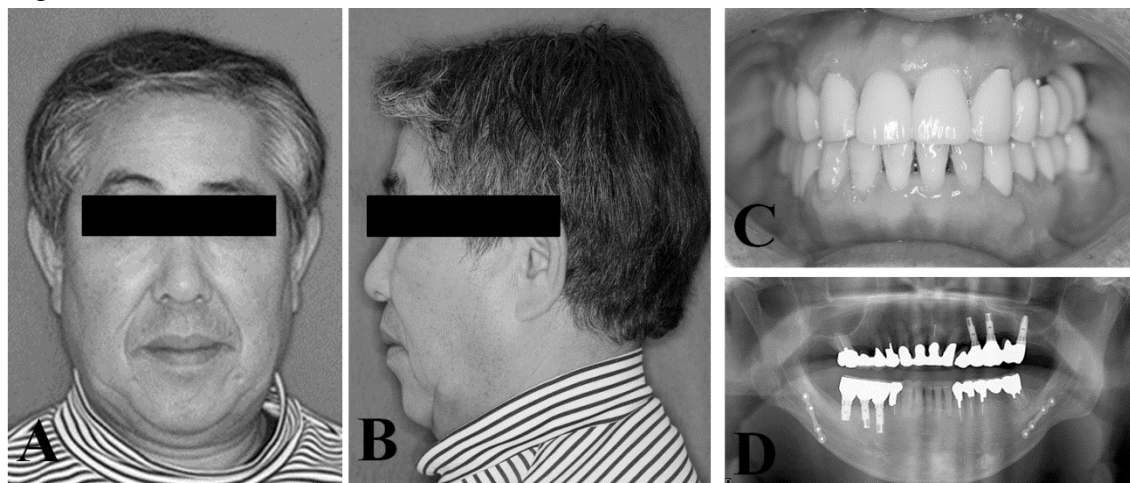


Table 1

	Average \pm SD	T0	T1	T2	T3	T4
SNA	81.80 \pm 3.10	81.0	82.2	82.2	81.9	82.5
SNB	76.80 \pm 3.10	78.5	78.9	75.0	74.4	74.6
Mandibular plane	26.30 \pm 6.30	40.0	44.4	43.9	43.8	44.4
Gonial angle	131.00 \pm 5.60	142.0	142.7	141.8	143.4	142.4
Ramus angle	83.00 \pm 4.40	77.0	75.9	78.2	77.7	80.1
Occlusal plane	9.5 \pm 4.00	10.5	11.3	11.0	12.1	11.2