CASE REPORT

"Surgery First" Skeletal Class III Correction Using the Skeletal Anchorage System

HIROSHI NAGASAKA, DDS, PHD
JUNJI SUGAWARA, DDS, PHD
HIROSHI KAWAMURA, DDS, PHD
RAVINDRA NANDA, BDS, MDS, PHD

Surgical-orthodontic treatment traditionally involves presurgical orthodontic preparation, including dental alignment, incisor decompensation, and arch coordination. In skeletal Class III patients, however, presurgical incisor decompensation will exacerbate an anterior crossbite and prognathic lip profile, and can increase the total treatment time with no significant benefit for the patient.[1]

We have adopted a new approach to such treatment: surgery first, followed by orthodontic alignment. This approach was made possible by the development of the Skeletal Anchorage System (SAS), which uses titanium miniplates as temporary anchorage devices and enables predictable three-dimensional movement of the entire dentition in nongrowing patients.[2-4]

The present article describes the treatment of a skeletal Class III patient with a combination of surgery and SAS orthodontic treatment.

Diagnosis and Treatment Plan

A 17-year-old female presented with the chief complaint of a prognathic profile. Initial examination revealed an excessive interlabial gap, mandibular excess, a Class III skeletal relationship, an edge-to-edge bite, maxillary incisor proclination, moderate maxillary crowding, and extreme buccoversion of the maxillary second molars (Fig. 1, Table 1). These problems, particularly the mandibular excess, indicated the need for orthognathic surgery.

After we presented the various surgical-orthodontic options, the patient elected the "surgery first" approach. We also decided

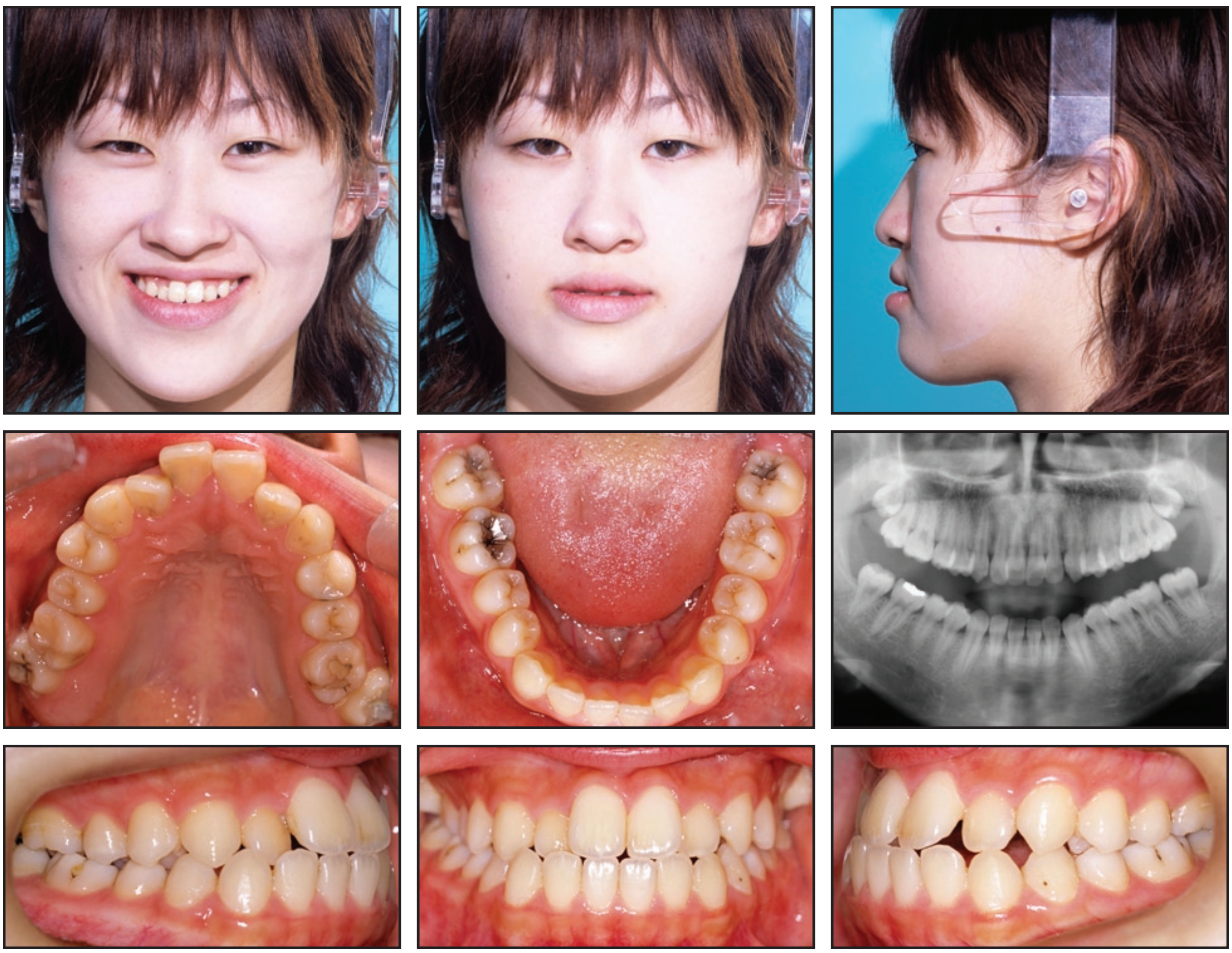

Dr. Nagasaka


Dr. Sugawara


Dr. Kawamura


Dr. Nanda

Dr. Nagasaka is a Lecturer, Dr. Sugawara is a Clinical Professor, and Dr. Kawamura is a Professor, Division of Maxillofacial Surgery, Graduate School of Dentistry, Tohoku University, Sendai, Japan. Dr. Sugawara is a Visiting Professor and Dr. Nanda is Professor and Head, Department of Craniofacial Sciences, Alumni Endowed Chair, School of Dental Medicine, University of Connecticut, 263 Farmington Ave., Farmington, CT 06030; e-mail: nanda@uchc.edu. Dr. Nanda is also an Associate Editor of the *Journal of Clinical Orthodontics.*



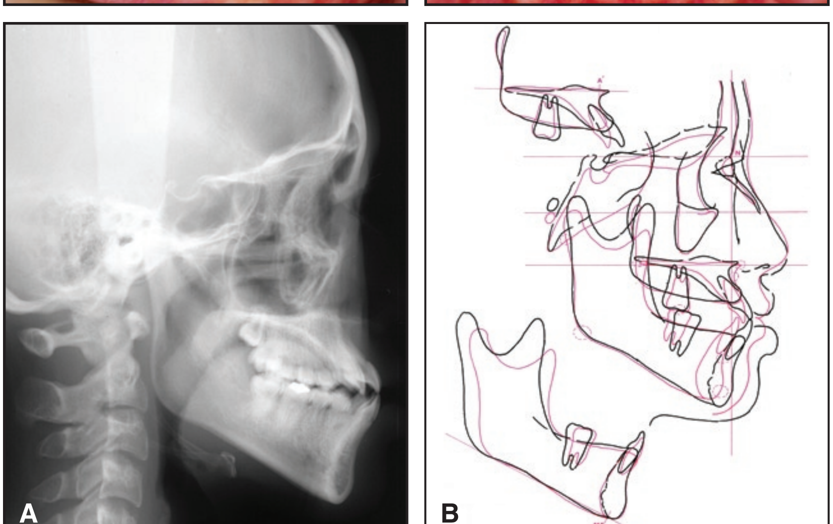


Fig. 1 A. 17-year-old female patient with mandibular excess, Class III skeletal relationship, edge-to-edge bite, and crossbite before treatment. B. Initial cephalometric analysis comparing craniofacial morphology of patient with norms for Japanese female adults.

TABLE 1
CEPHALOMETRIC DATA

	Norm	Pretreatment	Post-Treatment
NS	66.1mm	67.3mm	67.3mm
N-ANS	53.4mm	56.3mm	57.3mm
ANS-Me	69.7mm	72.9mm	71.3mm
N-Me	121.1mm	128.5mm	127.3mm
S′-Ptm′	18.4mm	19.3mm	18.6mm
A′-Ptm′	46.7mm	49.7mm	50.4mm
Is-Is′	30.8mm	27.0mm	28.7mm
Mo-Ms	23.4mm	25.3mm	22.6mm
Gn-Cd	115.2mm	127.3mm	121.2mm
Po’-Go	74.6mm	84.1mm	78.1mm
Cd-Go	60.3mm	61.7mm	60.9mm
Ii-Ii′	43.0mm	47.3mm	46.7mm
Mo-Mi	32.6mm	35.2mm	34.3mm
CdGn-CdA		40.9mm	35.5mm
Wits appraisal		–8.2mm	–4.6mm
Y-axis	65.4°	57.9°	58.9°
FH-SN	6.2°	8.5°	9.7°
SNA	82.3°	83.9°	83.9°
SNB	78.9°	86.4°	82.8°
ANB	3.4°	–2.5°	1.1°
Mandibular plane to SN	40.2°	32.6°	33.8°
Ramus plane to SN	89.0°	91.1°	89.8°
Gonial angle	131.0°	121.6°	124.0°
U1-SN	104.5°	122.9°	113.2°
L1 to mandibular plane	96.3°	89.6°	88.6°
Interincisal angle	124.1°	114.8°	124.4°
Occlusal plane to SN	20.2°	10.3°	14.7°

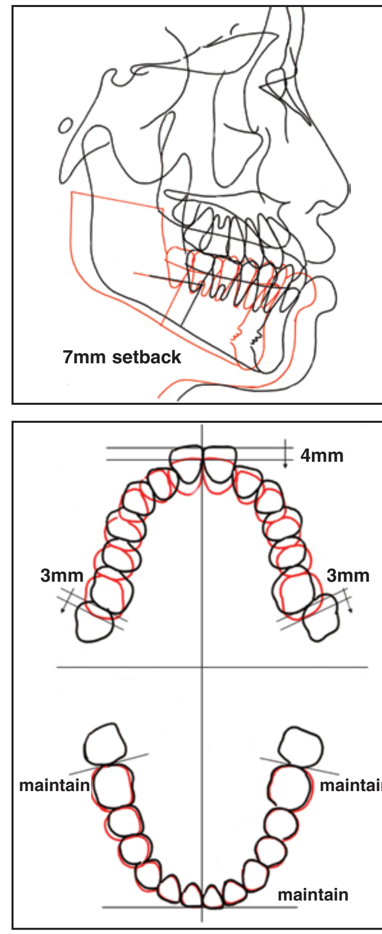


Fig. 2 Cephalometric and occlusogram predictions of treatment results immediately after orthognathic surgery and after orthodontic treatment, respectively, with target positions shown in red.

to extract the maxillary second molars to correct the crossbite and facilitate distalization of the maxillary posterior teeth, allowing the third molars to replace the second molars.

Cephalometric and occlusogram predictions were used for treatment planning (Fig. 2). The cephalometric analysis and Wits appraisal indicated the need for about 7mm of mandibular setback. The mandibular incisors were appropriately inclined, but the maxillary incisors were significantly proclined. Therefore, we planned to retrocline the maxillary incisors by about 4mm after moving the maxillary posterior teeth distally by 3-4mm.

Treatment Progress

Before orthognathic surgery, .022" preadjusted brackets were bonded to all the teeth except the maxillary second molars, and passive rectangular .018" × .025" stainless steel archwires were inserted. Model surgery was performed according to

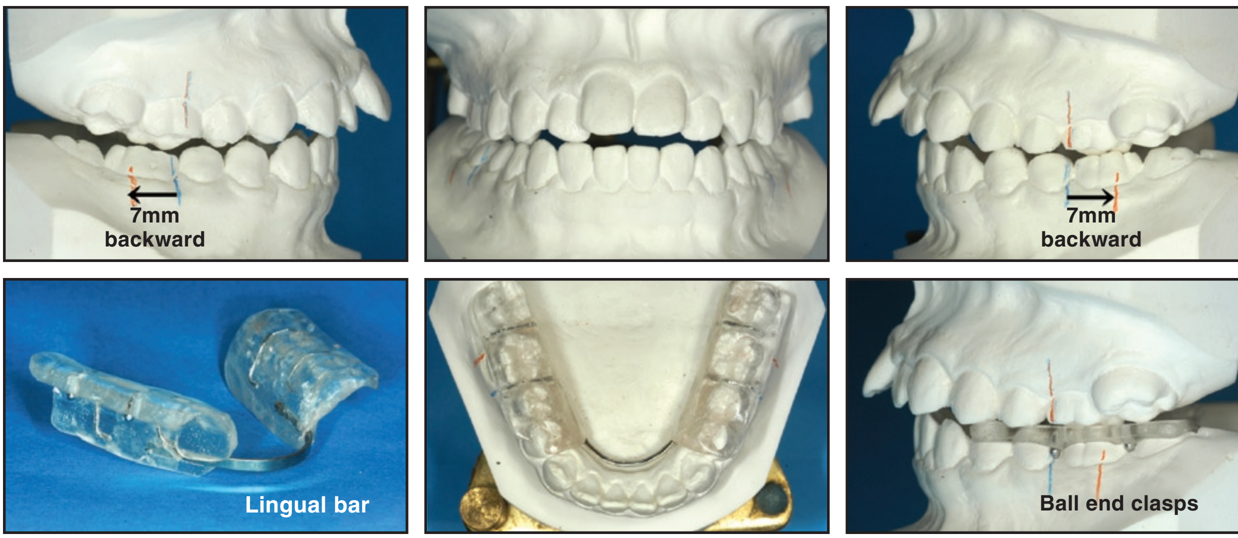


Fig. 3 Model surgery and surgical splint showing bilateral 7mm mandibular setback.

the cephalometric prediction. A surgical splint with a lingual bar and ball end clasps was fabricated to cover the posterior occlusal surfaces and ensure optimal positioning and stabilization of the mandibular model (Fig. 3).

Bilateral sagittal split ramus osteotomy was then performed to achieve the required mandibular setback. Titanium miniplates were used for rigid internal fixation. After the surgical splint was set in the mandibular arch, four intermaxillary fixation screws* were inserted in the anterior alveolar regions to prevent unwanted incisor extrusion. Simultaneously, the maxillary second molars were extracted, and Y-type orthodontic titanium miniplates** were implanted at the zygomatic buttresses, using titanium monocortical screws (2mm in diameter, 5mm long), to distalize the maxillary posterior teeth and thereby decompensate the maxillary incisors. Immediately after surgery, the patient demonstrated a Class II profile and a Class II occlusal relationship with open bite (Fig. 4). The intermaxillary fixation screws were replaced with vertical elastics.

Postsurgical orthodontic treatment was initiated one month after surgery. The maxillary posterior teeth were leveled with a nickel titanium archwire and simultaneously distalized using SAS mechanics, with the passive rectangular wire left in place in the anterior segment. The surgical splint was modified to a removable mandibular occlusal splint, which was used to stabilize the jaw position and masticatory function.

Once these goals had been achieved, one and a half months after surgery, leveling and alignment of the mandibular arch were begun without the splint (Fig. 5A). When sufficient space was available, the maxillary arch was leveled and aligned, and the maxillary anterior teeth were retracted (Fig. 5B-E). Coordination of the maxillary and mandibular arches was followed by finishing and detailing (Fig. 5F).

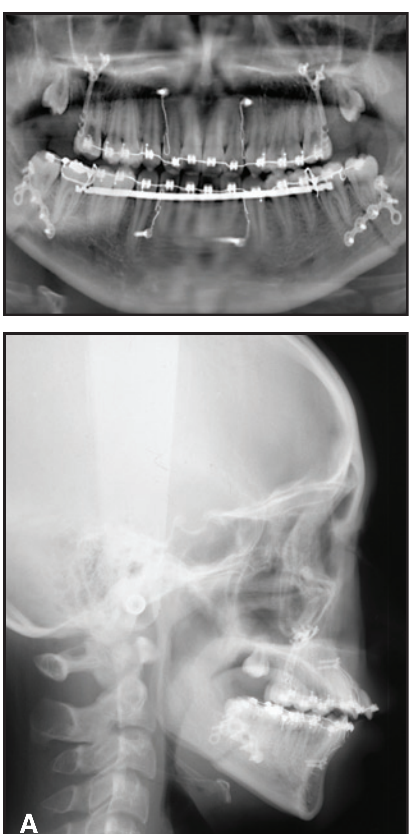
After a total treatment time of 12 months, all brackets were debonded, and the titanium miniplates and screws were removed under local anesthesia. A wraparound retainer was placed in the maxillary arch, and a lingual retainer was bonded in the mandibular anterior segment.

Treatment Results

Post-treatment records showed complete resolution of all the patient's orthodontic problems, resulting in a balanced pro-

*Dual-Top, trademark of JEIL Medical Corp., #702, Kolon Science Valley 2nd 822, Guro-Dong, Guro-Ku, Seoul, South Korea; www.jeilmed.co.kr.

**SMAP OrthoAnchor, trademark of Dentsply-Sankin Corp., 14-9 Yushima 3-Chome, Bunkyo-ku, Tokyo, Japan; www.dentsply-sankin.com.



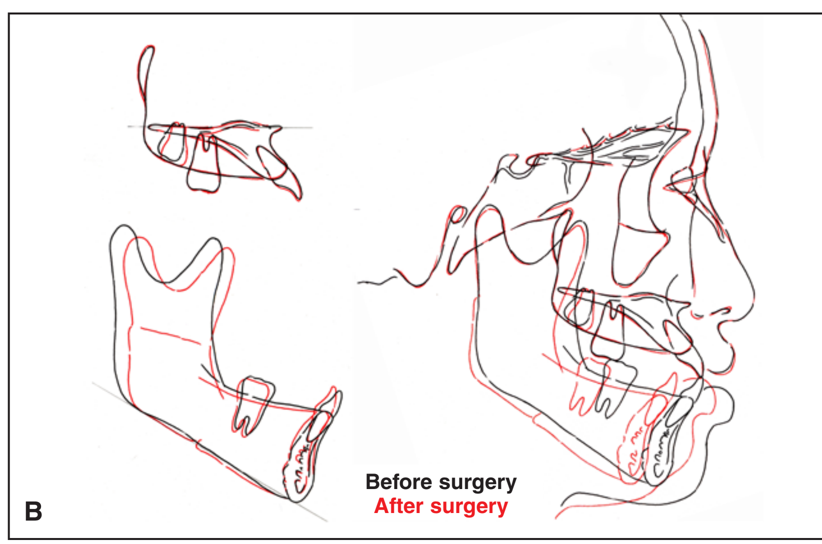


Fig. 4 A. Patient immediately after surgery, showing Class II occlusion with open bite and proper mandibular position maintained with surgical splint. B. Superimposition of preoperative (without surgical splint) and postoperative (with surgical splint) cephalometric tracings. Mandibular body length decreased approximately 8mm, with slight mandibular clockwise rotation.

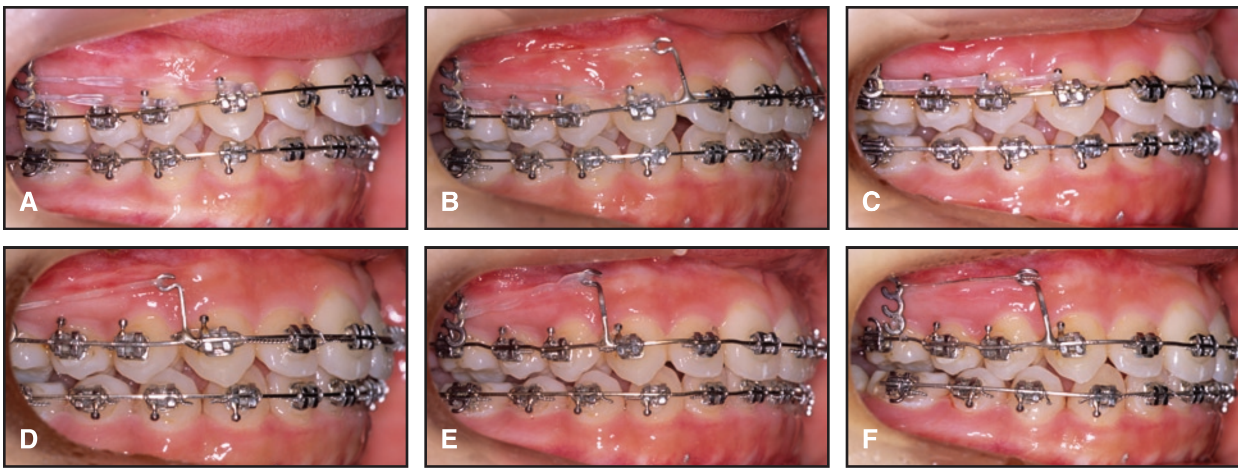


Fig. 5 Changes in canine and molar relationships during postsurgical orthodontic treatment, using the SAS. A. At one and a half months after surgery. B. At four months. C. At six months. D. At seven and a half months. E. At eight months. F. At 10 months.

file with a good occlusal relationship (Fig. 6). The maxillary third molars were erupting into the spaces formerly occupied by the second molars. Cephalometric analysis showed the patient's post-treatment profile to be nearly identical to the norm for Japanese female adults (Table 1). Superimposition of pre- and post-treatment cephalometric tracings showed achievement of all treatment goals. The patient was delighted with the treatment outcome.

Retention records obtained three years after debonding showed generally stable results, with a slight deviation of the lower dental midline (Fig. 7).

Discussion

Skeletal Class III malocclusion goes hand in hand with dentoalveolar compensation, typically involving proclination of the maxillary incisors and retroclination of the mandibular incisors. Therefore, when surgery is performed first, a Class III malocclusion always becomes a Class II relationship immediately after mandibular setback, requiring Class II orthodontic mechanics after surgery (Fig. 8).

Because SAS mechanics can predictably distalize the maxillary molars and protract the mandibular molars in nongrowing patients, it is not difficult to correct Class II malocclusions without premolar extractions.[5] The SAS mechanics can also be used to correct open bite, anterior crowding, dental asymmetry, or excessive arch spacing.[6-8] We now use the "surgery first" approach routinely for Class III correction requiring orthognathic surgery.

A surgical splint is essential to guide repositioning of the mandible, because the postsurgical Class II malocclusion is generally quite unstable. After surgery, the modified, removable splint helps stabilize the jaw and bring the patient into the final occlusion with aid of training elastics.

The "surgery first" approach has several biological and psychosocial advantages over traditional surgical-orthodontic treatment:

• Patient satisfaction is virtually guaranteed, because the patient sees a major improvement in the profile at the beginning of treatment. This rapid improvement makes the patient more willing to accept the Class II profile resulting from orthognathic surgery.

• The Class III profile and anterior crossbite are not exacerbated by incisor decompensation. Concerns about worsening the profile in presurgical treatment sometimes cause Class III patients to forgo orthognathic surgery.

• If a surgical error or skeletal relapse occurs, compensation can be made with SAS mechanics. In conventional treatment, because the decompensation is completed before surgery, it is difficult or impossible to recover from surgi-

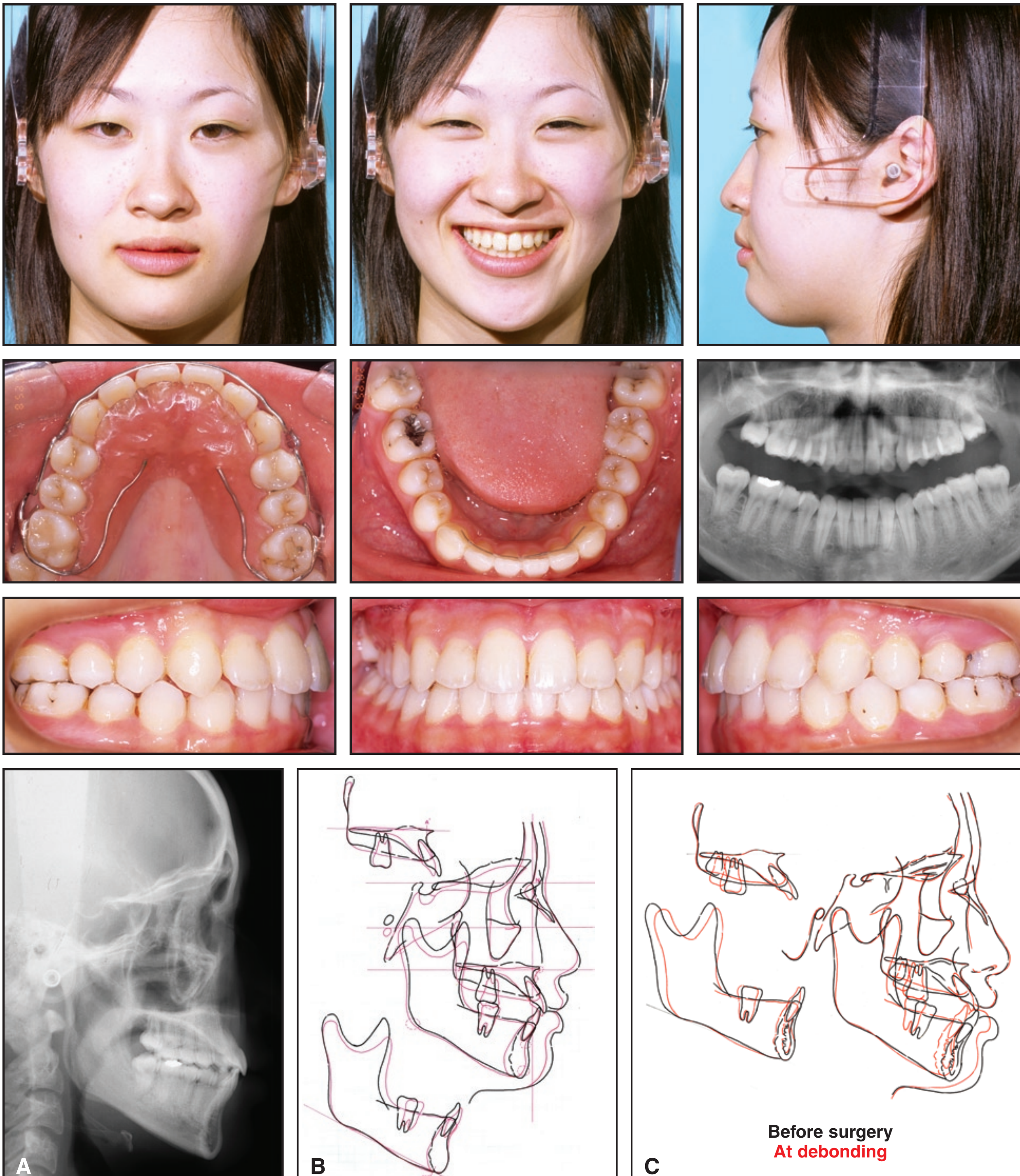


Fig. 6 A. Patient at debonding, 12 months after surgery, with maxillary wraparound retainer and mandibular lingual bonded retainer in place and all titanium miniplates and screws removed. Note eruption of maxillary third molars in proper positions. B. Post-treatment cephalometric analysis, showing dentofacial proportions nearly identical to norms for Japanese female adults. C. Superimposition of pre- and post-treatment cephalometric tracings, showing maxillary molars significantly distalized and maxillary incisors successfully decompensated.

Fig. 7 Patient three years after debonding.

cal error during postsurgical orthodontic treatment.

• The total treatment time is usually much shorter. The 12 months required to treat the case shown here is significantly less than the average time for presurgical orthodontic treatment alone.[9-11] Wilcko and colleagues reported that corticotomy could enhance tooth movement by increasing bone turnover and decreasing bone density.[12] Similarly, bone turnover after orthognathic surgery significantly accelerates orthodontic tooth movement.

• Decompensation can be performed effectively and efficiently. Because a Class III malocclusion becomes a Class II relationship after mandibular setback, the resulting improvement in the tone of the upper lip and tongue increases the force on the incisors of both arches, improving the efficiency of incisor decompensation. This phenomenon may also be a factor in reducing total treatment time.

On the other hand, the "surgery first" approach also has some disadvantages that must be taken into consideration:

• The occlusion cannot be used as a guide for establishing treatment goals, unlike traditional surgical-orthodontic treatment, in which decompensation of the incisors and coordination of the dental arches are performed before surgery. The skeletal disharmony must be accurately assessed to establish an effective treatment plan. The Wits appraisal[13] and craniofacial drawing standards (CDS) analysis[14] can be used to establish individualized treatment goals (Fig. 1B).

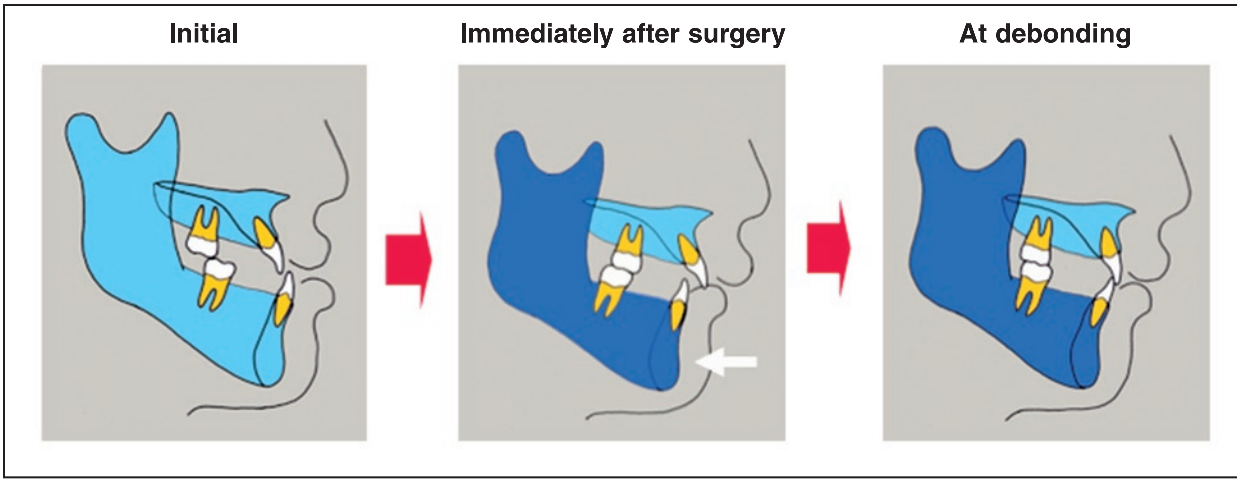


Fig. 8 "Surgery first" mandibular setback for skeletal Class III correction.

• Without presurgical orthodontics, it is difficult to obtain a stable occlusion immediately after surgery. Therefore, the patient must wear an occlusal splint while eating.
• The orthodontist must be experienced and skilled with the SAS technique, which is essential to achieving predictable three-dimensional molar movement.

Conclusion

The "surgery first" approach, combined with SAS mechanics, provides significant benefits to skeletal Class III patients compared with traditional surgical-orthodontic treatment. Among its advantages are rapid profile improvement, more efficient and effective decompensation, and greatly reduced treatment time. We believe these advantages substantially outweigh any disadvantages, and that this new treatment approach may become a standard clinical option in the near future.

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