

# Stability of Pre-Orthodontic Orthognathic Surgery Using Intraoral Vertical Ramus Osteotomy Versus Conventional Treatment

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**Purpose:** Postoperative skeletal and dental changes were evaluated in patients with mandibular prognathism who underwent mandibular setback surgery using an intraoral vertical ramus osteotomy (IVRO) with and without presurgical orthodontic treatment.

**Material and Methods:** This retrospective cohort study included consecutive patients with skeletal Class III malocclusions who underwent IVRO. Patients treated with pre-orthodontic orthognathic surgery (POGS) were compared with patients treated with conventional surgery (CS) with presurgical orthodontics (control) using lateral cephalograms (taken preoperatively, 7 days postoperatively, and 12 months postoperatively). Predictor (group and timing), outcome (cephalometric measurements over time), and other (ie, baseline characteristics) variables were evaluated to determine the differences in postoperative horizontal and vertical positional changes of the mandible, such as point B. Baseline demographics were similar between the groups (N = 37; CS group, n = 17; POGS group, n = 20). The data were analyzed with an independent *t* test, the Mann-Whitney *U* test, the Fisher exact *t* test, Pearson correlation analysis, and simple linear regression analysis.

**Results:** The mean setback of the mandible at point B was similar, but the mandible of the POGS group, particularly the distal segment, moved superiorly during the postoperative period in conjunction with the removal of premature occlusal contacts ( $P < .001$ ). In the CS group, the mandible had significantly more backward movement 12 months after surgery compared with the POGS group ( $P < .01$ ). In the POGS group, horizontal and vertical postsurgical changes were linearly correlated with the amount of setback and vertical movement of the mandible.

**Conclusions:** Mandibular setback surgery using IVRO without presurgical orthodontics leads to considerably different postoperative skeletal and dental changes compared with conventional treatment, with more superior movement being observed at point B during the 1-year postoperative period.

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Patients with skeletal Class III malocclusion and mandibular prognathism commonly undergo correction by bimaxillary surgery with presurgical orthodontic treatment to maximize stable postoperative

occlusion and for optimal skeletal correction at the time of orthognathic surgery.<sup>1-3</sup> Anteroposterior, vertical, and transverse dental positions are determined during the presurgical orthodontic

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treatment period.<sup>3-5</sup> However, patients might experience worsening of their facial profiles and function, and treatment during long-term presurgical orthodontic treatment might not be helpful.<sup>6</sup>

Recently, performing mandibular setback surgery in patients with skeletal Class III malocclusion without preoperative orthodontic treatment (known as pre-orthodontic orthognathic surgery [POGS]) followed by postoperative orthodontic treatment was proposed. POGS offers several advantages, including patient satisfaction because of early improvement in the facial profile and a shorter total treatment time.<sup>7-10</sup>

Many studies have investigated the postoperative stability of mandibular setback surgery without presurgical orthodontic treatment. Kim et al<sup>5</sup> reported that mandibular sagittal split ramus osteotomy (SSRO) without presurgical orthodontics was less stable than conventional orthognathic surgery (CS) for mandibular prognathism. Ko et al<sup>11</sup> reported that the initial overbite could be an indicator for predicting possible skeletal relapse of mandibular setback without presurgical orthodontic treatment. However, most previous studies have been limited to the SSRO technique. Few studies have investigated the postoperative stability and factors contributing to postoperative skeletal and dental changes without presurgical orthodontics using intraoral vertical ramus osteotomy (IVRO).<sup>12</sup> In addition, an evaluation of the different horizontal and vertical movements of the mandible during IVRO with the surgery-first approach to determine how much they affect postoperative change has not, to the best of the authors' knowledge, been performed. The proximal and distal segments are not fixed during the IVRO, which could allow early postoperative relapse; these patterns might differ between the SSRO and the IVRO.

The aim of this study was to evaluate the patterns of postoperative skeletal and dental changes in patients with mandibular prognathism who received mandibular setback surgery using IVRO with and without presurgical orthodontic treatment and to determine whether POGS results in acceptable postoperative results that are comparable to those of CS. In addition, this study investigated whether a correlation existed between surgical horizontal and vertical movements and postoperative changes 12 months after surgery.

## Materials and Methods

### STUDY DESIGN AND PATIENTS

This retrospective cohort study included patients who were diagnosed with skeletal Class III malocclusion and mandibular prognathism and underwent mandibular setback surgery using IVRO from 2007 through 2013 at the Department of Oral and Maxillofacial Surgery, Yonsei Dental Hospital (Seoul, Korea).

The exclusion criteria were previous orthognathic surgery; existing medical, physical, or mental conditions that would impair the potential for healing; syndromic craniofacial deformities, such as cleft lip and palate; major menton deviation greater than 4 mm from the facial midline; 1-jaw surgery; an extraction case; and the loss of or an incomplete series of identifiable lateral cephalograms. Thirty-seven patients (17 men and 20 women) who fulfilled the inclusion criteria were enrolled in this study (CS group,  $n = 17$ ; mean age,  $20.8 \pm 0.9$  yr; POGS group,  $n = 20$ ; mean age,  $21.1 \pm 0.7$  yr; Table 1). The mean patient age at the time of surgery was 21.0 years (range, 18 to 31 yr). The sample size was calculated (G\*Power 3, Düsseldorf, Germany) using a significance level of a  $P$  value less than .05, a power of 80%, and an effect size of 0.7 to detect differences in surgical and dental changes at each time point in each group using a paired  $t$  test. This study conformed to the Declaration of Helsinki and was approved by the institutional review board of Yonsei Dental Hospital.

### SURGICAL AND ORTHOGNATHIC TREATMENT

For patients in the POGS group, orthodontic braces and surgical arch wires were positioned without any active orthodontic force 1 month before surgery because of intermaxillary fixation (IMF). In the CS group, the presurgical orthodontic treatments included leveling and aligning teeth, relieving crowding, providing decompensation of teeth axes, and coordinating upper and lower arches. All orthodontic treatments were performed by an orthodontist (K.-J.L.) at the Department of Orthodontics, Yonsei Dental Hospital. All patients had conventional bimaxillary surgery, including maxillary 1-piece Le Fort I osteotomy and IVRO to set back the mandible. All surgeries used the same protocol and were performed by 2 surgeons (Y.-S.J.).

**Table 1. DEMOGRAPHIC CHARACTERISTICS OF THE 37 PATIENTS**

Variable	CS Group (n = 17)	POGS Group (n = 20)	P Value
Gender, n (%)			NS*
Men	8 (47.1)	9 (45.0)	
Women	9 (52.9)	11 (55.0)	
Age (yr)	$20.8 \pm 0.9$	$21.1 \pm 0.7$	NS†

Abbreviations: CS, conventional orthognathic surgery; NS, not statistically significant; POGS, pre-orthodontic orthognathic surgery.

\* By Fisher exact  $t$  test.

† By Mann-Whitney  $U$  test.

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