

Clinical Paper
Orthognathic Surgery

Comparison of the computed tomography values of the bone fragment gap after sagittal split ramus osteotomy in mandibular prognathism with and without asymmetry

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Abstract. The purpose of this study was to compare computed tomography (CT) Hounsfield unit values of bone fragment gaps after sagittal split ramus osteotomy (SSRO) in patients with and without asymmetry, and to evaluate differences between the deviated and non-deviated sides in asymmetric patients. Thirty-two patients who underwent a bilateral SSRO were included in this retrospective study. Patients were divided into symmetric and asymmetric groups by cephalometric analysis. CT values of the bone fragment gap were measured at 1 week and at 1 year after surgery. There were significant differences between CT values obtained at 1 week and at 1 year after surgery for all measurement points. However, there were no significant differences in CT values between symmetric and asymmetric patients at either 1 week or 1 year after surgery. Among asymmetric patients, there were no significant differences between the deviated and non-deviated sides at 1 week or 1 year after surgery. This study showed ossification of the bone fragments and adaptation to change the mandible form in patients with and without asymmetry following SSRO.

Key words: computed tomography value; osteotomy; asymmetry.

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The sagittal split ramus osteotomy (SSRO) is one of the preferred surgical procedures for the correction of various forms of mandibular prognathism.^{1,2} The advantage of SSRO is that it provides a large contact area of bone segments to advance or set back the jaw, including in cases with asymmetry.^{3,4}

With the conventional SSRO technique for asymmetric cases, the distal segment moves and rotates to the left or right side. The bony interference between the proximal and distal segments of the mandible causes a gap. This interference is prone to relapse after surgery, condylar disc displacement, or condylar resorption.⁵⁻⁸ Various methods have been proposed to solve this problem, including grinding the bony interference between the proximal and distal segments, bending the distal segment posterior to the last molar, and performing a bone graft in the area of the segment gap.⁹⁻¹¹ Conventional SSRO with bent plate fixation is a method in which a gap between the proximal and distal segments is created with a bent plate, preventing internal rotation of the condylar head¹² (Fig. 1). In setback surgery, especially in cases with asymmetry, fixation with a bent plate between the segments can be performed without a bony contact to prevent large changes in the condylar position and angle. Furthermore,

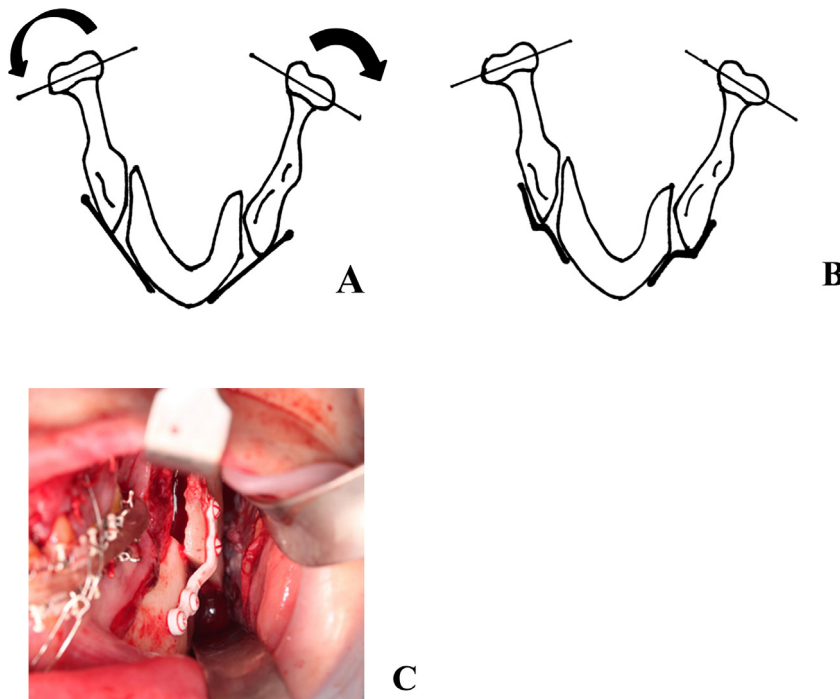


Fig. 1. (A) Jawbone model with straight plate fixation: the proximal segments containing the condylar head cause internal rotation. (B) Jawbone model with bent plate fixation: this method is less affected by internal rotation of the condylar head. (C) Intraoperative image showing bent plate fixation.

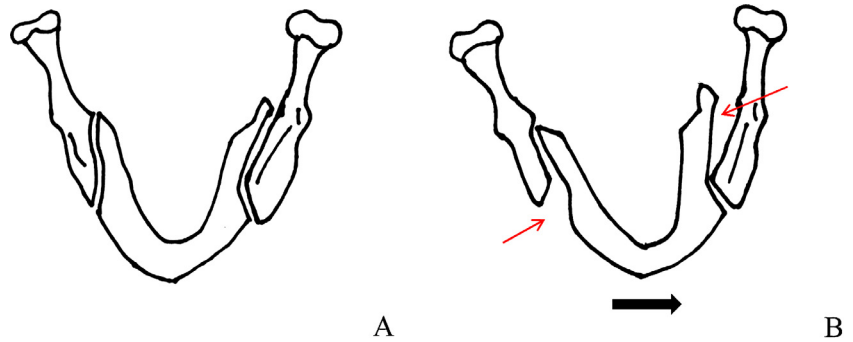


Fig. 2. (A) After splitting in a symmetric patient. (B) After splitting in an asymmetric patient; red arrows indicate the large fragment gaps.

bone volume and facial contour can be adjusted without bone grafts, preventing postoperative temporomandibular disorders.¹³ However, the treatment of asymmetric cases with a variety of modified SSRO procedures can result in small or large gaps between the bone fragments (Fig. 2).

The measurement of computed tomography Hounsfield unit values (CT values) and CT evaluation of the formation of bone and soft tissue has recently arisen as a useful way of evaluating bone healing. This method has been used to demonstrate that the gap between the proximal and distal segments can fill with new bone after SSRO.¹⁴ SSRO without rigid fixation

of the segments has been shown to exhibit poor bone healing.¹¹ Additionally, the types of fixation materials used in SSRO influence the healing of bone segments after the procedure.^{14,15}

This study aimed to use CT values (Hounsfield units, HU) to evaluate the healing of bone segments after SSRO in patients with and without asymmetry.

Materials and methods

Patients

This retrospective study included 32 patients (six men and 26 women; mean age 31.63 years, range 17–58 years) who were diagnosed with mandibular prognathism and underwent SSRO during the period November 2006 to August 2013. Inclusion criteria were: (1) no deformation of the midface (patients who did not undergo Le Fort I osteotomy); (2) no history of surgery involving the middle or lower face; (3) bent plate fixation was used on both sides; and (4) no bad fractures during surgery. Informed consent was obtained from all patients in accordance with the Declaration of Helsinki, and the study was approved by the necessary ethics committee. Cephalograms were obtained preoperatively, at 1 week postoperative, and at 1 year after surgery. CT scans were obtained at 1 week postoperative and at 1 year after surgery.

Surgical procedure

For all patients, the SSRO was performed by the same surgeon and assistants using the conventional Obwegeser method, with a 1.6-mm round bur used on the anterior side of the ramus, a Lindemann bur above the lingula of the mandible, and a reciprocating saw on the lateral cortex. The mandibular crack was split using an osteotome and a bone spreader. After the split, the proximal segments were tested

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