Analysis and comparison of clinical results of bilateral sagittal split ramus osteotomy performed with the use of monocortical locking plate fixation or bicortical screw fixation

Yuhji Kabasawa, DDS, PhD, Masaru Sato, DDS, PhD, Tsuyoshi Kikuchi, DDS, Yuriko Sato, DDS, PhD, Yukiko Takahashi, DDS, Yusuke Higuchi, DDS, PhD, and Ken Omura, DDS, PhD

Objective. The aim of this study was to compare clinical results of bilateral sagittal split ramus osteotomy (BSSRO) with the use of monocortical locking plate or bicortical screw fixation.
Study Design. Fifty-five patients underwent BSSRO for prognathism, using either monocortical locking plate (group A; n = 28) or bicortical screw (group B; n = 27) osseofixation. No intermaxillary fixation was done after surgery. Groups were subdivided according to presence or absence of mandibular asymmetry. Time course changes in condylar and skeletal stability were measured on lateral and posteroanterior cephalograms and axial radiographs before surgery and at 3 and 6 months after surgery.
Results. In facial symmetry subjects, the change in angle of the longitudinal axis of the condyle in group A was significantly greater than that for group B up to 3 months after surgery, but no significant differences were found in facial asymmetry subjects.
Conclusions. The findings of this study suggest that monocortical fixation using the locking plate system to stabilize SSRO is as reliable as bicortical screw fixation regardless of facial asymmetry. (Oral Surg Oral Med Oral Pathol Oral Radiol 2013;116:e333-e341)

Bilateral sagittal split ramus osteotomy (BSSRO) is one of the most useful mandibular orthognathic surgeries. Among the many systems designed for osteosynthesis of the mandible, bicortical titanium screw fixation or monocortical miniplate/screw systems have been widely used. We have used the bicortical titanium screw fixation method over the past 20 years and have found this system to have a high postoperative stability.[1-3] However, the recently introduced locking plate/screw system has many theoretic advantages compared with conventional plate systems.[4,5] These advantages include less screw loosening, greater stability, and less plate adaptation. Many studies have evaluated the locking plate/screw system in the treatment of fractures in head and neck injuries,[6-12] but there have been few reports of its use in orthognathic surgery.[13-15]

In the present study, we aimed to compare the postoperative stability of monocortical fixation using a locking plate system with that of bicortical screw fixation.

Oral and Maxillofacial Surgery, Graduate School, Tokyo Medical and Dental University.
Received for publication Sep 13, 2011; returned for revision Jan 15, 2012; accepted for publication Feb 1, 2012.

2212-4403/$ - see front matter
http://dx.doi.org/10.1016/j.oooo.2012.02.025

MATERIALS AND METHODS

Subjects

Following approval of the study design by the Institutional Review Board of Tokyo Medical and Dental University, 55 Japanese adults with mandibular prognathism, from each of whom informed consent had been obtained, were enrolled in the study. Twenty-eight subjects who received monocortical osseofixation using locking plates (group A) were classified according to facial asymmetry (16 subjects with facial symmetry, 12 with facial asymmetry). Group B was a control group of 27 subjects who received bicortical osseofixation using screw fixation (12 with facial symmetry, 15 with facial asymmetry; Table I). Facial asymmetry was de-

Statement of Clinical Relevance

Our findings showed no significant differences in postoperative clinical results between bicortical screw fixation and monocortical fixation using a locking plate system. This suggests that monocortical locking plate system after sagittal split ramus osteotomy is highly reliable, regardless of facial asymmetry.

Table 1. Number of subjects in each group and surgical procedures

		Group A	Group B	Total
Symmetry	BSSRO	8	4	12
	L1+BSSRO	8	8	16
Asymmetry	BSSRO	6	6	12
	L1+BSSRO	6	9	15
Total		28	27	

Group A: Monocortical osseofixation using locking plates; group B: bicortical osseofixation using screw fixation. *BSSRO*, Bilateral sagittal split ramus osteotomy; *L1*, Le Fort I osteotomy.

fined as a difference of ≤5 mm in the horizontal distance between the gonion and the midsagittal plane.

SURGICAL PROCEDURES

Subjects underwent surgery either for 1 jaw (BSSRO) or both jaws (Le Fort I osteotomy [L1] + BSSRO), as summarized in Table I.

SSRO was performed by the same operator (Y.K.) using the method described by Trauner and Obwegeser[16] and dal Pont[17] in all cases. The proximal and distal segments of the osteotomies were fixed monocortically with the use of a locking plate (Compact Lock 2.0 large; 1.5-mm thickness; Synthes Corp.). We often used only 4 of the 6 screw holes in the locking plate and cut the rest of the plate; thus, only 4 screws (2 × 8 mm and 2 × 6 mm) were required. In the control group, the proximal and distal segments of the osteotomies were fixed bicortically in the gonial region with 3 titanium position screws. In both groups, after completion of skeletal fixation, no maxillomandibular fixation with stainless steel wire was used, but elastic was placed to maintain an ideal occlusion in the same manner in both groups. Other details of the surgical procedure were described previously.[18] In all facial symmetry cases, a condylar repositioning appliance (CRA) was used to reposition the proximal segment and maintain the condylar position during the surgical procedure in both groups.[19-21] We applied CRA only for facial symmetry cases, because it was difficult to change the lateral angle of the mandibular ramus by using CRA.

Measurement of neurosensory disturbance

Using a thermostimulator (Intercross-200; Intercross Co., Tokyo, Japan), the thresholds for detection of warmth (WHF: W/m^2) and cold (CHF: W/m^2) in the skin over the chin of the subjects was measured as a means of estimating neurosensory disturbance (NSD). Details of the use of this technique were described elsewhere.[18,22,23] A variation in threshold of >400 W/m^2 for WHF or CHF was taken to indicate the occurrence of postoperative NSD.

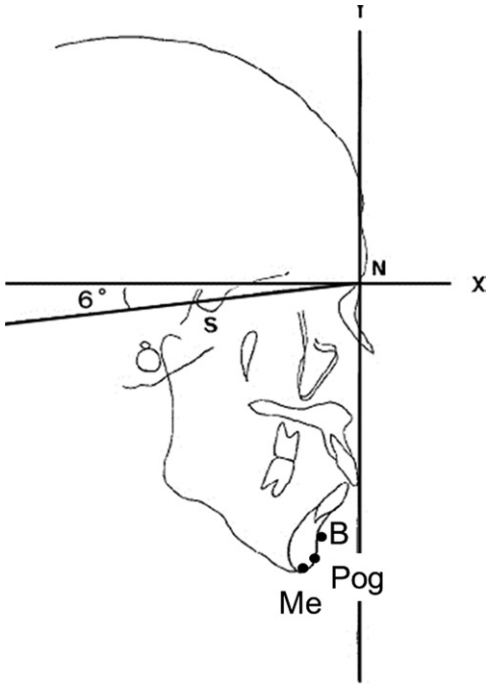

Fig. 1. Analysis of the lateral cephalogram Cephalometric landmarks and measurements on lateral cephalograms. The X axis, serving as a standard axis, was constructed by drawing a line through the nasion (N) 6 degrees up from the sella (S)-N line, and the Y axis was drawn as a straight line crossing the X axis and passing the N point. The positions of the cephalometric landmarks were indicated in relation to the X- and Y axis, and the changes in their position were represented as linear measurements in millimeters (B-x, B-y, Pog-x, Pog-y, Me-x, and Me-y). B, Point B; Pog, Pogonion; Me, menton.

Measurements of occlusal force and area

A thin pressure-sensitive sheet (Dental-Prescale; Fuji Film Co.) and its associated apparatus (Occluzer; Fuji Film Co.) were used for measurement and analysis of bite force and area. Details of this technique were described elsewhere.[24]

Measurements of skeletal and ramus position

The time course changes in condylar and skeletal stability were measured on lateral and posteroanterior cephalograms and on axial radiographs of the skull at 3 different times (before surgery and at 3 and 6 months after surgery). The gonion was measured by the cephalometric analysis method previously reported by Harada et al.[3] Point B, pogonion (Pog), and menton (Me) were measured at each time point (Figure 1). The lateral angle of the mandibular ramus was measured on posteroanterior cephalograms (Figure 2, *A*), and the