

Three-Dimensional Analysis of Long-Term Stability After Bilateral Sagittal Split Ramus Osteotomy Fixed With a Single Miniplate With 4 Monocortical Screws and 1 Bicortical Screw: A Retrospective 2-Center Study

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Purpose: This study evaluated the long-term stability of bilateral sagittal split ramus osteotomy fixed with a single miniplate with 4 monocortical screws and 1 bicortical screw (hybrid technique [HT]) using 3-dimensional (3D) analysis and an objective measuring tool, cone-beam computed tomography (CBCT).

Materials and Methods: Sixty-four patients who underwent bimaxillary surgery with mandibular advancement fixed with the HT were selected from 2 different institutions and enrolled in this retrospective study. All patients underwent CBCT preoperatively, 1 month after surgery, and 12 months after surgery. To estimate the long-term stability of the HT, volumetric comparisons were performed using the following measurements: distance between the gonion and the B point in the sagittal plane; distance between the right and left gonion transversally; and the angle of the line connecting the mandibular notch and the gonion and the line connecting the gonion and the B point vertically.

Results: Statistical analysis showed no relevant relapse (<1 mm or <1°) when using the HT. However, a positive correlation between the amount of advancement and the amount of postoperative relapse was observed.

Conclusion: The HT produces stable postoperative 3D results after 12 months.

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Rigid internal fixation (RIF) is an essential tool to achieve stability in orthognathic surgery (OS). It has become the standard method for securing the position

of the skeletal segments against unbalanced forces in the stomatognathic system, muscular pull, contraction of soft tissues, and gravitational displacement.¹

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Specifically, the goals of RIF with OS are 1) to achieve primary stability to promote rapid bone healing and prevent pseudoarthrosis or malunion phenomena; 2) to avoid postoperative intermaxillary fixation, thus initiating postoperative mandibular function as soon as possible and improving postoperative oral hygiene care; and 3) to increase long-term skeletal stability, thus averting relapse and decreasing the possibility of displacement of the bony segments, particularly the condylar proximal segment.^{1,2}

Mandibular advancement is an orthognathic procedure with a very high risk of skeletal relapse because of the anatomic features mentioned earlier and the gap between proximal and distal bony segments.³ Therefore, several RIF protocols after bilateral sagittal split ramus osteotomy (BSSO) have been described and applied clinically with success, with most of them using bicortical screws (BSs) or at least 1 miniplate with monocortical screws (MSs) with different patterns of placement, size, and number.^{1,4}

To achieve the objectives of RIF, the authors routinely use the "hybrid technique" (HT), first described by Luhr et al⁵ in 1986 and primarily designed for handling unfavorable splits or bone gaps from third molar sockets.² Placing a supplementary BS in the retromolar area increases the stability of 1 MS, maintains its technical advantages, and leaves enough condylar flexibility for postoperative passive accommodation at the glenoid fossa.^{6,7}

Stability after BSSO has been widely assessed in recent years, as have the many different possibilities for its RIF.^{1,6-10} The most common analysis applied is 2-dimensional (2D) evaluation through lateral cephalometry, although 2D radiography is considered outmoded in OS. Surgical planning and assessment of treatment outcomes can be performed more accurately with software applied to facial cone-beam computer tomography (CBCT).¹¹

In this context, this study evaluated the long-term stability of the HT after BSSO using CBCT, a 3-dimensional (3D) and objective measuring tool.

Materials and Methods

SAMPLE SELECTION

To address the research goals, the authors designed and implemented a retrospective 2-center study of patients treated for any dentofacial deformity from January 2011 to April 2015. Subjects were selected from 2 institutions (Maxillofacial Institute, Barcelona, Spain; and the Face Surgery Center, Parma, Italy) and operated by their respective main surgeons (F.H.A. and M.R., respectively) who had more than 20 years of clinical experience. A retrospective evaluation of all consecutive patients who underwent treatment for an underlying dentofacial deformity during this

period was performed, and only those who fulfilled the following criteria were selected. Inclusion criteria were 1) bimaxillary surgery with BSSO and mandibular advancement, 2) RIF using the HT, and 3) age at least 16 years with mandibular growth cessation at the time of surgery. Patients were excluded as study subjects if they had 1) any craniofacial syndrome or 2) pathologic background that could compromise bone healing, 3) a bad split during BSSO or mandibular reshaping of the B point or angles, 4) an incorrect surgical plan or primary RIF technique, or 5) not completed the active orthodontic treatment and postoperative follow-up.

The study was approved by the ethics committee at the Quirón-Teknon Medical Center Barcelona (Barcelona, Spain; number 3DRIF) and performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments, and all participants accepted an informed consent agreement.

SURGERY

Patients were operated on under general anesthesia. In all cases, the mandible was operated on first and BSSO was performed using the Dal Pont-Obwegeser technique. Rigid fixation was achieved using a single 4-hole straight titanium miniplate (2.0-mm BSSO plate; OSA System, OsteoMed, Dallas, TX) along the oblique ridge of the mandible fixed with 4 MSs and 1 BS (2.0-mm width; OSA System) placed at the proximal segment posterior to the last tooth and superior to the inferior alveolar nerve (Fig 1). All patients were extubated in the operating room, and dynamic intermaxillary fixation was maintained with guiding elastics.

POSTOPERATIVE MANAGEMENT

All patients wore a closed-circuit cold mask (17°C) during hospital admission and were discharged 24 hours

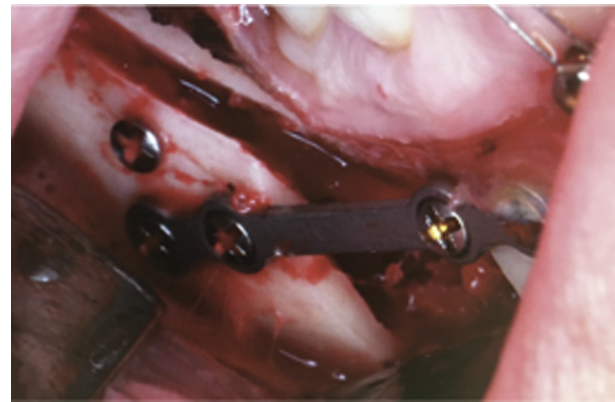


FIGURE 1. Hybrid technique.

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