Int. J. Oral Maxillofac. Surg. 2016; 45: 1195–1200
http://dx.doi.org/10.1016/j.ijom.2016.04.021, available online at http://www.sciencedirect.com

International Journal of Oral & Maxillofacial Surgery

Systematic Review
Orthognathic Surgery

Are bicortical screw and plate osteosynthesis techniques equal in providing skeletal stability with the bilateral sagittal split osteotomy when used for mandibular advancement surgery? A systematic review and meta-analysis

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E. A. Al-Moraissi, E. A. Al-Hendi: Are bicortical screw and plate osteosynthesis techniques equal in providing skeletal stability with the bilateral sagittal split osteotomy when used for mandibular advancement surgery? A systematic review and meta-analysis. Int. J. Oral Maxillofac. Surg. 2016; 45: 1195–1200. © 2016 International Association of Oral and Maxillofacial Surgeons. Published by Elsevier Ltd. All rights reserved.

Abstract. The objective of this study was to perform a systematic review and meta-analysis to test the null hypothesis that there is no difference in postoperative skeletal stability between bicortical screw and monocortical plate fixation after mandibular advancement surgery with bilateral sagittal split ramus osteotomy (BSSO). A comprehensive search of major databases (PubMed, EMBASE, and Cochrane CENTRAL) was conducted to locate all relevant articles published from inception to October 2015. Studies were selected based on inclusion criteria; randomized controlled trials, controlled clinical trials, and retrospective studies comparing bicortical screw vs. monocortical plate fixation after BSSO, reported in peer-reviewed publications in the English language, were considered eligible. Changes in linear measurements (horizontal and vertical) were analyzed. Five relevant studies were identified, involving 203 patients (bicortical screw $n = 98$, monocortical plate $n = 105$). No significant difference was found between monocortical plate and bicortical screw fixation in horizontal ($P = 0.099$) or vertical measurement ($P = 0.882$). Based on this review, there is overall agreement in the

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literature that the amount of advancement has a direct relationship with postoperative changes. The results of this meta-analysis support the hypothesis that there is no statistically significant difference in skeletal stability between bicortical screw and monocortical plate fixation of the BSSO following mandibular advancement surgery.

Keywords: BSSO; bicortical screw; plate fixation; mandibular advancement; meta-analysis; relapse; skeletal stability; evidence-based medicine.

Accepted for publication 27 April 2016
Available online 13 May 2016

The bilateral sagittal split ramus osteotomy (BSSO) is one of the most useful mandibular orthognathic surgeries. Among the many fixation methods commonly used to stabilize the BSSO, bicortical titanium screws and monocortical miniplate/screw fixation are the most common.

In spite of the extensive use of the BSSO, there is still controversy regarding the best method of fixation. Several clinical studies have found the two methods of fixation (bicortical screws and monocortical miniplates) not to differ significantly from each other when comparing the amount of advancement with the amount of postsurgical instability, so their use is a matter of surgical choice.[1,2] However, *in vitro* studies have demonstrated that bicortical screw fixation tends to be more rigid and less susceptible to deformation than a monocortical plate.[3–8]

As no evidence-based report has addressed this controversial issue, the present study was performed to test the null hypothesis that there is no difference in postoperative skeletal stability between bicortical screw and monocortical plate fixation after mandibular advancement surgery with BSSO.

Materials and methods

Literature search strategy

In order to ensure a systematic approach and more reliable findings, this systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement for reporting systematic reviews.[9] Studies aimed at assessing the stability of bicortical screw fixation vs. plate fixation with BSSO, published from inception to October 2015, were sought using three electronic databases: PubMed, Cochrane CENTRAL, and EMBASE. Other sources were searched manually, including the reference lists of the studies included and five journals highly likely to contain studies relevant to the review topic: *Journal of Oral and Maxillofacial Surgery*, *International Journal of Oral and Maxillofacial Surgery*, *British Journal of Oral and Maxillofacial Surgery*, *Oral Surgery*, *Oral Medicine*, *Oral Pathology*, *Oral Radiology*, and *Journal of Cranio-Maxillo-Facial Surgery*. The searches were limited to articles published in the English language. An attempt was made to identify unpublished material and to contact authors of published studies for further information. To complete the search, the references of each selected publication that compared skeletal stability after BSSO using either bicortical screws or monocortical plates were searched by hand. The electronic search strategy is shown in Table 1.

Study eligibility and focused question

The inclusion criteria were adapted using the PICOS criteria (Table 2). The focused question was 'Are bicortical screw and plate osteosynthesis techniques equal in providing skeletal stability after mandibular advancement with the bilateral sagittal split osteotomy?'

The exclusion criteria encompassed case reports, technical reports, animal and *in vitro* studies, review papers, uncontrolled clinical studies, studies that did not report the data required to perform a meta-analysis (mean and standard deviation), publications in which the same data were published by the same group of authors, and studies that used BSSO for mandibular setback, because the relapse pattern is different (opposite direction).

Data collection process

The eligibility of all studies retrieved from the databases was assessed carefully. The following data were extracted from the studies included in the final analysis: authors, year of publication, study design, sex distribution (male, female), mean age in years, number of patients in the groups, fixation methods, follow-up period, outcomes assessed, use of intermaxillary fixation, magnitude of the advancement (in millimetres), and amount of relapse at B point (in millimetres).

Table 1. Search strategy for the systematic review.

Search strategy	
Population	(1) MeSH term: Angle class II OR short face deformity OR retrognathic mandible (2) Text word: Angle class II OR short face deformity retrognathic
Intervention	(3) MeSH term: bicortical osteosynthesis OR positioning screws OR lag screws OR rigid fixation (4) Text word: bicortical osteosynthesis OR positioning screws OR lag screws OR rigid fixation
Comparison	(5) MeSH term: monocortical osteosynthesis OR miniplate fixation OR miniplate with monocortical screws at superior-lateral surface OR semi-rigid fixation (5) Text word: monocortical osteosynthesis OR miniplate fixation OR miniplate with monocortical screws at superior-lateral surface OR semi-rigid fixation
Outcomes	(7) MeSH term: skeletal stability OR relapse OR vertical postsurgical changes OR horizontal postsurgical changes
Study design	(8) MeSH term: randomized controlled trials AND controlled clinical trials AND retrospective studies AND case series
Search combination	1 AND 2 AND 3 AND 4 AND 5 AND 6 AND 7 AND 8
Language	English
Electronic database	MEDLINE/PubMed, Cochrane Central Register of Controlled Trials (CENTRAL), EMBASE
Focused question	Are bicortical screw and plate osteosynthesis techniques equal in providing skeletal stability after mandibular advancement with the BSSO?

MeSH, medical subject heading; BSSO, bilateral sagittal split osteotomy.

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