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Stability of bicortical screw versus plate fixation after mandibular setback with the bilateral sagittal split osteotomy: a systematic review and meta-analysis

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Abstract. The purpose of this study was to test the hypothesis that there is no difference in skeletal stability between bicortical screw and miniplate fixation after mandibular setback surgery with the bilateral sagittal split osteotomy (BSSO). A systematic and electronic search of several databases with specific key words, a reference search, and a manual search through September 2014 was performed. The inclusion criteria encompassed clinical human studies, including randomized controlled trials (RCTs), controlled clinical trials (CCTs), and retrospective studies, with the aim of comparing bicortical screw fixation to miniplate fixation after mandibular setback with the BSSO. Changes in both linear (horizontal and vertical) and angular measurements (SNB and mandibular plane) were analyzed. The initial PubMed search identified 317 studies, of which seven met the inclusion criteria—one RCT, four CCTs, and two retrospective studies. Bicortical screw fixation was found to provide slightly better skeletal stability than miniplate fixation after setback with the BSSO, but the difference was not statistically significant. The results of this meta-analysis support the hypothesis that there is no statistically significant difference in skeletal stability between bicortical screw fixation and plate fixation of the BSSO when used for mandibular setback.

Key words: BSSO; bicortical screw; plate fixation; mandibular setback meta-analysis; relapse; skeletal stability.

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The bilateral sagittal split osteotomy (BSSO) is the most commonly performed procedure by oral and maxillofacial surgeons for the correction of mandibular deformities. To gain the required postoperative stability, either bicortical screws or miniplates have been used to join the proximal and distal segments after BSSO. Biomechanical studies have shown that bicortical screw fixation tends to be more stable than a monocortical plate.[1–7] However, several studies employing miniplates with monocortical osteosynthesis after the BSSO have obtained stable results.[8–10] The performance of these two fixation methods remains inconclusive in terms of stability. Thus the purpose of this study was to test the hypothesis that there is no difference in skeletal stability between bicortical screw fixation and miniplate fixation after BSSO when used for mandibular setback.

Materials and methods

Literature search strategy

This systematic review and meta-analysis was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)-Equity 2012 checklist.[11] An electronic search of the PubMed, Ovid MEDLINE, and Cochrane CENTRAL online databases was conducted from their respective dates of inception to December 2014. Free text words and medical subject heading (MeSH) terms were used. The heading was 'bicortical screws', 'monocortical osteosynthesis' and 'bilateral sagittal split osteotomy', 'mandibular setback surgery' in combination with 'skeletal stability'.

The low yield from this search led to the use of another search term omitting the reference to bicortical versus monocortical fixation after bilateral sagittal split ramus osteotomy or BSSO: (mandibular prognathism OR large mandible OR class III/II malocclusion) AND (bicortical osteofixation OR positioning screws OR internal rigid fixation OR lag screws or locking/unlocking plate) AND (skeletal stability OR relapse OR clinical finding OR mandibular plane angle OR B point OR pogonion OR SNB angle) AND (mandibular setback surgery) AND [limit to OR clinical trial OR randomized controlled trial OR retrospective trial)]. The abstracts of articles identified were reviewed and the full text was obtained for those with apparent relevance. The references of identified papers were cross-checked for unidentified articles, and the individual databases of key subject journals were searched using the same terms as above. These journals were the *Journal of Oral and Maxillofacial Surgery*, *International Journal of Oral and Maxillofacial Surgery*, *Journal of Oral Surgery*, and *British Journal of Oral and Maxillofacial Surgery*. The searches were limited to articles published in the English language. An attempt was made to identify unpublished material or to contact authors of published studies for further information. To complete the search, the references of each selected publication on bicortical fixation versus miniplate with monocortical screw fixation after mandibular setback surgery with BSSO were hand-searched.

Study eligibility and focused question

The inclusion criteria were developed using the PICOS guidelines (Table 1). The focused question was 'Are bicortical screw and plate osteosynthesis techniques equal in providing skeletal stability after BSSO following mandibular setback surgery?'

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

Risk of bias in individual studies

A methodological quality rating was performed by combining the proposed criteria of the Meta-analysis of Observational Studies in Epidemiology (MOOSE) statement,[12] the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement,[13] and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement[14] to verify the strength of scientific evidence in clinical decision-making. The classification of the risk of bias potential for each study was based on the following five criteria: random selection in the population, definition of inclusion and exclusion criteria, report of losses to follow-up, validated measurements, and statistical analysis. A study that included all of these criteria was classified as having a low risk of bias and a study that did not include one of these criteria was classified as having a moderate risk of bias. When two or more criteria were missing, the study was considered to have a high risk of bias.

Synthesis of results

Meta-analyses were to be conducted only if there were studies of similar comparisons, reporting the same outcome measures. For binary outcomes, it was planned

Table 1. PICOS criteria for the systematic review.

Patients or population (P)	All patients had a jaw deformity diagnosed as mandibular prognathism with or without bimaxillary asymmetry and maxillary hypo/hyperplasia, and required a BSSO to perform mandibular setback; age was 15–50 years
Intervention (I)	Bicortical osteosynthesis
Comparator or control group (C)	Monocortical osteosynthesis (miniplate with monocortical screws at the superior-lateral surface)
Outcomes (O)	Postoperative skeletal relapse (linear and angular measurements)
Study design (S)	Clinical human studies including randomized controlled trials, controlled clinical trials, and retrospective studies whose aim was to compare skeletal stability between bicortical and monocortical fixation after BSSO
Focused question	Are bicortical screw and plate osteosynthesis techniques equal in providing skeletal stability after BSSO following mandibular setback surgery?

BSSO, bilateral sagittal split osteotomy.