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Surgery-first/early-orthognathic approach may yield poorer postoperative stability than conventional orthodontics-first approach: a systematic review and meta-analysis

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Objective. There are conflicting views on the postoperative stability of surgery-first and surgery-early approaches in orthognathic surgery. We systematically reviewed the literature to compare the difference in postoperative stability between a surgery-first/early orthognathic approach (SFEA) and a conventional orthodontics-first approach (COA).

Study Design. PubMed, Embase, and Cochrane Library were searched for studies related to the postoperative stability of SFEA. The primary outcome was the horizontal relapse at the pogonion. Weighted mean differences with 95% confidence intervals were pooled using a random-effects model.

Results. We analyzed 12 studies (total of 498 participants). The pooled estimate suggested that the SFEA group manifested less postoperative stability than COA group (weighted mean difference, 1.50; $P < .00001$), with moderate heterogeneity ($I^2 = 53\%$). The result of subgroup analysis yielded no subgroup difference. Sensitivity analysis conducted by omitting one study at a time further validated the robustness of the result.

Conclusions. Based on the meta-analysis, the mandible tends to rotate counterclockwise more in the SFEA group, which indicate a poorer postoperative stability than in the COA group. Patient screening and treatment plans should be reviewed carefully to compensate for possible postoperative relapse when adopting SFEA. (Oral Surg Oral Med Oral Pathol Oral Radiol 2018;■■:■■–■■)

Dentofacial deformities are an array of conditions (congenital or acquired) that result in alteration to the shape of the mouth and face, which can cause facial deformities and dysfunction and have serious social and psychological implications. For severe and complex deformities, orthodontic treatment alone would be insufficient to correct the deformity or would otherwise fail to achieve satisfactory results. In those instances, joint orthognathic–orthodontic treatment would be often necessary for patients wishing to obtain an ideal facial profile and for stable occlusion.

In the 1960s, surgeons rarely relied on orthodontic treatment to align and level the dentition before surgery. However, they soon came to realize that the amount of mandibular setback was limited by the magnitude of overjet between the maxillary and mandibular incisors.[1-4] Starting in the 1970s, the conventional orthodontics-first approach (COA) gradually gained popularity to become a widely accepted methodology for orthognathic surgical treatment, with most orthognathic teams implementing the approach.[1,4] COA is, however, a time-consuming and tedious process, including a prolonged period of preoperative orthodontic treatment of 12-24 months.[1-5] The total treatment cycle is even longer, usually more than 2 years, which may be exhaustive for patients.[6-8] In addition, the less than charming prospect of having to wear braces over a period of time while enduring worsened facial deformity and dental function also made it a torture for patients.[5,7]

Recently, the surgery-first/early-orthognathic approach (SFEA), which starts the orthognathic surgery in the beginning of the treatment cycle without preoperative orthodontic preparation or with a minimum preoperative orthodontic treatment of less than 6 months, has become more and more favored by clinicians and patients.[5,6,9,10] Aided by the Skeletal Anchorage System (SAS), which uses titanium miniplates as temporary anchorage devices and enables predictable 3-dimensional movement of the entire dentition in nongrowing patients,[11] SFEA has become a new concept in the combined orthodontic-orthognathic treatment for jaw deformities.[6]

Statement of Clinical Relevance

A surgery-first/early-orthognathic approach may yield poorer postoperative stability than a conventional orthodontics-first approach according to the current evidence. Therefore, patient screening and treatment plans should be reviewed carefully to compensate for possible postoperative relapse when adopting a surgery-first/early-orthognathic approach.

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On the topic of whether occlusal instability and a high degree of orthodontic tooth movement in postoperative orthodontics can cause relapse after surgery, 12 articles included in the present study have collected and summarized relevant evidence. The conclusions appear conflicting and controversial. With collective data and evidence, we have performed a systematic review and meta-analysis of current studies to compare the postoperative stability between SFEA and COA.

MATERIALS AND METHODS

Literature search and selection criteria

This systematic review was organized according to previously recommended guidelines and was written in line with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) checklist.[12] Electronic searches were performed independently by 2 authors (H.P.W. and Z.X.L.) on PubMed, Embase, and Cochrane Database for records reporting the comparison of postoperative stability between SFEA and COA. The detailed PubMed search strategy was as follows: ((("Malocclusion"[Mesh]) OR skeletal malocclusion) OR malocclusion) AND ((((((surgery first) OR surgery early) AND "Orthognathic Surgery"[Mesh])) OR surgery first orthognathic) OR surgery early orthognathic). Two authors independently carried out the initial search, deleted duplicate records, screened the titles and abstracts for relevance, and identified each as excluded or requiring further assessment. Discrepancies were resolved by discussion with a third investigator (X.D.W.). The last search was run on July 23, 2017. A manual search was also carried out using the reference lists of selected articles and previous reviews to identify additional eligible studies.

Studies meeting the following criteria were included: (1) Participants: nongrowing, nonsyndromic patients with a skeletal maxillofacial deformity, (2) intervention: treated with SFEA, (3) comparisons: treated with COA, (4) outcomes: postoperative stability, (5) study design: cohort study (prospective or retrospective). Two authors reviewed all titles and abstracts for relevance independently. If these data were not sufficient, the full text was retrieved so the authors could further determine whether the study was eligible for inclusion. Figure 1 shows the study selection process.

Data extraction and quality assessment

The same two authors independently extracted data from eligible studies, including first author, year of publication, study location, participant characteristics, duration of preoperative orthodontics in SFEA group, type of surgery, method of fixation, and postoperative changes of bony landmarks using a standard form. Extracted data were entered into a standardized (Microsoft) Excel file. The primary outcome was the postoperative horizontal changes of pogonion. Secondary outcomes included postoperative vertical changes of pogonion, postoperative horizontal and vertical changes of point A, postoperative horizontal and vertical changes of point B, postoperative horizontal and vertical changes of point ANS, postoperative horizontal and vertical changes of point PNS, postoperative changes of SNA and SNB. The quality of these observational studies was evaluated using the Newcastle-Ottawa Scale.[13-15]

Statistical analysis

A random-effects model was used for all comparisons regardless of heterogeneity because degree of malformation,

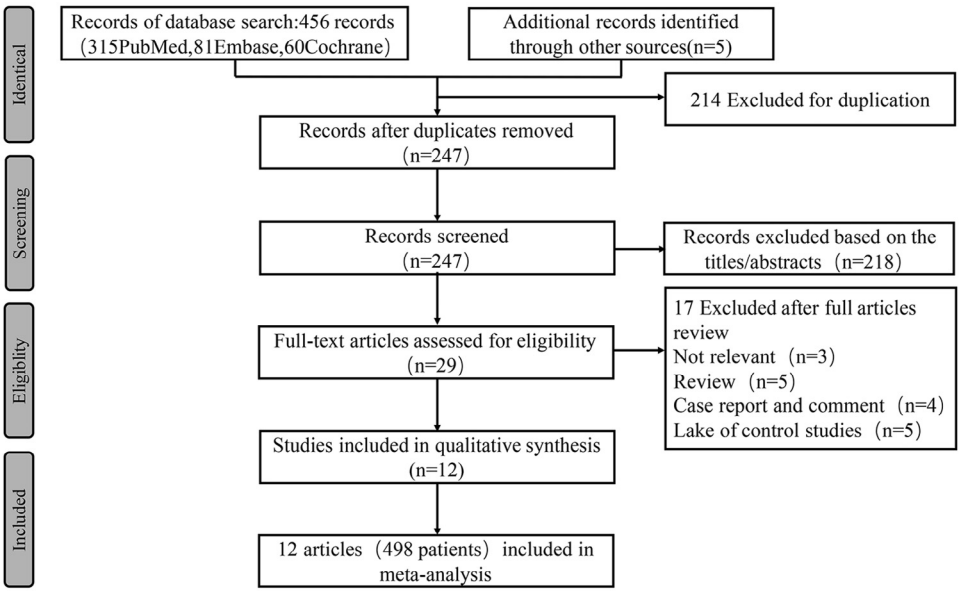

Fig. 1. Flow diagram of the study selection process.

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