Surgery first in orthognathic surgery: A systematic review of the literature

María A. Peiró-Guijarro,[a] Raquel Guijarro-Martínez,[b] and Federico Hernández-Alfaro[c]
Barcelona, Spain

Introduction: Compared to the conventional approach to orthognathic surgery, "surgery first" protocols could be advantageous in terms of shortened treatment times and immediate esthetic improvement. However, consensus regarding patient selection, technical protocol, and stability is still lacking. **Methods:** A systematic review of the scientific literature on surgery-first treatment (January 2000 to January 2015) was performed. The PubMED and Cochrane Library databases were accessed. Patient selection criteria, specific surgical-orthodontic protocol, treatment duration, patient and orthodontist satisfaction, and stability of results were compared with a similar population treated conventionally. **Results:** The search yielded 179 publications. The application of strict selection criteria gave the final group of 11 articles. In total, 295 patients were managed with a surgery-first approach. A Class III malocclusion was the most prevalent underlying malocclusion (84.7%). Total treatment duration was shorter in surgery-first patients than in those treated conventionally. There was substantial heterogeneity among articles and high reporting bias regarding the inclusion and exclusion criteria, the orthodontic and surgical protocols, and the stability of results. A meta-analysis of combined data was not possible. **Conclusions:** The surgery-first approach is a new treatment paradigm for the management of dentomaxillofacial deformity. Studies have reported satisfactory outcomes and high acceptance. However, the results should be interpreted with caution because of the wide varieties of study designs and outcome variables, reporting biases, and lack of prospective long-term follow-ups. (Am J Orthod Dentofacial Orthop 2016;149:448-62)

Until recently, the conventional approach to orthognathic surgery involving preoperative orthodontics, followed by surgery and postoperative orthodontics, was the sole recognized approach to orthognathic surgery. The first orthognathic surgeons realized that the amount of mandibular setback was limited by the magnitude of overjet between the maxillary and mandibular incisors.[1] Consequently, the "orthodontics-first" concept became a widely acknowledged dogma.[2] It emphasized that optimal surgical repositioning of the jaw was possible only after the removal of all dental compensations before surgery. Over the years, acceptable levels of stability and satisfaction with posttreatment outcomes have validated this approach.[3]

In 1959, Skaggs[4] raised the issue of surgical timing in relation to orthodontic treatment and suggested that surgery should precede orthodontic treatment if a satisfactory interarch relationship can be reached surgically. This is, to our knowledge, the first documented reference to what is currently known as "surgery first." Behrman and Behrman[5] hypothesized that when the jaw position is corrected, the normalized surrounding soft tissues—lips, cheeks, and tongue—facilitate postoperative tooth movement and reduce the length of orthodontic treatment. They illustrated this concept metaphorically with their suggestion to "build the house and then move the furniture." Brachvogel et al[6] defined further potential advantages of this surgery-first approach, suggesting that dental arch alignment after surgery is similar to orthodontic treatment in any Class I case, and that possible postsurgical relapse can be easily addressed with postoperative orthodontics. Whereas the case report by Nagasaka et al[7] in 2009 is often cited as the

[a]Fellow, International University of Catalonia, Barcelona, Spain.
[b]Oral and maxillofacial surgeon, Institute of Maxillofacial Surgery, Teknon Medical Center Barcelona, Barcelona, Spain; assistant professor, Department of Oral and Maxillofacial Surgery, International University of Catalonia, Barcelona, Spain.
[c]Director, Institute of Maxillofacial Surgery, Teknon Medical Center Barcelona, Barcelona, Spain; chairman, Department of Oral and Maxillofacial Surgery, International University of Catalonia, Barcelona, Spain.
All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest, and none were reported.
Address correspondence to: Raquel Guijarro-Martínez, Institute of Maxillofacial Surgery, Teknon Medical Center Barcelona, Vilana, 12. D-185, Barcelona 08022, Spain; e-mail, guijarro.raq@gmail.com.
Submitted, March 2015; revised and accepted, September 2015.
0889-5406/$36.00

http://dx.doi.org/10.1016/j.ajodo.2015.09.022

first clinical application of this approach, an article by Dingman[8] in 1944 reported an "improved" method for correcting mandibular prognathism based on performing surgery before orthodontics.

Subsequent research has demonstrated that compared with the traditional scheme, surgery-first protocols seem to reduce total treatment time and obtain immediate improvement of the facial profile or upper airway constriction. These factors may lead to high patient satisfaction rates from the early stages of treatment and improved cooperation during postoperative orthodontics.[9-11] The observed reduction in total treatment time is related to more efficient postoperative orthodontics.[10-15] It has been suggested that surgery-first patients typically require shorter orthodontic treatment times.[10-14] This observation may be related to partial resolution of dentoalveolar compensation after surgery, leading to less complex orthodontic treatment.[13,16] After the correction of the skeletal base discrepancy, the direction of postsurgical treatment coincides with the natural direction of spontaneous dental compensation and muscular force, thereby decreasing the time to full compensation.[11,15] Moreover, orthodontic tooth movement may be facilitated by the surgically induced regional acceleratory phenomenon.[9-11,16] This metabolic process is a complex physiologic phenomenon involving accelerated bone turnover and decreased regional mineral density.[16]

The proposed benefits of surgery first have led to a growing acceptance in surgical and orthodontic communities toward these protocols. Nevertheless, there is currently no consensus regarding surgical protocols, specific complications or limitations of this treatment sequence, and stability of the results. Consequently, the aims of this systematic review were to analyze current protocols and results of patients treated with surgery first and to compare the outcomes with those obtained from a conventional approach.

MATERIAL AND METHODS

The PICOS (participants, intervention, comparisons, outcomes, and study design) criteria focused on nongrowing, nonsyndromic patients with a skeletal maxillofacial deformity treated with a surgery-first approach and a similar population treated with the conventional orthognathic approach. Outcomes assessed included treatment duration, patient satisfaction, orthodontist satisfaction, and stability. Regarding the study design, a level of evidence of at least IV was required. In the level III group, case series with a sample size less than 10 were excluded.

An electronic search of PubMed and Cochrane Library databases was performed from January 2000 to January 2015. The search strategy was designed to include 2 aspects: terms related to the surgical procedure of interest (orthognathic surgery) and terms related to the specific approach of interest (surgery first). The following term sequence was used in PubMed: ("surgery first") AND ("orthognathic surgery") OR ("surgery first") AND ("orthodontics" [MeSH]). No preliminary exclusion of articles based on language of publication was applied. The electronic search was augmented with manual searches of the reference lists of the selected publications.

This search strategy was undertaken independently by 2 investigators (M.A.P-G., R.G-M.). All titles obtained by the electronic searches were screened. When the title did not contain enough information for exclusion, the article was selected for abstract evaluation. Subsequently, the abstracts of all potentially relevant articles were reviewed based on the inclusion criteria. Those that apparently fulfilled these criteria and articles whose title and abstract did not contain enough relevant information were obtained in full. The Cohen kappa coefficient was used to measure interrater agreement for title and abstract selection.[17] Full-text articles were analyzed for final inclusion with reasons for rejection noted. In case of a discrepancy between investigators, a consensus decision was made.

The methodologic quality of studies was assessed for a risk of bias independently by the same 2 investigators. Depending on the type of study—randomized or nonrandomized—the use of the Cochrane Collaboration Tool[18] or the Newcastle-Ottawa scale[19] for quality and risk of bias assessment was planned. In case of a discrepancy between the investigators, a consensus decision was made.

RESULTS

The electronic search produced 164 publications in PubMed and 15 in the Cochrane Library (total, 179). After removal of duplicates, 177 potentially relevant titles were assessed. Of these, 29 were selected for further abstract analysis (interrater agreement, $\kappa = 0.89$). Subsequently, 23 articles were retrieved for full-text evaluations. Manual search led to the inclusion of 10 additional articles (Tables I and II).

Application of the inclusion criteria caused the exclusion of 21 articles. One publication was not retrievable.[24] Eleven articles fulfilled the inclusion criteria and were selected for systematic analysis. The PRISMA flow diagram (Fig 1) gives an overview of the selection process. Table I summarizes the sample's demographic