# Combined surgical-orthodontic treatment: How did it evolve and what are the best practices now?


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It has been 50 years since the landmark presentation by Hugo Obwegeser at Walter Reed Army Hospital. At that conference, Professor Obwegeser offered American surgeons techniques to correct facial skeletal deformities with access through intraoral incisions. As important advances in surgical technique and anesthesia evolved for the surgical procedures, a major contribution by American orthodontists in collaboration with surgeons was the creation of a common diagnostic, planning, and treatment scheme for use by both clinician groups in the treatment of dentofacial deformities, the skeletal and dental problems of the most severely affected 5% of the population. This article summarizes what American orthodontists and surgeons have learned in the late 20th and early 21st centuries, and forecasts what might be the future of treatment for patients with dentofacial deformities. (Am J Orthod Dentofacial Orthop 2015;147:S205-15)

Although occasional mandibular surgery to set back the mandible was performed in the first half of the 20th century, modern orthognathic surgery began in the 1950s with the introduction of ramus osteotomy to reposition the tooth-bearing segments of the mandible. The use of a fixed orthodontic appliance for presurgical and postsurgical orthodontics and for stabilization at surgery followed quickly. The key surgical procedures, bilateral sagittal split ramus osteotomy (BSSO) and LeFort I down-fracture, were introduced in the 1960s, instigated by Professor Hugo Obwegeser, who showed American surgeons how to correct facial skeletal deformities through intraoral incisions. Since then, the combined efforts of orthodontists and surgeons have led to steady progress in efficient and predictable treatment outcomes, with the options of 3-dimensional (3D) imaging and computer-assisted surgical planning the most recent advances.

The purpose of this article is to provide an overview of how current surgical-orthodontic treatment evolved, with an emphasis on what has been learned about the controversial aspects of diagnosis and treatment planning, the coordination of orthodontic and surgical treatment, and computer applications for planning surgical procedures and evaluating outcomes. Although any prediction of the future is problematic, based on our collective experience we offer what we see evolving in the decades ahead as treatment for patients with dentofacial deformities.

## ORTHOGNATHIC SURGERY PROCEDURES

Most orthognathic surgery patients now are treated with 1 or both of 2 procedures developed in the late 1950s and 1960s: BSSO of the mandibular ramus[1] and LeFort I osteotomy of the maxilla via down-fracture, refined by American surgeons.[2,3]

The basic technique of BSSO has not changed, but some important modifications have been introduced in recent years. The key element in this surgical procedure is the split within the ramus to obtain good bony apposition of the condylar and body segments after the body segment has been repositioned (Fig 1). The current emphasis is on completing the procedure with minimal

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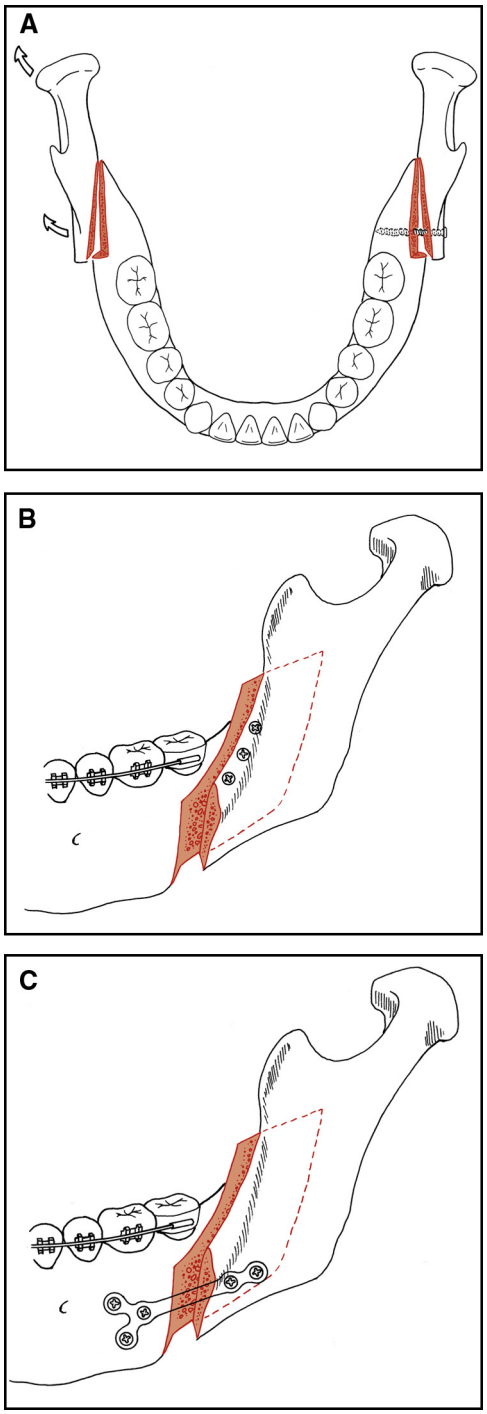


**Fig 1. A,** Diagram of a BSSO showing the possibility of flaring the condyle-ramus segment unless a position screw is used; **B,** pattern of placement for screws; **C,** bone plate fixation across the osteotomy site, particularly useful if an unanticipated split occurs (from Proffit and White,[4] with permission from Elsevier).

trauma to the inferior alveolar nerve. The steps in the surgery and the critical elements are discussed in detail in current texts.[4,5]

As with BSSO, the basic technique of the LeFort I down-fracture remains unchanged, with important modifications through the years. Its critical element is osteotomy cuts that make down-fracture possible, giving access to superior structures so that segmentation of the maxilla and modifications in the nose are possible (Fig 2). This surgery also is described and illustrated in detail in current texts.[4-6] The combination of these surgeries occurs frequently in current orthognathic surgery.

In the later decades of the 20th century, lower border osteotomy of the mandible was added more often to the surgical plan. This procedure allows repositioning of the bony chin in all 3 planes of space (Fig 3). In contrast to BSSO and LeFort I down-fracture, it has not been widely presented in the orthodontic literature.

In patients with true mandibular asymmetry, the chin often is deviated to 1 side more than the dentition is, and repositioning the chin along with a ramus osteotomy to achieve normal occlusion and symmetry often is preferred. The bony chin can be moved backward, but the limitation with backward movement is the relaxation of the soft tissues over the chin. The effect of backward movement can be an unesthetic wrinkling of the skin. Moving the chin forward or up can be achieved by angling the direction of the osteotomy cut upward; moving it down requires a bone graft but is quite feasible.

A lower border osteotomy to move the chin upward and forward is termed a functional genioplasty because it allows normal lip function after correction of excessive chin height and inadequate chin projection. The procedure can be done at any time after the mandibular canines erupt. It is much less invasive than LeFort I or mandibular ramus surgery (Fig 4) and can greatly improve the functional and esthetic outcomes of orthodontic treatment for long-face Class II patients. An important recent finding is that bone remodeling above and behind the chin segment is better when this surgery is done before age 15 years than in older adolescents, and the results are better in older adolescents than in adults.[7] Genioplasty is an underused component of comprehensive orthodontic treatment at present.

With surgically assisted rapid palatal expansion (SARPE), transverse expansion of the maxilla is an important part of current orthodontic therapy. Before age 8 or 9 years, the midpalatal suture can be opened with a relatively light force delivered by a lingual arch