Orthodontic considerations in orthognathic surgery: Who does what, when, where and how?

Jae Hyun Park, Michael Papademetriou, and Yong-Dae Kwon

Surgical orthodontics to correct severe malocclusions and skeletal deformities involves a considerable amount of treatment planning and coordination with a multidisciplinary team. The success of the surgery requires an excellent collaboration between the orthodontist and the surgeon primarily, and secondarily with other specialties that may be involved during the diagnostic, treatment, and posttreatment phases. There is a recent movement into the "surgery-first" approach, which eliminates esthetically undesirable facial changes due to decompensation of the teeth from the presurgical orthodontic preparation. For both the conventional and "surgery-first" approaches, careful and detailed creation of a treatment plan is crucial to produce the most accurate, esthetic, and functional results. Advanced development and application of cone-beam computed tomography with three-dimensional models, craniofacial morphology and growth studies, and virtual orthodontic and surgical treatment planning are changing the traditional way that orthognathic surgery is being performed. This article discusses the interaction between orthodontists and surgeons concerning orthognathic surgical patients to improve communication between both the specialties. (Semin Orthod 2016; 22:2–11.) © *2016 Elsevier Inc. All rights reserved.*

Introduction

Early communication and coordination between the orthodontist and the surgeon to correct severe malocclusions and skeletal deformities are essential to the success of surgical treatment and to ensure patient satisfaction. The patient is the primary member of the team and should be involved in all discussions, noting his or her expectations and concerns.[1] The success of a surgery is directly related to the competency and consistency of the surgical team to achieve predictable, stable, and esthetic results.

Before the 1960s, most orthognathic surgeries were performed either without orthodontic treatment, or before any orthodontic treatment. Later, a three-stage approach to conventional surgical-orthodontic treatment (presurgical orthodontics, surgery, and postsurgical orthodontics) became popular because of stability and satisfaction with posttreatment outcomes. This success was the product of the development of new surgical techniques, orthodontic materials, and rigid fixation. However, longer treatment times and transitional detriment to the facial profile has led to a new approach called "surgery-first," which eliminates the presurgical orthodontic phase.[2] The "surgery-first" approach was first introduced by Nagasaka et al.[3] in 2009. Over time, this approach has gained in popularity among orthodontists and surgeons for several reasons.[4] First, the esthetic concern for the patient is addressed from the beginning.[5,6] Second, the length of the orthodontic treatment, which ultimately affects the total treatment time, is significantly reduced. This is probably related to the regional acceleratory phenomenon (RAP)[5,7–9] and a more efficient skeletal position in which soft tissue imbalances that can interfere with orthodontic movements have been suppressed. Third, when compared to the conventional three-stage surgical-orthodontic approach, a "surgery-first" approach does not seem to impair the final occlusion.[7] However, there has

Arizona School of Dentistry & Oral Health, A.T. Still University, Mesa, AZ; Graduate School of Dentistry, Kyung Hee University, Seoul, South Korea; Department of Oral and Maxillofacial Surgery, School of Dentistry, Kyung Hee University, Seoul, South Korea.

Address correspondence to Jae Hyun Park, DMD, MSD, MS, PhD, Arizona School of Dentistry & Oral Health, A.T. Still University, 5835 East Still Circle, Mesa, AZ 85206. E-mail: JPark@atsu.edu

1073-8746/12/1801-$30.00/0
http://dx.doi.org/10.1053/j.sodo.2015.10.002

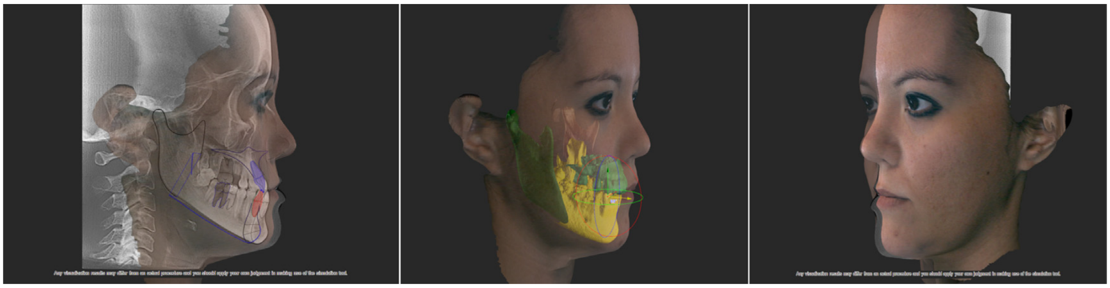

Figure 1. Mandibular surgical simulation movement using Morpheus3D CT software (Seoul, Korea).

been more instability and the outcome has been unpredictable.[8,10] Therefore, in order to reduce the uncertainty of postsurgical occlusion and increase the predictability of the results, the use of minimal presurgical orthodontics has been proposed.[11–13] Joh et al.[13] concluded that after treatment, there was no significant difference in hard and soft tissue measurements between the minimal presurgical orthodontic group and the conventional presurgical orthodontic group, but the total treatment time was significantly shorter in the minimal presurgical orthodontic group due to the shorter presurgical orthodontic treatment time.

Another advancement in jaw surgery is the utilization of three-dimensional (3D) imaging technology such as cone-beam computed tomography (CBCT). The shift from a two-dimensional (2D) to 3D imaging expands the possibilities for better diagnosis, surgical simulation, and surgical splint construction. This virtual planning allows for a more thorough analysis and surgical planning, especially in patients with facial asymmetries.[2] With 3D virtual technology, we have a tremendously helpful tool that allows us to more closely replicate the actual patient (Fig. 1). Incorporating 3D cephalometry is essential, but it is still in the early stages of development. Even though we have the ability to measure the right side and the left side separately, a potentially valuable benefit when treating asymmetries,[14] we still apply it as we do in 2D, by using the average measurements of the two sides.[15] Different software programs are available for 3D planning and fabrication of splints using CAD/CAM (computer-aided design/computer-aided manufacturing) technology.[16] The fabrication of CAD/CAM surgical wafers has introduced a working methodology which is different from conventional clinical practice. Being able to use computer-aided surgical simulation (CASS), a 3D virtual environment for planning and simulating surgery, provides surgeons with the best possible scenario for preoperative treatment planning (Fig. 2).[16] Although CBCT scans significantly reduced the radiation exposure compared with the multi-slice CT scans,[17] there are concerns

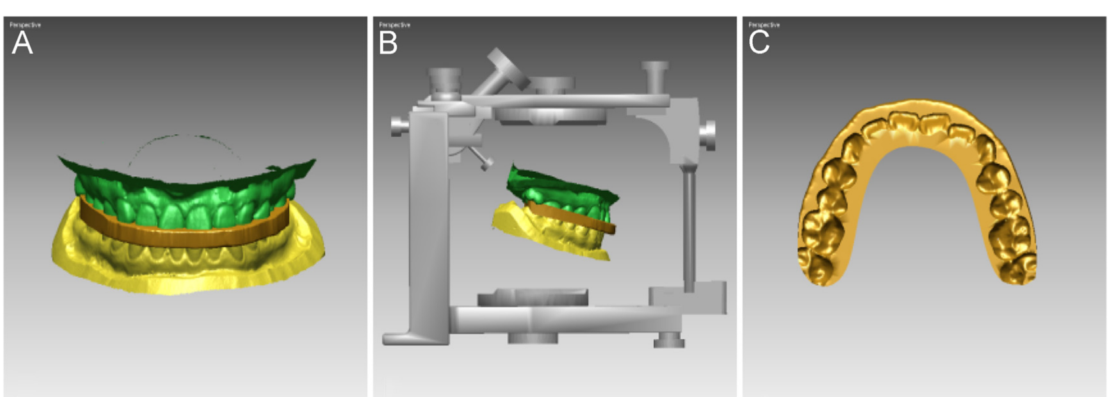

Figure 2. (A and B) 3D virtual models were constructed and mounted into the virtual articulator. They were repositioned according to the STO using the 3D Virtual Model Surgery program (Orapix, Seoul, Korea). (C) A 3D virtual wafer (3D-VIW) was constructed using a stereolithographic technique (Viper2; 3D Systems,Rock Hill, SC).