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Clinical Paper
Orthognathic Surgery

Can a surgery-first orthognathic approach reduce the total treatment time?

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Abstract. Although pre-surgical orthodontic treatment has been accepted as a necessary process for stable orthognathic correction in the traditional orthognathic approach, recent advances in the application of miniscrews and in the pre-surgical simulation of orthodontic management using dental models have shown that it is possible to perform a surgery-first orthognathic approach without pre-surgical orthodontic treatment. This prospective study investigated the surgical outcomes of patients with diagnosed skeletal class III dentofacial deformities who underwent orthognathic surgery between December 2007 and December 2014. Cephalometric landmark data for patients undergoing the surgery-first approach were analyzed in terms of postoperative changes in vertical and horizontal skeletal pattern, dental pattern, and soft tissue profile. Forty-five consecutive Asian patients with skeletal class III dentofacial deformities who underwent surgery-first orthognathic surgery and 52 patients who underwent conventional two-jaw orthognathic surgery were included. The analysis revealed that the total treatment period for the surgery-first approach averaged 14.6 months, compared with 22.0 months for the orthodontics-first approach. Comparisons between the immediate postoperative and preoperative and between the postoperative and immediate postoperative cephalometric data revealed factors that correlated with the total treatment duration. The surgery-first orthognathic approach can dramatically reduce the total treatment time, with no major complications.

Key words: surgery-first orthognathic approach; without pre-surgical orthodontic treatment; orthognathic surgery; class III dentofacial deformity; accelerated orthodontic treatment.

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The traditional orthognathic approach requires pre-surgical orthodontic treatment with an average duration of approximately 17 months,[1] followed by surgery and post-surgical orthodontic treatment for approximately 6–12 months. Therefore, the total treatment time for the conventional orthognathic approach is approximately 18–36 months.[2–4] Because traditional orthognathic surgery requires 2–3 years to complete, it is a rarely adopted procedure. Shortening the total treatment time would be extremely beneficial for patients. It has been mentioned previously by several authors that the pre-surgical orthodontic treatment is the key time-consuming element in the entire orthognathic surgery process.[2,5–7] Furthermore, questions have been raised regarding the necessity of pre-surgical orthodontic treatment for all patients.

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Human teeth naturally adapt to their loco-regional environment. For example, in the case of a class III dentofacial deformity, the lower teeth tend to incline lingually and the upper teeth tend to revert labially to produce a functional occlusion. Most patients with a class III dentofacial deformity can bite with their teeth because of these adaptive mechanisms. As a result, most class III patients before orthognathic surgery display deformed tooth positioning relative to the normal occlusion and location of teeth, as well as a malpositioned maxilla and mandible.[5,8–11] Pre-surgical orthodontic treatment is therefore indicated for this condition, as without it, the postoperative occlusion following orthognathic surgery would be unstable. Thus, pre-surgical orthodontic treatment is thought to be required for the correction of the following issues: dental decompensation, arch alignment, maxilla and mandible arch coordination, and the aggravated curve of Spee.[9,12]

The primary problem is that the direction of pre-surgical orthodontic treatment is opposite to that of natural dental compensation. Therefore, the pre-surgical orthodontic movement for dental decompensation requires time to overcome the natural compensation forces. Although pre-surgical orthodontic treatment has been accepted as a necessary process for stable orthognathic correction before surgery, recent advances in the application of miniscrews and in the pre-surgical simulation of orthodontic management using dental models have shown that it is possible to perform a surgery-first orthognathic approach without pre-surgical orthodontic treatment.[13] In addition, advancements in fixation systems have enabled the bony segments to be fixed in a more stable manner than was possible in the past.

The surgery-first orthognathic approach without pre-surgical orthodontic treatment has been applied at the authors' institution since 2006, and over 150 patients have been treated with this approach to date. Patients who undergo the surgery-first orthognathic approach receive only post-surgical orthodontic treatment.[13] Most patients undergoing this approach have succeeded in achieving a normal occlusion without any major complications.

For the surgery-first approach, there are two possible outcomes regarding the total treatment time: (1) omitting the pre-surgical orthodontic treatment process might lengthen the total treatment duration due to an unstable postoperative occlusion, or (2) it might shorten the treatment duration via a more rapid natural dental adaptation process or a regionally accelerated phenomenon, or by facilitating natural compensation during post-surgical orthodontic treatment. Therefore, various aspects of the surgery-first orthognathic approach, including the total treatment period, were compared to those of the standard orthognathic approach in this study.

The purpose of this study was to compare the total treatment time of the surgery-first orthognathic approach without pre-surgical orthodontic treatment to that of the traditional orthognathic approach, and to analyze factors that correlate with the total treatment duration.

Materials and methods

Study design and patients

This prospective study investigated the surgical outcomes of a surgery-first approach group and a traditional orthodontics-first approach group to address the research purpose. All patients included in the study had a skeletal class III dentofacial deformity and underwent orthognathic surgery between December 2007 and December 2014. They completed all the orthognathic procedures during this interval. As the surgery-first approach concept requires that the skeletal deformity be corrected first, followed by the dental deformity, this study attempted to include all aspects of dentofacial deformity. However, as severe malocclusion might pose a risk to postoperative bone stability, this study selected patients who would obtain the maximum benefit from the surgery-first approach based on the preoperative dental model setup.

Patients in the surgery-first group were chosen after consideration of certain inclusion and exclusion criteria. The indications were based on the pre-surgical simulation of the dental model; the orthodontists predicted the possible outcomes of the surgery-first orthognathic approach using this preoperative simulation model setup. After simulation surgery, only patients who maintained stability without preoperative orthodontics were included. Patients with cleft-related deformities, syndromic patients, patients undergoing orthognathic surgery due to a facial asymmetry or class II deformity, and those with severe open bites were excluded. Overall, contraindications to the surgery-first approach based on the concept of this study were as follows: (1) when functional deformation of the condylar process is highly probable (centric relation–centric occlusion (CR–CO) discrepancy); (2) when a unilateral or bilateral scissor bite may occur postoperatively due to a transverse disharmony in the maxillomandibular molar area preoperatively; (3) when maxillomandibular canine interferences occur due to a severe disharmony between the maxillomandibular horizontal widths; (4) when excessive occlusal interferences that may result in an open bite occur due to the exaggerated eruption of the second molar teeth preoperatively.

Pre-surgical orthodontic treatment was not performed in the surgery-first approach. However, comprehensive simulation surgery using dental models was performed before surgery to create the appropriate occlusal splints (Fig. 1). This pre-surgical procedure with the dental model is the most important step in the surgery-first approach. The surgery-first approach includes pre-surgical simulation on the dental model for dental alignment, incisor decompensation, and arch coordination.[14] The simulation model can also provide a basis for the amount of surgical movement of the maxilla and mandible and the appropriate wafer, and can be used to estimate the extent of post-surgical orthodontic treatment. This pre-surgical procedure represents a critical step, as reported previously.[13]

After surgery, the post-surgical orthodontic treatment was performed by orthodontists. The state of the occlusion was evaluated at every visit. When the orthodontists noted that the final occlusion state had been achieved, the orthodontic treatment was ended.

Surgical and orthognathic treatment

The overall procedure is performed as follows: (1) First, standard model mounting is performed to analyze the state of the occlusion (Fig. 2A). (2) In the model setup, teeth that have adapted to the skeletal discrepancy are simulated and then reorganized into their predicted location, similar to real pre-surgical orthodontic treatment (Fig. 2B); all of the teeth are rearranged via the separation of the teeth from the dental model. (3) Next, a simulation of the actual orthognathic surgery is performed, including maxillary impaction or advancement and mandibular setback processes for class III cases. This will indicate the possible occlusal outcome of the standard approach (Fig. 2C). (4) If the position of the teeth is reverted to the condition before pre-surgical orthodontic treatment, this model will reflect the possible condition following orthognathic surgery without pre-surgical orthodontics (Fig. 2D). (5) Intermediate and final wafers for orthognathic surgery with

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