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Short Communication

Utilizing virtual surgical planning and orthognathic surgery to correct severe facial asymmetry without orthodontic treatment

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Abstract Combining double-jaw surgery and orthodontic treatment to correct dentofacial asymmetry is a standard procedure but time consuming and costly. In order to provide alternative solutions, previewing the possible results with precise virtual surgical planning (VSP) system can help clinicians select patients suited for correcting facial asymmetry surgically without orthodontic treatment. In our experiences, after rigid or semirigid fixation of the maxilla, using intermaxillary fixation (IMF) without mandibular bony fixation is another key. This kind of fixation can minimize the chances of changing the condylar position and occlusion after the rotation of the maxillomandibular complex. If the original occlusion can be maintained, then orthodontic treatment can be avoided. Here we presented two facial asymmetry cases who requested surgical correction and refused orthodontic treatment. With careful pre-operative planning using VSP, double-jaw surgery with maxillary bony fixation and IMF was

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conducted and both patients were satisfied by their aesthetic outcomes. With minimal dental compensation, the long-term results were relatively stable.

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Introduction

In order to achieve ideal occlusion and facial appearance, orthognathic surgery (OgS) combined with orthodontic treatment is a standard protocol for correcting dentofacial asymmetry.^{1–3} However, the entire process can be time consuming and costly. In order to reduce the treatment time and cost, skipping orthodontic treatment and performing orthognathic surgery only can be an alternative option. By rotating the maxillomandibular complex (MMC) clockwise to a pre-planned position with rigid fixation, a better facial profile can be achieved in symmetric patients.⁴ However, when encountering facially asymmetric patients, controlling the condyle position when plating the proximal and distal segments of the mandible is very difficult due to the excess yaw and roll movements. Once the condyle is under too much torque or in an undesirable position during plating, the mandibular position and occlusion will change and orthodontic treatment will become necessary.⁵

Another problem in dealing with these facially asymmetric patients is canting of the upper anterior teeth. The key component to patient satisfaction is creating the ideal balance of facial appearance and teeth axis. Virtual surgical planning (VSP) helps visualize the patient's facial and dental condition simultaneously and enhances the communication between the patient and the surgical team, making surgical correction of facial asymmetry without orthodontic treatment feasible.^{6–8} Here we presented two patients with severe facial asymmetry corrected with OgS without orthodontic treatment. The long-term stability and relapse were also discussed.

Materials and methods

This study was conducted in Wanfang Hospital, Taipei, Taiwan, and was approved by the Institutional Review Board (TMU-JIRB No.: N202103052). Two facially asymmetric patients who refused orthodontic treatment and underwent orthognathic surgery were presented in this report. Their presurgical and follow-up clinical data, photographs, and X-rays were collected for evaluation.

Case 1

A 29-year-old female with facial asymmetry and no underlying diseases came to our outpatient department for OgS consultation. She received camouflage orthodontic treatment at early adolescence because her parents opposed surgery. Although her chewing function was good, she was still eager to correct her facial asymmetry. After explaining

the surgical plans and possible outcome with VSP, she decided not to receive orthodontic treatment again and correct her facial appearance by surgery only. The surgical plan was shown in Fig. 1E. The Le Fort I maxillary osteotomy, bilateral sagittal split ramus osteotomy (BSSRO), genioplasty and tooth 48 extraction were done on 2019/04/10. In order to keep her presurgical occlusion, bony fixations were only implemented on the maxilla and chin. Instead of plating the proximal and distal segments of the mandible, intermaxillary fixation (IMF) with interdental continuous wiring at the premolar and first molar area was done for 8 weeks. The patient withstood the whole procedures well and was satisfied with the result.

Case 2

A 31-year-old male with facial asymmetry but without any underlying diseases, came to our outpatient department for OgS consulting. Both of his sisters had been treated with OgS combined with orthodontic treatment several years ago. He found that orthodontic treatment was too time-consuming and he was looking for the possibility of surgical treatment only. As long as he could have good facial profile and keep the same chewing scheme, he had no complaints with the preexisting crowding of his teeth. Utilizing VSP, he agreed with our surgical plan which was described in Fig. 2F. We arranged the Le Fort I maxillary osteotomy, bilateral intraoral vertical ramus osteotomy (BIVRO), genioplasty and tooth 18 extraction for him on 2014/11/26. After the operation, 8 weeks of IMF for consolidation was arranged.

Results

Facial asymmetry was significantly improved in both patients after orthognathic surgery (Fig. 1A–D, and 2A to D). Posteroanterior cephalometric analysis of case 1 showed the canted occlusal plane had been corrected from 8.1° to –0.7° but relapsed 1.4° clockwise rotation 2 years after the surgery (Fig. 1I). The relapse of the mandible towards the shorter facial side could be seen in intraoral photographs at post-operative 7-weeks follow-up (Fig. 1F), and led to a decrease of the anterior overbite even before the removal of IMF (Fig. 1G). Comparison of the immediate post-operative photograph to that at the 2-year-follow-up showed the midline of the maxillary dental arch also remained stable but overbite increased due to dental compensation. Lateral cephalometric analysis showed maxillary impaction immediately after surgery and the palatal plane relapsed less than 1° after two years. Surprisingly, the occlusal plane was altered due to self-corrective tooth movement without orthodontic force,

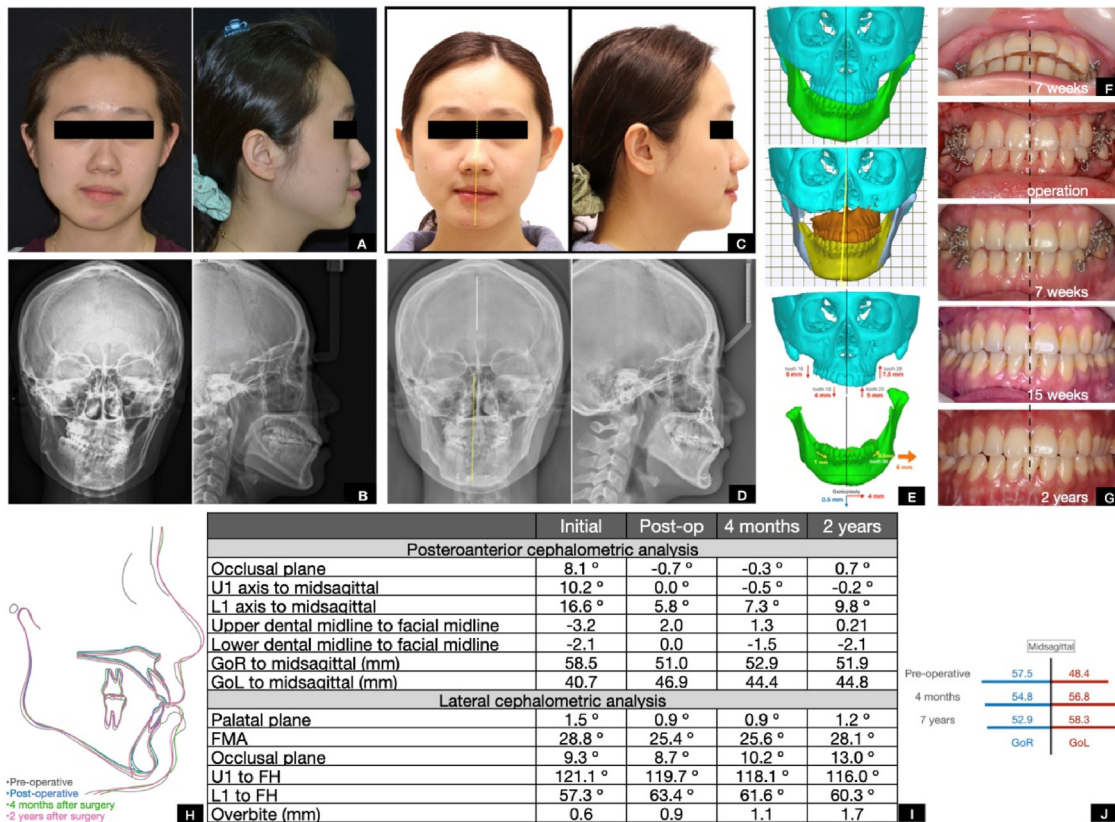


Figure 1 Clinical data of case 1 (A) Preoperative clinical photographs in frontal and lateral view (B) Preoperative posteroanterior and lateral cephalometric radiographs (C) 2-year postoperative clinical photographs in frontal and lateral view (D) 2-year postoperative posteroanterior and lateral cephalometric radiographs (E) The illustration of VSP and surgical plan (F) Increased overjet at 7-week follow-up (G) Frontal view of occlusion in different time (H) Overall superimposition (I) Summaries of the cephalometric analysis (J) Illustration of the symmetric change of the mandible.

including uprighting of the upper incisors, intrusion of maxillary molars, and extrusion of mandibular molars. Further, comparison of the mandibular plane angle showed a clockwise rotational relapse (Fig. 1H and I). Although both skeletal relapse and new dental compensation were noted during the follow-up, the patient could not identify the difference (Fig. 1G and J).

Based on the posteroanterior cephalometric analysis of case 2, the gonion might be the predominant factor affecting facial asymmetry, rather than the canted occlusal plane (Fig. 2A–E). The distance between the bilateral gonions to midsagittal line had a 9.4 mm discrepancy initially, which was then overcorrected to -2 mm through surgery. Further, a 2-mm-shifting to the left side was noted 7 years after the surgical treatment whereas the menton had less than 1-mm shifting, which was unexpected (Fig. 2I and J). The lateral cephalometric analysis (Fig. 2H and I) showed the mandibular plane with a 0.3° clockwise rotational relapse 7 years after surgical treatment, which suggested that the surgery was fairly stable. Mild occlusal alterations included extrusion of the incisors and mandibular molars found during the follow-up (Fig. 2G–I).

Discussion

Combination of the double-jaw surgery and orthodontic treatment with VSP is a standard treatment in correcting facial asymmetry nowadays. In addition, rigid or semirigid fixation of all the osteotomy sites can also provide patients faster healing times and more stable results. Once the bone segments are fixed in the proper place, the transitional malocclusion shows dental imperfections that can then be treated by post-operative orthodontic treatment.^{1–3} OgS with mandibular bony fixation has become a trend and orthodontic treatment is undoubtedly important.

In 2019, Lee et al. first published a case series report and showed that lateral facial profile can be improved by rigid fixation OgS without orthodontic treatment when patients have normal occlusion and symmetrical appearance.⁴ The improvement is quick and significant. In their cases, the MMC movement mainly involves pitch rotation. However, in correcting facial asymmetry, a more aggressive three-dimensional MMC movement is needed, leading to more torque and pressure at the temporomandibular joint. A different degree of condylar sag is also easily seen due to plating the bone segments. All these issues can lead

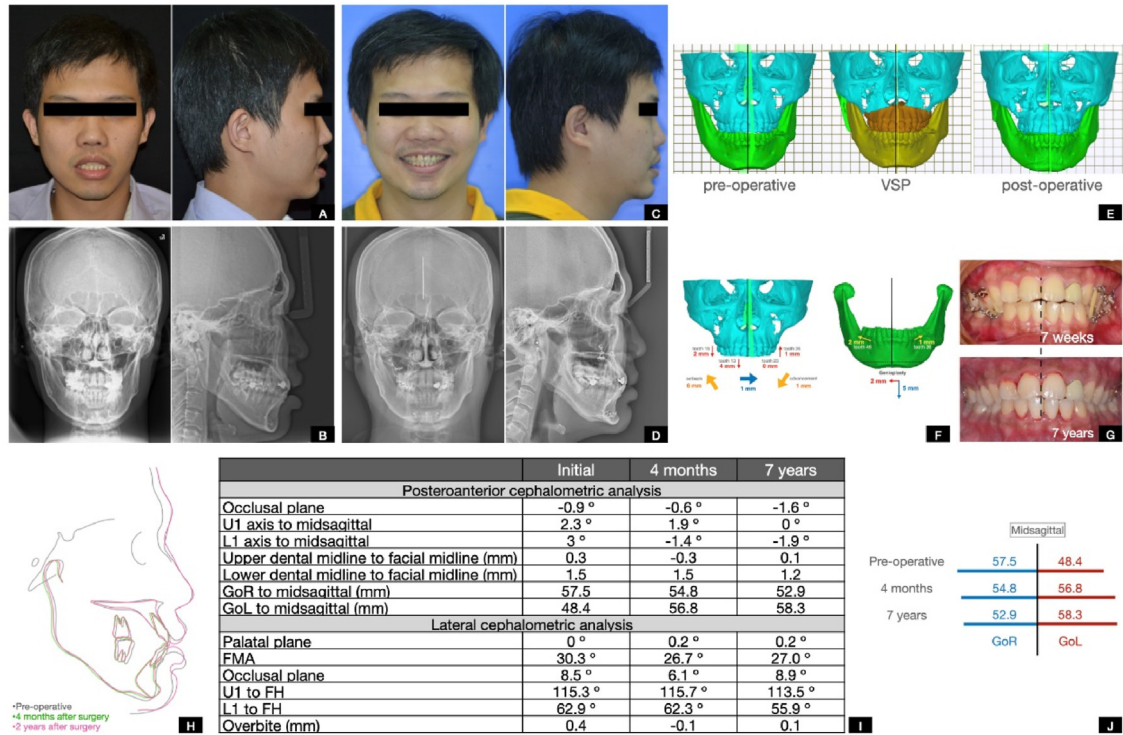


Figure 2 Clinical data of case 2 (A) Preoperative clinical photographs in frontal and lateral view (B) Preoperative posteroanterior and lateral cephalometric radiographs (C) 7-year postoperative clinical photographs in frontal and lateral view (D) 7-year postoperative posteroanterior and lateral cephalometric radiographs (E) The illustration of VSP and three-dimensional reconstruction of the post-operative computed tomography (F) The illustration of surgical plan (G) Frontal occlusal view at 7-week and 7-year postoperative (H) Overall superimposition (I) Summaries of the cephalometric analysis (K) Illustration of the symmetric change of the mandible.

to change of the mandibular position and following occlusal changes once the patient awakes from general anesthesia or is freed of IMF. For correcting the change of occlusion, orthodontic treatment cannot be avoided. On the other hand, if we secure the mandible position by IMF only, the influence of condylar position can be eliminated. When we use IMF without mandibular plating, there is minimal force applied on the condyle head during the healing phase. The approximate original jaw relation and condylar position can be kept then.

The major disadvantage of IMF is the prolonged maxillary immobilized time, while rigid fixation has better bone contact and allows a more rapid healing process. The long-term stability of OgS when only using IMF is a common question from the publics. Yoshioka et al. evaluated stability one year after surgery of bilateral sagittal split ramus osteotomy with semirigid fixation and that of bilateral intra-oral vertical ramus osteotomy with no fixation system, showing no significant difference.⁸ However, they also found more posterior movement after removal of IMF in the non-semirigid fixation group.⁹ This phenomenon was also noted in the cephalometric evaluation of both our cases. In our two cases, regardless of bilateral sagittal split ramus osteotomy or bilateral intra-oral vertical ramus osteotomy, no bony fixation was performed on the

mandible and they underwent mild occlusal alterations without additional orthodontic treatment. The relapse of mandible towards the shorter side could be noted during the healing phase, leading to a decrease of the anterior overbite even when the IMF was still tightly secured. This early relapse may be the cost of not using a mandibular bony fixator. At the long-term follow up, a mild uprighting of the anterior teeth and extrusion of both posterior and anterior dentition were found. Hence, we inferred that postoperative mandibular position and occlusal alterations begin with persistent muscle force during the muscle adaptation process; then, mild extrusion of the posterior dentition; finally, hard and soft tissue balancing causes anterior teeth uprighting and compensation.

In conclusion, for patients with acceptable occlusion but undesirable facial profile, direct orthognathic surgery without perioperative orthodontic treatment can be an alternative approach. With VSP, canting occlusal plane, dental axis, and chin deviation must be considered beforehand to improve facial asymmetry. In order to avoid postoperative malocclusion, patients need longer IMF time. Instability and relapse are noted mostly during the healing phase. In our limited experiences, despite the postoperative changes, the patients obtain a satisfactory correction of facial asymmetry and the result is relatively stable.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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