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Sequencing of bimaxillary surgery in the correction of vertical maxillary excess: retrospective study

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Abstract. The aim of this study was to evaluate the precision of bimaxillary surgery performed to correct vertical maxillary excess, when the procedure is sequenced with mandibular surgery first or maxillary surgery first. Thirty-two patients, divided into two groups, were included in this retrospective study. Group 1 comprised patients who received bimaxillary surgery following the classical sequence with repositioning of the maxilla first. Patients in group 2 received bimaxillary surgery, but the mandible was operated on first. The precision of the maxillomandibular repositioning was determined by comparison of the digital prediction and postoperative tracings superimposed on the cranial base. The data were tabulated and analyzed statistically. In this sample, both surgical sequences provided adequate clinical accuracy. The classical sequence, repositioning the maxilla first, resulted in greater accuracy for A-point and the upper incisor edge vertical position. Repositioning the mandible first allowed greater precision in the vertical position of pogonion. In conclusion, although both surgical sequences may be used, repositioning the mandible first will result in greater imprecision in relation to the predictive tracing than repositioning the maxilla first. The classical sequence resulted in greater accuracy in the vertical position of the maxilla, which is key for aesthetics.

Key words: orthognathic surgery; Le Fort I osteotomy; sagittal split ramus osteotomy; surgical sequence.

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Technological advances have resulted in changes to orthognathic surgery at a speed that could not even have been imagined when the biological basis for such procedures was first established[1]. Biological knowledge resulted in a safe procedure. Following this, treatment was no longer limited to mandibular repositioning. Maxillary osteotomies and bimaxillary surgery then became popular and have since been performed routinely. With the development of new techniques, instruments, and materials for osteosynthesis, surgical repositioning such as counterclockwise rotation of the occlusal plane, which was considered extremely unstable, has become a useful tool for the surgeon[2].

Among the factors associated with the success of orthognathic surgery are correct diagnosis, adequate treatment planning, accurate reproduction of the treatment plan during surgery, and postoperative stability of the results[3,4].

Initially, because osteosynthesis was done with wires, the traditional operative sequence was required when performing bimaxillary surgery. Thus, it was necessary to reposition the maxilla first and then reposition the mandible, as guided by the maxilla, which was held in place with wires. Internal stable fixation using plates and screws made it possible to invert the operative sequence, allowing the mandible to be repositioned first[5]. Although this is considered a fairly recent technique, it was first described in 1978 as a mandibular osteotomy fixated with screws[6].

The sequencing most used for bimaxillary surgery is repositioning of the maxilla first. This is due in part to the fact that most surgeons have been trained using this sequence. However, operating on the mandible first as the treatment choice has increased significantly, especially in the last decade.

Supporters of the classical surgical sequence justify that preference because they think that the maxillary position will be more accurate, especially when vertical repositioning is to be performed. On the other hand, those who prefer to initiate the procedure by repositioning the mandible feel that this allows compensation for errors in condylar positioning. Other specific reasons are used to justify the use of each one of the surgical sequences[7,8].

At this time, the choice concerning the sequence used is largely made according to surgeon preference and the literature on the subject is somewhat scarce. This study evaluated the accuracy of bimaxillary procedures used for the correction of vertical maxillary excess with surgery initiated by mandibular or maxillary repositioning.

Materials and methods

This retrospective study compared the postoperative results of patients submitted to bimaxillary orthognathic surgery that included maxillary superior repositioning as part of the treatment plan. The sample comprised 32 patients from the Oral Face Care Clinics (Santos, SP, Brazil), operated on by the same surgeon during the period from March 2007 to January 2014. All patients signed a consent form for the use of their medical records. The study was approved by the Ethics Committee of Araraquara Dental School, São Paulo State University – UNESP, Brazil.

All patients underwent pre-surgical orthodontic preparation. Radiographic control was obtained at a maximum of 30 days after surgery and included frontal and lateral cephalometric and panoramic radiographs. Orthodontic treatment was resumed after that control.

Inclusion criteria were (1) adult patients, (2) vertical maxillary excess, (3) any type of occlusal pattern, (4) bimaxillary surgery with counterclockwise rotation of the occlusal plane, with or without genioplasty, (5) pre- and postoperative lateral cephalometric radiographs obtained in the same set, and (6) free of any syndrome or craniofacial cleft. Exclusion criteria were (1) history of facial trauma, (2) submitted to temporomandibular joint surgery, (3) previous orthognathic surgery, (4) segmented surgery, (5) facial asymmetry, and (6) incomplete records.

The patients were divided into two groups according to the surgical sequence performed. Group 1 included 16 patients (10 female and six male) with a mean age of 26.96 years (range 18–40 years), who underwent the traditional surgical sequence of repositioning the maxilla first. Group 2 included 16 patients (nine female and seven male) with a mean age of 27.81 years (range 17–51 years). In this group, the surgical sequence was altered and the mandible was repositioned first. For both groups, an external reference was used to reposition the maxilla. This was done with a Kirschner wire positioned at nasion. All patients received stable fixation with four 2.0-mm L- or T-plates in the maxilla and hybrid fixation with one 2.0-mm miniplate associated with a bicortical screw behind the plate in the mandible. No postoperative intermaxillary fixation was used.

The preoperative lateral cephalometric radiograph, obtained in the week prior to the procedure, was digitized using Dolphin software (Dolphin Imaging Management Solutions, Chatsworth, CA, USA). The predictive tracing was then constructed. Model surgery was done using dental models mounted in a semi-adjustable articulator (Arcon Bio-Art, São Carlos, SP, Brazil) and using the Erickson platform (Rocky Mountain Orthodontics, Denver, CO, USA).

The models were mounted in centric relation in the articulator. For each patient, two sets of upper and lower models were mounted. Reference lines were drawn on the models, and the mesiobuccal cusps of the first molars, canine cusps, and incisor edge of the right upper central incisor were marked to allow measurements in the Erickson platform. Model surgery was performed according to the prediction tracing and following the traditional sequence for both groups. Thus, the maxilla was repositioned first and then the mandible was repositioned into the final occlusion. After this, the final splint was made.

For the group of patients who were to receive maxillary surgery first, the second mounted mandibular model, which was intact, was positioned in the articulator and the intermediate splint was constructed. For the group of patients who were to receive mandibular surgery first, the second intact mounted maxillary model was positioned in the articulator and the intermediate splint was made.

The postoperative lateral cephalometric radiograph was obtained after a maximum of 30 days and was also digitized in the same fashion, allowing the postoperative tracing to be constructed. The tracings produced by the software included the frontal and nasal bones, cranial base, ear canal, mandible, maxilla, upper and lower central incisors, upper and lower first molars, orbit, and soft tissue profile.

The cephalometric landmarks considered to verify changes in the position of the maxilla were anterior nasal spine (ANS), posterior nasal spine (PNS), A-point, upper central incisor edge (U1 tip), and upper first molar (6S occlusal). The landmarks used for the mandible were lower central incisor edge (L1 tip), pogonion (Pg), B-point, and lower first molar (6I occlusal)[8]. All landmarks were located by two separate examiners who had previously been calibrated. When discrepancies were greater than 0.5 mm or 0.5°, two new measurements were obtained. The method used the values of the Cartesian coordinates (x horizontal and y vertical) of each point in the predictive and postoperative tracings. The origin was where the Cartesian axes intersected sella (S), represented by the coordinates $x = 0$ and $y = 0$.

To compare the accuracy of the two different surgical sequences, the postoperative tracings were superimposed onto the prediction tracings using the points sella (S) and nasion (N). The vertical and horizontal positions of each point considered were compared to determine whether the treatment planning was accurately reproduced and whether there were differences in the precision obtained by the two different operative sequences. Each point was located twice and measurements were taken in duplicate in order to calculate the method error. Results were tabulated for statistical analysis.