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Original Article

Osteotomy and osteosynthesis in complex segmental genioplasty with double surgical guide

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Abstract: Chin osteotomy is used in esthetic and functional procedure; genioplasty shows different surgical options as lineal osteotomy, curved osteotomy, segmental osteotomy and others for different conditions of the face. This communication shows the use of two surgical guides used in a patient with extremely facial asymmetry; the surgical plan was realized in a stereolithographic biomodel. The first surgical guide was used for osteotomy and the second surgical guide was used for putting the plate, previously bent, and for segmented osteotomy in the planned position on the biomodel; this technique showed adequate adaptation and security in this extremely asymmetric case. The potential use of this surgical guide was discussed.

Keywords: Genioplasty, facial deformity, surgical planning

Introduction

The chin osteotomy has been used to treat different conditions in facial deformities. Its use enables the optimization of cosmetic characteristics and favorably harmonizes facial characteristics such that its indication responds to the individual needs of each patient [1].

Genioplasty has important advantages over other techniques such as the installation of a chin alloplastic implant [2, 3]. Surgical options for the chin osteotomy include the three-dimensional replacement and its use in facial feminization and cosmetic compensations.

Surgical planning of the osteotomy in patients with facial deformities includes two-dimensional and three-dimensional images, computer programs and stereolithographic biomodels [4]. This last one offers the possibility of planning, executing and observing prior to the surgery as well as the preparation of surgical guides [5] and the manipulation and previous bent of osteosynthesis plates that can be used during the surgery.

The following report presents the use of stereolithographic biomodels in the surgical planning of a severe case of facial asymmetry with the use of consecutive surgical guides for the genioplasty and installation of osteosynthesis plates.

Case report

A male patient 18 years of age presented in our University Hospital due to the presence of a severe facial asymmetry caused by an ear infection at the age at 2-year-old with the consequent deformity of the left temporomandibular joint. This caused a deficiency in the growth and development of the left hemifacial area as well as a deficiency in sagittal mandibular and chin growth (**Figure 1**). This was found to be a Class I dental occlusion so there were some limitations to performing all the desired movements in just one phase (**Figure 2**). The initial diagnosis observed a cant of occlusal plane and a severe deviation of the chin to the left approximately 12 mm as well as a retro position of 15 mm (**Figure 1**). TMJ was assessment by clinical analysis showing an open mouth in 43 mm and left/right literalities without limitation; the patient did not present pain in function or another TMJ symptomatology.

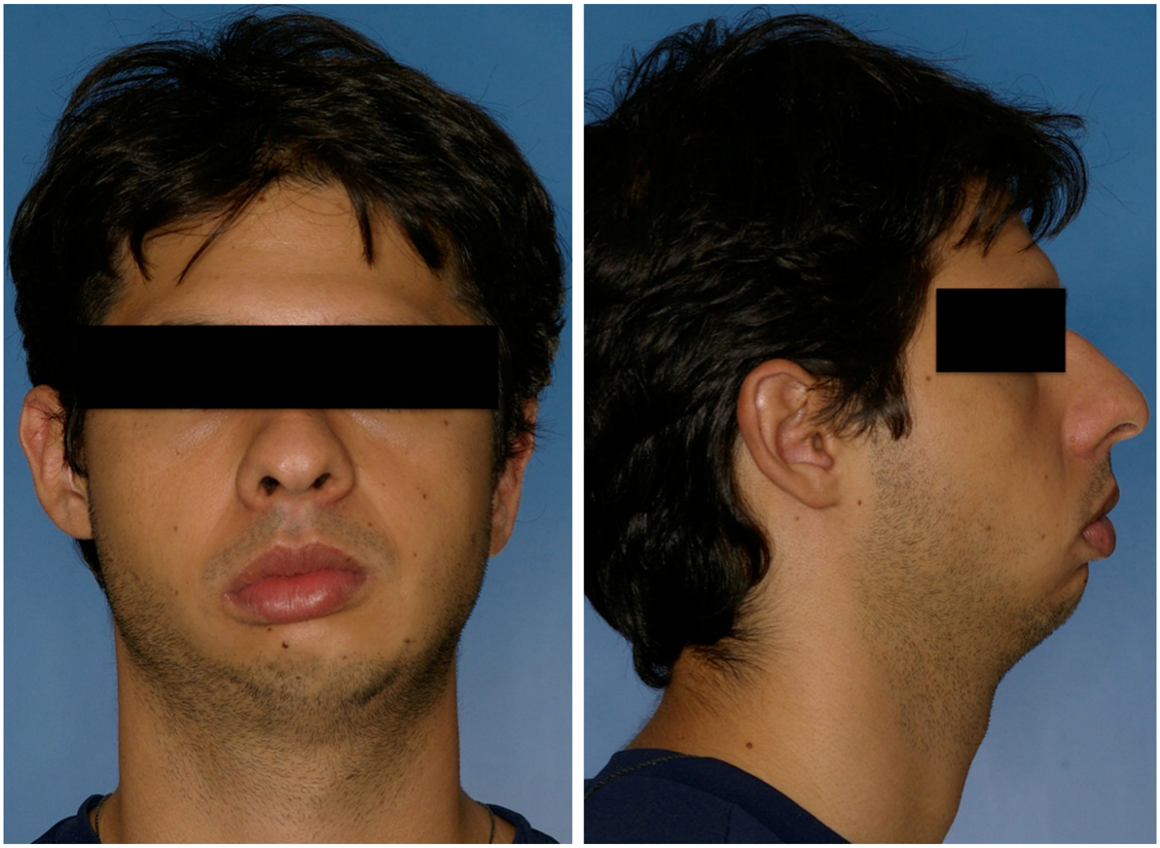

Figure 1. Patient in frontal and lateral view in the initial consultation. Facial asymmetry and antero-posterior deficiency of the chin can be clearly observed; a craniocervical inclination towards the posterior is observed, probably maintaining a higher and more anterior position of the chin and the airway.

Figure 2. Class I stable occlusion after orthodontic treatment.

Bimaxillary orthognathic surgery was planned with a LeFort I osteotomy and bilateral sagittal split osteotomy; the cosmetic and functional results were adequate and the follow-up after 7 months show a better occlusal plan with a diminished occlusal cant; the left mandibular angle was repositioned inferiorly 4 mm in relation to the previous position and the chin was mobilized to the right side in 6 mm approximately (**Figure 3**). At this point the second surgery was planned to obtain a better position of the chin with assessment of clinical, radiography and tomography studies, and the decision was made to mobilized the central point of the chin in 6 mm down position, 5 mm to forward and 6 mm to right; in addition, 5 mm to increase the middle area was planned to optimize the male cosmetic characteristics.

Planning on the stereolithographic biomodel

In this stage, the surgery was planned and performed on a polyurethane stereolithographic biomodel from a CT image in DICOM format according to the conventional techniques. The final planning consisted in the horizontal and vertical chin osteotomy with the creation of two surgical guides in a stereolithographic biomodel as follows:

Step 1: Horizontal cutting guide in transparent acrylic; the cut was planned below the right mental foramen, considerably lower than the contralateral one, making the cut symmetrically and continuously (**Figure 4**).

Figure 3. Patient in frontal and lateral view 7 months after the first bimaxillary orthognatic surgery. A partial recovery of the asymmetry is observed; the chin has a deviation to the left and an antero-posterior deficiency; there is also a craniocervical inclination, but less severe.

Figure 4. Stereolithographic Biomodel of jaw used to create a surgical cutting guide stabilized with 2.0 system 12 mm screw; the horizontal cut is made under the mental foramen of the right sector.

Step 2: Vertical osteotomy on the midline (symphysis) and mobilization of segments to obtain the planned symmetry and desired movements with a better width of the chin. The final position of the segment was made with moldable wax.

Figure 5. Selection and installation of bilateral plates, folded and positioned passively in each segment; monocortical superior and bicortical inferior screws from the 2.0 system are used; plate between the segments is not used because the bone graft will stabilize the position of each chin segment.

Step 3: Manipulation and installation of bend plates in the stereolithographic biomodel and creation of a surgical guide that enabled its

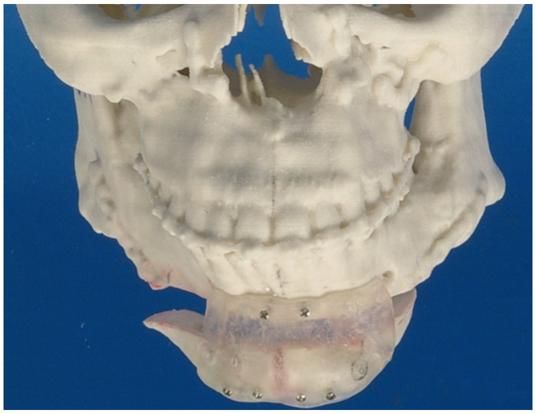

Figure 6. Creation of a guide on the position of plates; once the acrylic resins are stabilized with screws in their upper and lower area the guide and the plates are removed. Then the surgical guide is positioned again and the holes are drilled that enable the insertion of the screws for each plate; finally the position of each plate is painted inside.

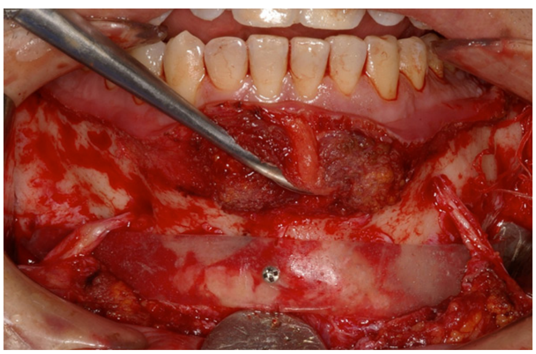

Figure 7. Intraoperative stage where the first stabilized cutting guide is used as planned; the cut is made completely with a reciprocating saw.

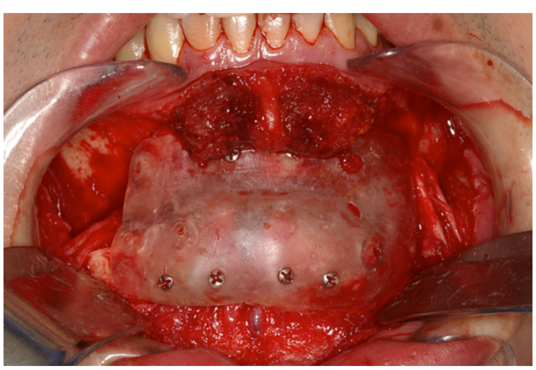

Figure 8. Position of the osteosynthesis guide with fixation in its superior and inferior parts; once the segments are positioned, the holes are drilled for each of the screws where the previously plates will be.

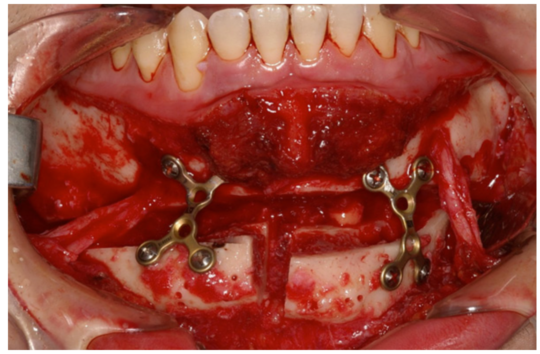

Figure 9. Plates and screws installed according to the previous surgical planning, respecting the exact position and the passivity of the screws.

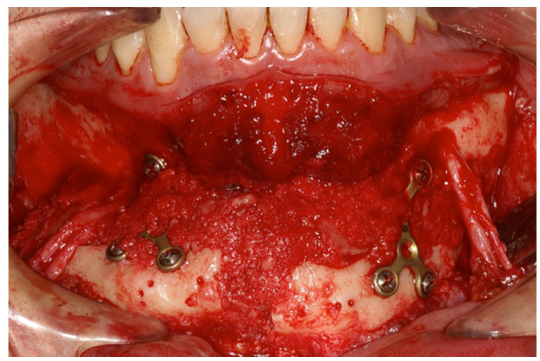

Figure 10. Bone graft harvested from hip used in block between each segment and in particulate form to cover all the defects caused by the osteotomy and osteosynthesis.

position intraoperatively (**Figures 5** and **6**). In this guide was made a position guide of the drill.

Surgical procedure

Under general anesthesia, was used an intraoral surgical approach to completely exposed the bone tissue of the chin. Then the first surgical guide was positioned with a 2.0 system 12 mm screw at the median point (**Figure 7**) to stabilize the guide and to perform the osteotomy with a reciprocating saw. The guide was subsequently removed and the vertical osteotomy was performed on the median line for the mobilization of segments.

Then the two segments were mobilized and the second surgical guide positioned with 2.0 screws in the inferior and superior area (**Figure 8**) to stabilize the mobilized chin. The guide displayed the holes that indicated with precision the insertion point for the screws on each plate.

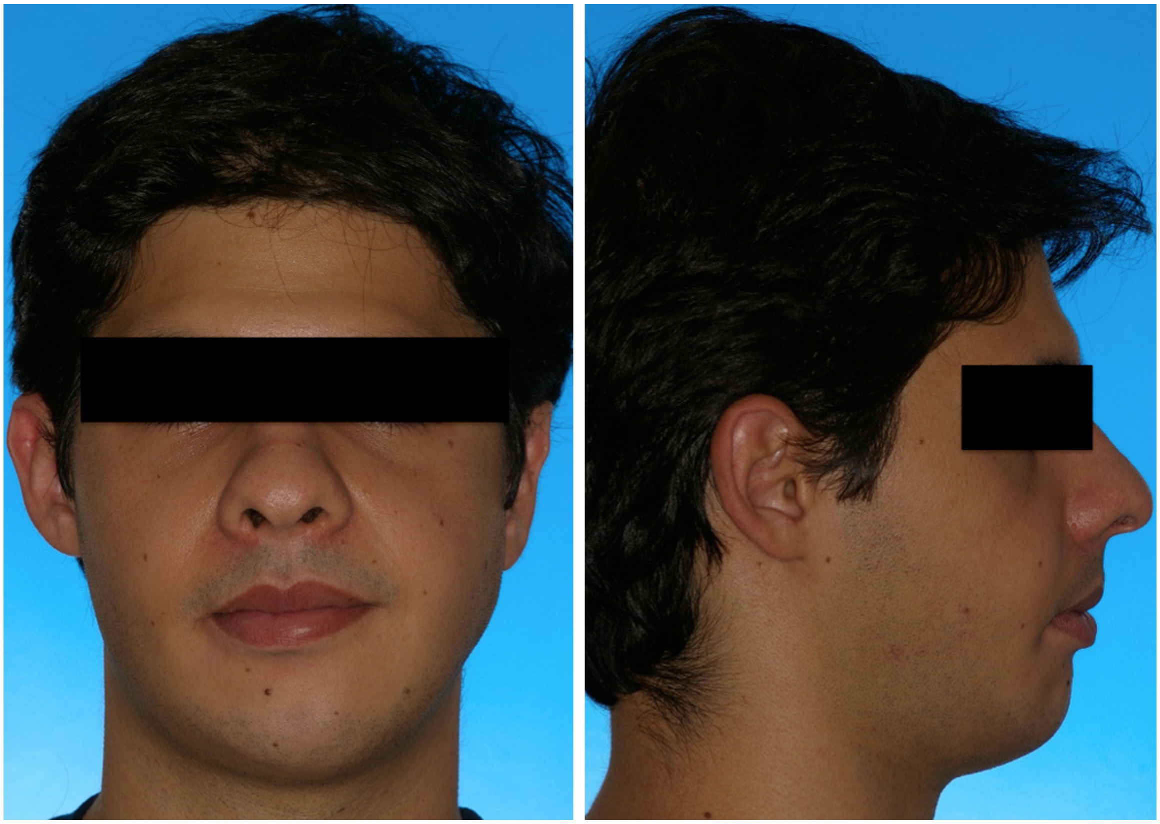

Figure 11. Patient in frontal and lateral view in post-operative stage 6 months after the second surgery. An adequate vertical and sagittal position of the chin as well as a slight residual asymmetry at the level of the mandibular angle is observed. The procedure is stable in the medium term with an adequate craniocervical position.

Figure 12. Lateral radiography showing the stability and the position of the chin, with the bone graft without complication.

Figure 13. Frontal radiography showing the residual skeletal asymmetry; in comparison to soft tissue, residual asymmetry is observed in cases with complex deformities.

The second surgical guide was removed and with the holes already drilled the (previously bend) plates were put in place (**Figure 9**), installing the screws (2.0 system) first in the upper segment (monocortical) and then in each lower segment (bicortical).

The bone graft harvested from the iliac crest was placed in all the created spaces in block form and the remaining spaces were filled with particulate bone of the same origin (**Figure 10**). Suturing was done in the conventional way and compression applied to the skin. After 6 months of follow-up, stability of the surgery was observed and symmetry was achieved in the procedure (**Figure 11**) and radiographic evaluation show stability of the treatment (**Figures 12** and **13**); nevertheless, residual elements of facial asymmetry were observed, which is common in the management of severe facial asymmetries.

Discussion

Different designs of osteotomies have been used in genioplasty: the classic horizontal linear osteotomy [6], curving osteotomy [7], M-shaped osteotomy [8], sagittal split osteotomy [9], transverse reduction segmental osteotomy [10], basilar osteotomy [11], zig-zag osteotomy [12], among others, which indicates the versatility of the surgery.

In addition, the lower reposition of the chin with iliac crest grafts has also shown stability in 1-year follow-up [13]; other materials can be used [14], but the use of autogenous bone ensures stability of movement; for other hand, the stability of the segments and the blood irrigation can maintain the mobilized segments.

Thus, the osteotomy techniques in genioplasty cover both cosmetic needs such as the feminization of the face as well as functional needs such [15] as the optimization of labial competence [16] and the management of patients with sleep apnea [17]. In all these cases, adequate planning is fundamental since the esthetic function given to the chin is greater than other cosmetic procedures of the face [18]. In severe cases of facial deformities the use of software and other elements has been assessed positively in the literature [19], although the manipulation and bend of plates is achieved efficiently through the use of stereolithographic biomodels [5, 19].

Thus, the use of this device in surgical planning has a high predictability, decreasing operating time and increasing precision in the procedure [20]. This paper reports on the use of two consecutive surgical guides for the osteotomy and for segment repositioning, which takes resources from other previously published clinical situations [19], and demonstrates the progressive use of surgical guides through analysis prior to surgery. We can conclude the efficiency of the procedure, the reduction in operating time and its recommendable the implementation as a routine technique in surgical planning in moderate and complex cases.

Disclosure of conflict of interest

None.

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