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M-shaped Genioplasty: New Findings after 10 Years of Experience

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Background: This study aimed to evaluate changes of the M-shaped genioplasty in sagittal and vertical planes in a group of 34 patients and describe other indications, such as the increase of the mentolabial angle, decrease in the depth of the mentolabial fold, and the centering of the chin.
Methods: A retrospective analysis was performed on 34 patients between 2010 and 2019. All studies were conducted at T0 (preoperative), T1 (a month after surgery), and T2 (1 year after surgery). The position of the bone pogonion (Pg) was measured vertically and horizontally at T0, T1, and T2; the mentolabial angle and the depth of the mentolabial fold were measured at T0 and T2.
Results: The average sagittal advancement at T1 was 6.6 mm and at T2 was 6.4 mm. The inferior movement was an average of 5.6 mm at T1 and T2, showing both movements excellent stability. The mentolabial angle increased at T2 an average of 28.2 degrees (5 degrees per each millimeter of inferior movement), whereas the depth of the mentolabial fold decreased an average of 2.8 mm (decreased 49% from the initial depth and decreased 0.56 mm per each mm of inferior movement). The average increase of the lower third of the face was 5 mm. No complications were observed in any patient.
Conclusions: M-shaped genioplasty is an anterior osteotomy of the mandible, which allows the chin to move forward and downward. Additionally, it allows an increase of the mentolabial angle and decreases the mentolabial fold. *(Plast Reconstr Surg Glob Open 2023; 11:e4778; doi: 10.1097/GOX.0000000000004778; Published online 23 January 2023.)*

INTRODUCTION

The chin is a skeletal unit that is a fundamental part of the lower third of the face.[1] Its different morphological and positional alterations are mainly observed in combination, affecting facial harmony and balance, mainly in the context of dentofacial anomalies or craniofacial malformations. In this context, the corrective chin osteotomies (genioplasty) have shown great versatility and stability over time. Initially described in 1940 by Hofer as "anterior osteotomy of the mandible," different designs to correct specific alterations of the chin have been described, for example, sliding genioplasty, which allows the chin to be advanced, leaving it in a balanced anterior position.[2] Cases that require a combined correction in the sagittal and vertical direction at the same time require more detailed planning. That is why, when vertical reduction and sagittal advancement are required, it is possible to design an osteotomy according to the description of Michelet et al.[3] Another alternative for less severe cases is to perform a sliding osteotomy with an ascending inclined plane in a posterior-anterior direction, which allows the chin to be positioned in a more anterior and superior position.[4] For those cases in which there is a vertical and sagittal deficit, the performance of a sliding osteotomy and the placement of a graft between the bone fragments and fixation of the distal segment in a more anterior and inferior position was usually proposed.[5] However, in 2012, Fariña et al[6]

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proposed an M-shaped osteotomy design that allows advances and inferior movements of the chin with a simple design.

This technique allows movements in the three planes of space, avoiding autologous graft, and reducing both complications and morbidity. Other benefits of this technique are improvement of the mentolabial fold and mentolabial angle when they are deep and acute, respectively, because with conventional sliding genioplasty, the mentolabial fold increases, and the mentolabial angle decreases.

This study aims to evaluate the changes produced by M-shaped genioplasty and their impact on the aesthetic and functional results.

Takeaways

Question: This publication shows a long-term follow-up of the M-shaped genioplasty technique, described by the authors in 2012.

Findings: In addition to its initial indication of advance and descent of the chin with a single osteotomy, a positive impact on mentolabial angle and mentolabial fold was observed.

Meaning: A single osteotomy allows the chin to be mobilized forward and downward, as well as improving the aesthetic result of the angle and depth of the mentolabial fold.

MATERIALS AND METHODS

A descriptive, retrospective analysis was performed on 34 patients who underwent M-shaped genioplasty isolated or in association with other osteotomies of the jaws [Lefort I osteotomy (L1) and/or bilateral sagittal split ramus osteotomy (BSSRO)] (Table 1). All those patients were operated on between March 2010 and December 2019, in the maxillofacial surgery service of the Hospital del Salvador and the private practice of Dr. Fariña.

The decision of treatment with M-shaped genioplasty isolated or as part of the uni- or bimaxillary orthognathic surgery was made according to the particular needs of each case, always considering the particular indications of the technique for the mentonian unit.

Through a vestibular approach, the design is drawn on the bone tissue or using a surgical guide, with the planned inclination of the osteotomy. The cut is made bicortically, with a reciprocating saw, with a caudocephalic inclination generating an inclined plane. The distal segment slides toward a lower and anterior position, maintaining bone contact with the proximal segments. Once the chin is positioned, it is fixed with osteosynthesis plates and screws 2.0.

Depending on the magnitude of the desired movement in the vertical and sagittal direction, it can use a trigonometric formula (tangent function^{-1}) or determine the inclination of the plane by repeating the geometric angle from the visual treatment objective to the patient, either in conventional or virtual planning (Figs. 1 and 2).

The indications of M-shaped genioplasty are:

- Lower third of the face decreased (more than 10% of middle third of the face or lower height between lower stomion to menton, compared with distance from subnasale to upper stomion).
- Laterogenia that requires centering descent with or without advance.
- Vertical excess of the maxilla that requires maxillary ascent through L1 osteotomy, which would change the vertical facial proportions.
- Depth of mentolabial fold greater than 6 mm (norm is 4 ± 2 mm).[7]
- Mentolabial angle less than 110 degrees (norm is 122 degrees ± 12 degrees) in patients with microgenia or retrogenia.[8]
- Euryprosopic (79–83.9) or hypereuriprosopic (<78.9) in facial index (Martin and Saller: facial length × 100/facial width).[9]

Table 1. Types of Surgery in the 34 Patients

Type of Surgery	No. Patients	Gender (Male/Female)
L1+BSSRO+ M-shaped genioplasty	11	6/5
L1+ M-shaped genioplasty	6	3/3
BSSRO + M-shaped genioplasty	10	4/6
Isolated M-shaped genioplasty	7	3/4
Total	34	16/18

An analysis of the cases was carried out, using visual treatment objectives, frontal and profile photographs, and cephalometry on a cone beam computed tomography (CBCT). The studies of bone pogonion were conducted at T0 (preoperative), T1 (a month after surgery), and T2 (1 year after surgery). The position of the bone pogonion was measured vertically and horizontally from a line perpendicular to the occlusal plane passing through the incisal edge of the lower central incisor. This measurement was done to eliminate the effects of BSSRO on the vertical and sagittal movement (Fig. 3). The mentolabial angle and mentolabial fold were measured in T0 and T2 (1 year after surgery, to avoid the effects of postoperative edema on soft tissues). The mentolabial angle was measured on the photographs from two imaginary lines that intersect the sublabial point (a line between the lower labial point to the sublabial point and another line between the sublabial point to the soft pogonion)[8] (Fig. 4). The depth of the mentolabial fold was determined by measuring the CBCT, the distance in millimeters from the deepest point of the sulcus to a line designed between the inferior labial point to the soft pogonion (Pg´). The increase of the lower third of the face was measured from the incisal edge of the lower incisor to the soft Me' chin point in the CBCT, perpendicular to the Frankfort plane. This way to measure was done to eliminate the he effects of L1 and BSSRO on the vertical and sagittal movement. This study follows the Declaration of Helsinki on medical protocol and ethics and has been approved by the ethical review board of Hospital del Salvador.

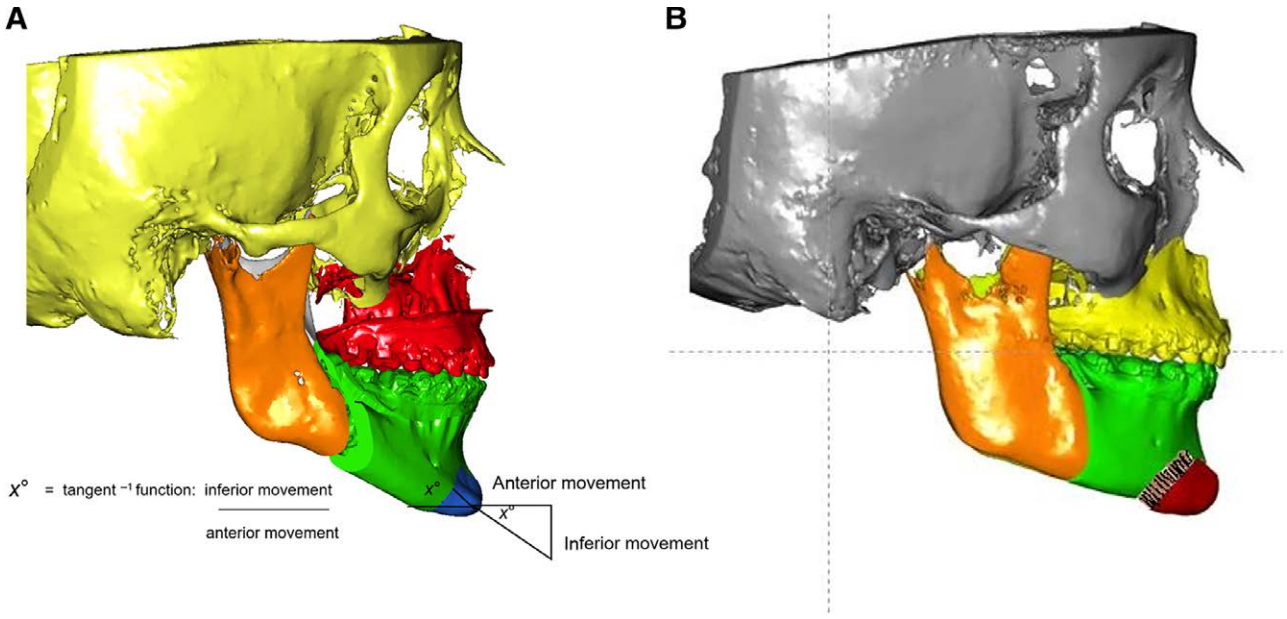

Fig. 1. M-shaped genioplasty. A, Lateral view of virtual planning, forward and downward movement. B, Hatched area: slanted bicel cut.

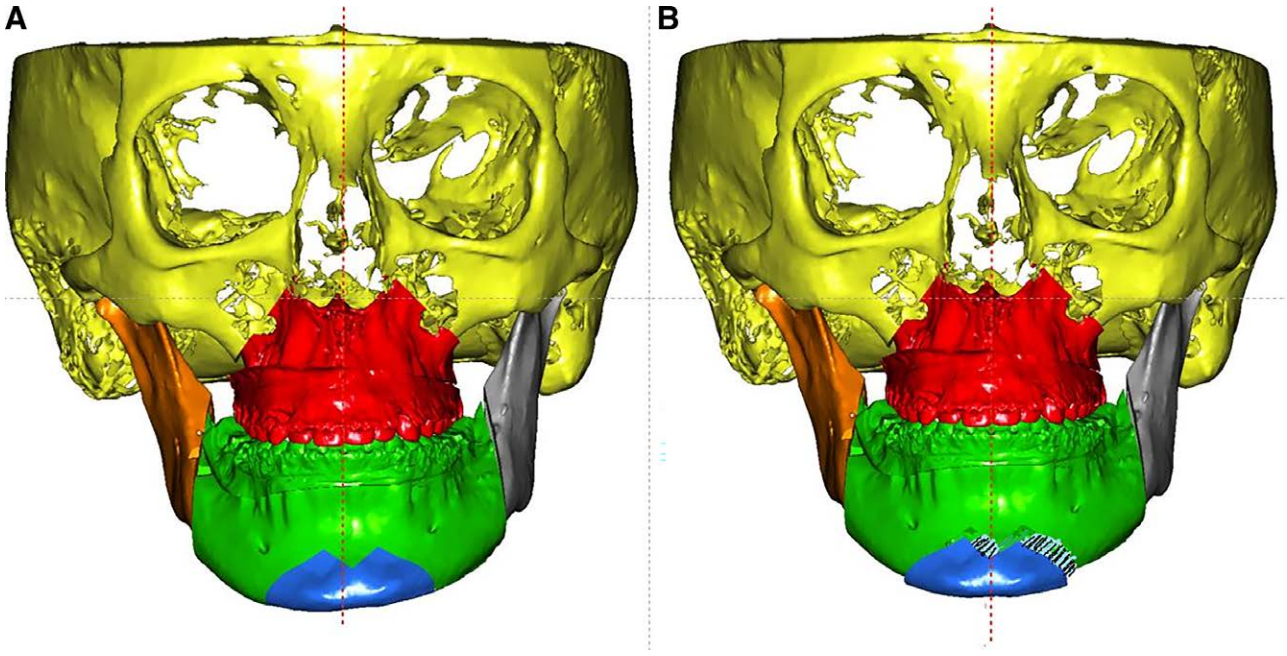

Fig. 2. M-shaped genioplasty. A, Lateral view of virtual planning, forward and downward movement. B, Hatched area: slanted bicel cut.

RESULTS

Thirty-four patients were operated on with M-shaped genioplasty, 11 patients with L1 osteotomy and BSSRO (Figs. 4–7), six patients with L1 osteotomy, 10 patients with BSSRO (Figs. 8 and 9), and seven patients with only M genioplasty (Fig. 10).

The distribution by gender was 18 women and 16 men (Table 1). Average sagittal advancement at T1 was 6.6 mm and at T2 was 6.4 mm, decreasing just 3% in a 1-year follow-up. The inferior movement was an average of 5.6 mm at the level of the bone pogonion at T1 and T2, showing both movements excellent stability. The mentolabial angle increased at T2 by an average of 28.2 degrees (5 degrees per each millimeter of inferior movement), whereas the depth of the mentolabial fold decreased by an average of 2.8 mm (decreased 49% from the initial depth, and decreased 0.56 mm per each 1 mm of inferior movement). The average increase of the lower third of the face was 5 mm (89% of inferior the bone movement) (Table 2). No complications

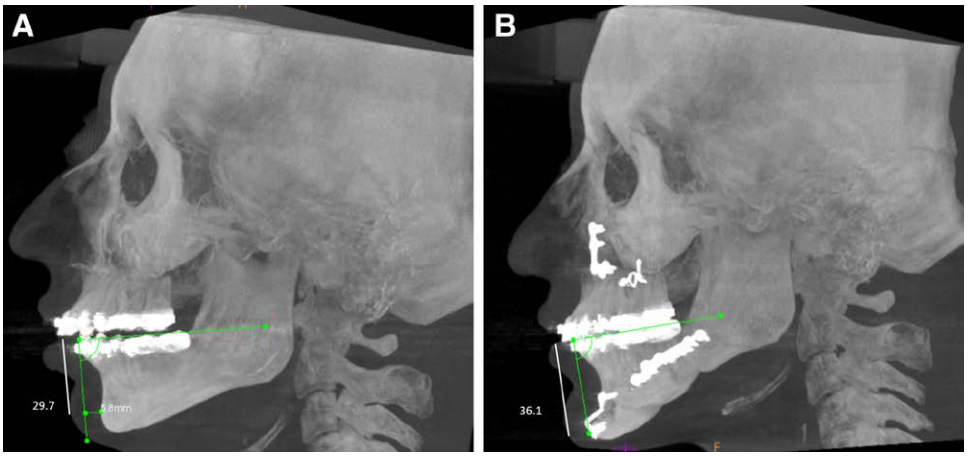

Fig. 3. CBCT before (A) and after (B) (T2) bimaxillary surgery. The position of the bone pogonion was measured vertically and horizontally from a line perpendicular to the occlusal plane passing through the incisal edge of the lower central incisor. This measurement was done to eliminate the effects of BSSRO on the vertical and sagittal movement. B, Before surgery, the Pg height was 29.7 mm and it was 5.8 mm behind the perpendicular line to occlusal plane from the incisal border. After surgery, the Pg height was 36.1, and it was 5.8 mm forward (touching the vertical line from incisal edge).

Fig. 4. Lateral view. Before (A) and after (B) L1 (impaction surgery), BSSRO and M-shaped genioplasty. Note the change in mentolabial angle.

were observed in any patients, and a good stability was observed after a 1-year follow-up.

DISCUSSION

Genioplasty is a mandibular osteotomy that is used to correct structural and spatial anomalies of the chin. Multiple designs have been described that want to correct the underlying skeletal anomaly.[3] Among its multiple design alternatives, Fariña et al[6] described M-shaped genioplasty in 2012, which allows the modification of the position of the chin in the vertical and sagittal plane. It is an easy technique to perform, and it requires precise presurgical planning to determine the inclination of the corresponding inclined plane for each case, to allow the chin movement in the desired direction and magnitude. It reduces the morbidity of another technique describing the same objective (genioplasty with interpositional graft placement) and its complications.

This technique can also change the transversal plane to center the chin, with an inferior and lateral movement

Fig. 5. Frontal view. Before (A) and after (B) L1 (impaction surgery), BSSRO, M-shaped genioplasty and rhinoplasty.

Fig. 6. Lateral view. Before (A) and after (B) L1 osteotomy, BSSRO (counterclockwise movement) and M-shaped genioplasty.

(Fig. 2). At the same time, we have found that it allows to decrease the mentolabial fold and increase the mentolabial angle, optimizing aesthetic results in patients with deep mentolabial fold and acute mentolabial angle. This occurs because, when the bony chin moves down, the mentalis soft tissues are pulled, mobilizing them caudally. This is an advantage in patients with a small chin and deep mentolabial fold, who require genioplasty of advancement (Fig. 3). Reddy et al[10] demonstrated that conventional advancement genioplasty causes an average of 1.14 mm increase in the depth of the mentolabial fold.

A limitation of this study is that we did not measure patient-related outcomes, so future research should include this information to know the impact of genioplasty on postoperative outcomes directly from patients. Moreover, a widely used PROM is the Oral Health-Related

Fig. 7. Frontal view. Before (A) and after (B) L1 osteotomy, BSSRO (counterclockwise movement) and M-shaped genioplasty.

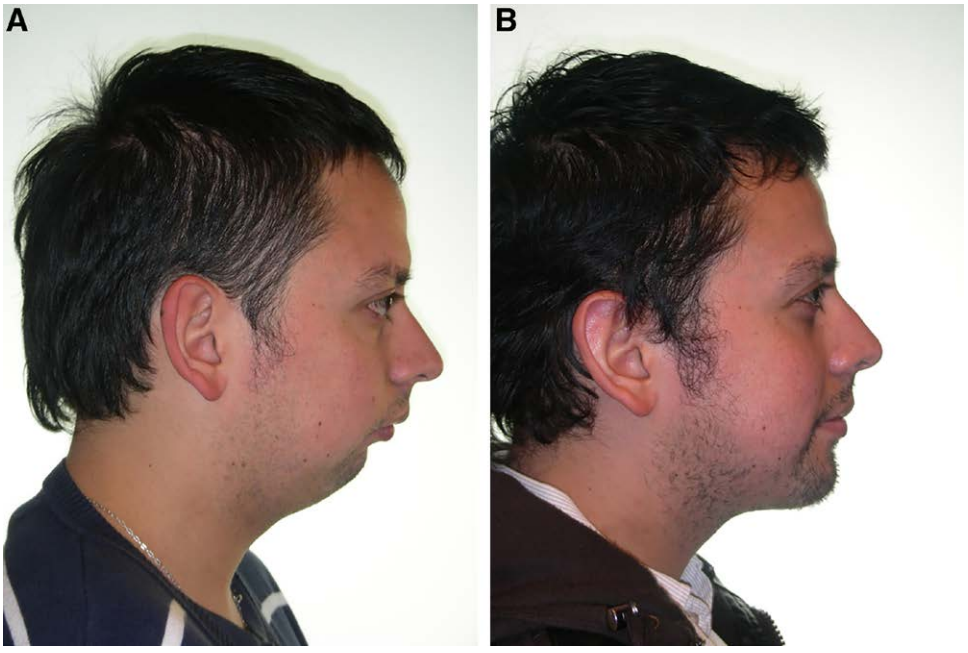

Fig. 8. Lateral view. Before (A) and after (B) BSSRO, M-shaped genioplasty, and otoplasty.

Quality of Life (OHRQoL), which refers to the impact of oral conditions on at least three dimensions of quality of life, including physical, emotional, and social well-being. Also, OHRQoL could be measured by generic or disease-specific instruments. In this way, Disease-specific questionnaires may show intervention-related changes more precisely than the generic ones, applicable to all populations. The Orthognathic Quality of Life Questionnaire is the only validated instrument to measure OHRQoL in patients with dentofacial deformities.[11]

In this retrospective descriptive study, the patients included are all those operated on in the time interval described. The two-step method for gender identity collection was not used. Although this method is not widely used in Chile, the lack of this identification could be considered a limitation of the study as it does not fully

Fig. 9. Lateral view. Before (A) and after (B) BSSRO, M-shaped genioplasty, and otoplasty.

Fig. 10. Lateral view. Before (A) and after (B) M-shaped genioplasty and rhinoplasty.

Table 2. Average Measurements of the Variables under Study

Patient 34	Anterior Movement Pg (mm) T1/T2	Inferior Movement Pg (mm) T1/T2	Mentolabial Angle: Before/After (T0/T2)	Mentolabial Fold (mm): Before/ After (T0/T2)	Increase of Lower Third Measured from Inferior Incisal Edge to Soft Me (mm) in Vertical Line from Frankfort Plane (T2)
Average	6.6/6.4 (97%)	5.6/5.6	100.4°/126.8° (↑28,2°)	7/ 4.2 (↓2.8)	5

represent the patients and how they identify. Oftentimes, the limiting binary options with the addition of "other" might be considered offensive[12] or inaccurate, which is why the two-step method provides people with validation as well as an option for those who prefer to decline to state. This two-step method is recommended and encouraged

for future research to gather more accurate data on the individuals and provide representation to those who felt neglected.

M-shaped genioplasty is a good alternative for those cases in which it is required to mobilize the chin forward and downward, decrease the mentolabial fold, and increase the mentolabial angle.

CONCLUSIONS

M-shaped genioplasty is an anterior osteotomy of the mandible, which allows the chin to move forward and downward. In addition, it increases the mentolabial angle and decreases the mentolabial fold.

After 10 years of experience, it has proven to be simple, versatile, and stable over time, with low associated morbidity.

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PATIENT CONSENT

Patients provided written consent for the use of their images.

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