

# Captain America Shield Genioplasty

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**Abstract:** The chin represents one of the most important determinants of the facial aesthetics. Like many aesthetic parameters, the “ideal” chin has changed in history regarding projection and prominence. From the Renaissance’ retrusive profiles, stronger and more defined mandibular contour are nowadays desired both by masculine and feminine population.

This change in the ideal references plays an important role in diagnosis and treatment planning. Various techniques for chin augmentation have been described, using both alloplastic materials and osteotomies.

An interesting osteotomy variant, so-called chin shield osteotomy, has been described by Triaca et al to avoid a deep mentolabial fold. The authors describe herein the use of a shield plate, very similar in his form to the Captain America’ shield, that can at the same time provide bone fixation and soft tissues sustain in the mentolabial fold region, preventing the invasion of the gap between the bone fragments by the connective tissue, as it happens in a Guided Bone Regeneration procedure.

**Key Words:** Chin genioplasty, osseous genioplasty, sliding genioplasty

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The chin represents one of the most important determinants of the facial aesthetics. Like many aesthetic parameters, the “ideal” chin has changed in history regarding projection and prominence. From the Renaissance’ retrusive profiles, stronger and more defined mandibular contour are nowadays desired both by masculine and feminine population. This change in the ideal references plays an important role in diagnosis and treatment planning.<sup>1</sup> Various techniques for chin augmentation have been described, using both alloplastic materials and osteotomies.<sup>1</sup> The most frequently used osteotomy for the correction of the retruded chin is the horizontal sliding genioplasty, first described by Hofer in 1942.<sup>2</sup> Since then, various modification to the sliding osteotomy have been introduced. Furthermore, different alloplastic materials have been implemented for chin augmentation. Nowadays, the indications for each technique still remain controversial. One of the main critiques to the

sliding osteotomy in the possible deepening of the mentolabial fold that can result quite unesthetic. Normally, the extent of this deformity increases with the amount of the inferior segment advancement and with the dissection of the mentalis muscle when this muscle is not reattached in his position at the end of the surgery.<sup>3</sup> If the deep mentolabial fold will combine with ptosis of the premental soft tissue and with the notching at the posterior margin of the sliding genioplasty osteotomy, then a deformity called “witch’s chin”, as described by Gonzalez-Ulloa<sup>4</sup> in 1972, will develop. Various strategies have been proposed to overcome this problem. Either autologous graft or alloplastic implants have been used.<sup>5,6</sup> An interesting osteotomy variant, so-called chin shield osteotomy, has been described by Triaca et al<sup>7</sup> to avoid a deep mentolabial fold. We describe herein the use of a shield plate, very similar in his form to the Captain America’ shield, that can at the same time provide bone fixation and soft tissues sustain in the mentolabial fold region, preventing the invasion of the gap between the bone fragments by the connective tissue, as it happens in a Guided Bone Regeneration procedure.

## SURGICAL TECHNIQUE

The incision runs horizontally in the lower lip mucosa, 1 cm labial to the sulcus to allow sufficient submucosal tissue for closure. The extent of the incision is from cuspid to cuspid. The dissection is carried out perpendicular to the mucosal incision in order to preserve the mentalis muscle as much as possible. A reference stich on the mentalis muscle is put on both sides before transecting it. After the identification of the ramus labialis of the mental nerve, the incision in continued down to the bone. The periosteum is then elevated to the inferior mandibular border anteriorly and to the mental foramen posteriorly. A reference mark in the midline and two lateral vertical marks are made using the oscillating saw. The osteotomy is performed below the mental foramen and as much as possible posterior to it, on both side of the mandible. The posterior extent of the osteotomy is very useful to reduce the possible gap at the end of the osteotomy and the consequent hourglass esthetic deformity or the appearance of the so-called witch’s chin in frontal view. A reciprocating saw is used to carry the horizontal extended sliding osteotomy. Care is taken to protect lingual periosteum end posterior soft tissues. The chin segment is then advanced and lowered. To secure and fix it we decide to use the plate normally used by neurosurgeons to close the burr holes (Fig. 1A). This plate was like a shield and allowed not only to stabilize the chin fragment but also to prevent the soft tissue to invade the space of the osteotomy gap, like a guided bone regeneration procedure

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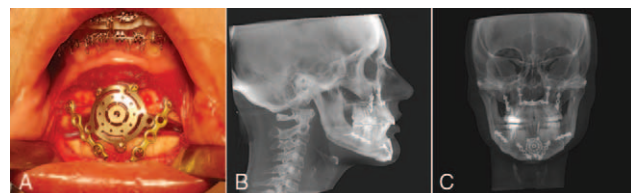
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**FIGURE 1.** (A) Genioplasty with burr hole cover. (B) 1-year post-op Lateral X-Ray. (C) 1-year post-op Frontal X-Ray.

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(Fig. 1B and C). Three or 4 screws are normally used. In all case, we also use 2 additional stronger lateral plates to better stabilize the chin segment. Then, the mentalis muscle is precisely reattached, as suggested by Chaushu et al<sup>3</sup> and eventually the vestibular oral incision is closed with resorbable suture.

## MATERIAL AND METHODS

A retrospective analysis was performed on medical charts of patients who underwent genioplasty from June 2017 to September 2019.

In the considered period, 28 patients underwent genioplasty. Among these, 15 patients underwent bilateral sagittal split osteotomy, whilst the remaining 13 genioplasty only. In 25/28 cases an advancement genioplasty was performed. Among those subjects, we used the shield plate in 11 patients (7 males and 4 females, mean age: 20.4 years). All these last-mentioned patients were affected by chin retrusion and reduced vertical dimension of the inferior lower face.

All patients underwent a preoperative thin cut (0.6 mm) axial Cone Beam Computed Tomographic (CBCT) scan. The data were recorded in a generic Digital Imaging and Communications in Medicine (DICOM) format and transferred to a Dolphin Imaging Software 12.0 a dedicated software for orthognathic Virtual Surgical Planning (VSP). The software reformats the DICOM images into 3D STL file. The scan was oriented by anatomic symmetry landmarks and orthognathic planning was performed.

Patients were photographed from frontal, oblique, basal, and lateral view preoperatively, at 6 months post-operatively, 1 year post-operatively and annually thereafter.

The average follow-up time was 1.2 years ranging from 7 months to 3 years.

The study was undertaken with the understanding and written consent of each participant according to principles of the Declaration of Helsinki.

The outcome variables studied in the group of the 11 patients in whom the shield plate was used were labiomental angle, the depth of labiomental fold and any post-operative complication like asymmetric chin, infection, plate/screw extrusion, paresthesia, relapse or nonunion.

The vitality of lower incisors was tested by electronic pulp tester.

Patients were asked to complete an anonymous in-office questionnaire at 6-months of follow-up. The patients' satisfaction with the final shape of their facial aspect was evaluated by this questionnaire. A 4-point scale was used, with the ratings as follows: 4: excellent; 3: good; 2: fair and 1: poor.

## RESULTS

No post-operative complications like infection, plate or screws extrusion, nonunion and asymmetry of the chin were observed. Only 3 patients referred persistent paresthesia that regressed spontaneously at 3 months follow-up in 2 patients and at 7 months follow-up in the other patient. No change in lower anterior teeth vitality was detected. The mean value of the nasolabial angle was 109.9° (SD: 15.6; range: 88–132) in the group of the 11 patients in whom the shield plate was used. The mean post-operative value was 111.4° (SD: 5.6; range: 103–121). The mean linear depth of the mentolabial fold resulted 6.9 mm (SD: 3.8; range: 2–13) in the preoperative and 5.1 mm (SD: 0.7; range: 4–6).

With regards to patient's satisfaction, 9 patients rated excellent, 2 good and nobody fair or poor.

## DISCUSSION

The genioplasty is a very useful procedure that could have a dramatic effect on the facial aesthetics. Excessive chin

advancement can lead to a marked mentolabial fold. The depth of this fold could be expressed as a linear measure, while a very important factor to express the harmony of this region is the value of the nasolabial angle. This angle could be affected by the mandibular incisor proclination and to the thickness of the inferior lip and the chin pad. All surgical procedure that increases vertically the mentolabial height will augment the value of the mentolabial angle. If surgery reduces the anterior mandibular face height, the effect will be the deepening of the fold and the decrease of the angle. The normal angle, associated with a good facial appearance, is between 107° and 118°. In our patients the mentolabial angle was not so altered in the preoperative measured values because on the one hand it would have been very large because of the chin retrusion, on the other hand this was compensated by the reduced vertical height of the lower face.

Most of the improvement with the alloplastic technique is related to the materials and to different and custom-made shapes of the implants. Patients are generally satisfied with the outcome of both techniques, but some Authors have demonstrated better degree of satisfaction and less complications rate in patients who underwent osteotomies.<sup>1</sup> One of the unesthetic and bothersome changes associated with genioplasty are the notching at the inferior border of the mandible at the lateral end of the sliding osteotomy behind the chin segment, that could accentuate the soft tissue jowls. To avoid this, a prolonged osteotomy behind the mental foramen similar to a chin wing osteotomy could be performed.<sup>9</sup> The other frequent deformity associated with advancement genioplasty is the excessive depth of the mentolabial angle. To prevent this deformity, various materials both alloplastic and autologous have been used putting them in the mentolabial fold region. Non-absorbable silicone implants have been used for many years, but they present many problems such as bone erosion, displacement and infection.<sup>10</sup> Extraoral bone grafts from Iliac crest, cranium, tibia, rib and intraoral grafts from retromolar, ramus and cortical bone of the genial segment in genioplasty have also been used.<sup>5</sup> A visor osteotomy of the anterior mandible with a coronal displacement of the pedicled bone fragment has also been proposed to support mentolabial fold and improve labial competence.<sup>6</sup> Another modification of the classic sliding genioplasty osteotomy is the chin shield osteotomy, proposed by Triaca et al.<sup>7</sup> This technique consists of an advancement of a cephalic anterior mandibular segment along with the chin segment. This osteotomy is not easy to perform, but it could help to avoid a deep mentolabial fold and to improve labial competence.

The shield plate could have a guided bone regeneration effect, based on the same principle of using barrier membranes for maintaining space over a defect, preventing connective tissue from invade the defect, allowing in this way the bone regeneration.

Our technique has the same basic concepts of the chin shield genioplasty, but it is easier to perform and in our hands, it is very effective in the correct definition of the mentolabial angle and mentolabial fold's depth.

## CONCLUSION

The use of the shield plate in advancement and lowering genioplasty is a good option to prevent the deepening of the mentolabial fold and to obtain good aesthetic results.

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