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Original Article

Profile changes after conventional and chin shield genioplasty

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ABSTRACT

Introduction: The aim of this study was to compare the profile changes after conventional and chin shield genioplasty.

Material and method: 20 patients with retruded chin were randomly allocated to two different groups. The experimental group had chin shield osteotomy with interposition of hydroxyapatite collagen graft soaked in platelet rich plasma, while the controls had a conventional genioplasty. The outcome variables evaluated were lip seal, chin thickness, mandibular base length, SNB, labiomental angle, anterior lower facial height, transverse chin shift, and complications.

Results: There was an increase in chin thickness among all, but a significant increase in anterior lower facial height was seen in the experimental group only. There was no statistically significant difference in satisfaction score in both groups.

Conclusion: Chin shield genioplasty provides horizontal as well as vertical lengthening of chin without deepening of the mentolabial fold. Hydroxyapatite collagen bone graft and platelet rich plasma promote healing, induce bone formation and reduce bone resorption.

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1. Introduction

Chin morphology contributes to facial aesthetics by maintaining a balance between the nose, lip, chin, and perioral function. Genioplasty is a versatile procedure and can improve the disharmony of the lower third of the face in a three dimensional plane.¹ Conventional genioplasty involves oblique osteotomy of the symphysis to facilitate horizontal augmentation, thereby decreasing the vertical height and

resulting in deepening of the mentolabial fold. Chin shield osteotomy technique for genioplasty, is a modified technique that allows vertical lengthening as well as horizontal augmentation of the chin, supports mentolabial fold, limits its depth, and improves labial competence.²

Hence, this study was planned with an aim to compare the conventional oblique osteotomy for genioplasty without any bone substitute, and chin shield osteotomy with hydroxyapatite collagen (HA/Col) graft soaked in platelet rich plasma (PRP) and study the profile changes.

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Fig. 1 – Conventional genioplasty.

2. Material and methods

The study comprised 20 patients with retruded chin, 15–35 years of age, who visited our outpatient department of oral and maxillofacial surgery, King George's Medical University, Lucknow for esthetic correction of chin. These patients were randomly allocated to two different groups where genioplasty was performed using conventional osteotomy in Group A (Controls) and chin shield osteotomy with interposition of HA/Col graft soaked in PRP as sandwich graft in Group B (Experimental group). The study was ethically approved by the Institutional research committee. Informed written consent was obtained from all patients before enrollment in study.

Standard intraoral vestibular approach involved a paravestibular incision extending from first premolar on one side to other. The dissection was stepped through the mucosa, submucosa, muscle and periosteum to expose anterior mandible. The mental nerve was exposed bilaterally and

Fig. 2 – Fixation at planned position in conventional genioplasty.

Fig. 3 – Preoperative profile in a case of conventional genioplasty.

retracted. Osteotomy was performed using powered oscillating and reciprocating saw. Three vertical marks were inscribed to avoid transverse deviation and rotation of the inferior segment.

Fig. 4 – Postoperative profile in the same case of conventional genioplasty.

Fig. 5 – Chin shield genioplasty.

2.1. Group A

The osteotomy was started approximately 2 mm below the mental foramen to exit at the inferior border on both the sides. The bony cut was completed through labial and lingual cortices, checked for completion with an osteotome, and the fragment was mobilized inferiorly to split the inferior chin segment. Any irregularity on the lingual cortical plate, when present, was smoothed to allow even and smooth advancement of the fragment (Figs. 1–4).

2.2. Group B

Osteotomy was started 4 mm below the apices of the cuspids, and stepped 4 mm below the level of mental foramina and gradually deepened to exit at the inferior border on both the sides. The bony cut was completed and inferior segment was moved horizontally in planned position. G bone graft, Surgi-wear™ (HA/Col block), soaked in PRP was interposed between the two osteomised segments (Figs. 5–8).

Fig. 6 – Hydroxyapatite Collagen with Platelet Rich Plasma and titanium plate fixation in Chin shield genioplasty.

Fig. 7 – Preoperative profile in a case of Chin shield genioplasty.

2.3. Preparation of PRP

8 ml of blood from a vein was collected in a tube containing 0.5 ml 0.129 mol/L sodium citrate and 0.35 ml calcium chloride. Centrifugation at 5600 rpm for 10 min separated the red blood cell from plasma that contained platelets, clotting

Fig. 8 – Postoperative profile in the same case of Chin shield genioplasty.

Table 1 – Postoperative index of lip seal at different time intervals.

Group A (n = 10)	Preop n (%)	IMP n (%)	3 WK n (%)	6 WK n (%)	12 WK n (%)	24 WK n (%)
INC	6 (60)	4 (40)	3 (30)	1 (10)	1 (10)	1 (10)
CO	4 (40)	6 (60)	7 (70)	9 (90)	9 (90)	9 (90)
Group B (n = 10)	Preop n (%)	IMP n (%)	3 WK n (%)	6 WK n (%)	12 WK n (%)	24 WK n (%)
INC	7 (70)	3 (30)	1 (10)	0 (0)	0 (0)	0 (0)
CO	3 (30)	7 (70)	9 (90)	10 (100)	10 (100)	10 (100)

(n – Total patients; Preop – Preoperative period; IMP – Immediate postoperative period; WK – Week; INC – Incompetent lips; CO – Competent lips) $\chi^2 = 1.75$, $p = 0.78$ (Non significant).
Group A: Control group, Group B: Experimental group.

factors and white blood cells. The upper half, contained plasma with platelets while lower half, other blood cells. The upper half, was again centrifuged at 2400 rpm for 10 min and PRP was collected in lower half. Two ml of PRP was collected for every 8 ml of blood.

After mobilization of the chin to the planned position, miniplates and screws were used to achieve stabilization in both groups. The wound was irrigated and closed in layers. A chin dressing with mild compression was placed for 48 h to prevent hematoma formation. Assessment was done at immediate postoperative, 3, 6, 12, 24 weeks and compared to baseline preoperative. The mean follow up was 2.4 years, which ranged from 2 to 3 years.

3. Results

The outcome variables studied were lip seal, chin thickness, anterior lower facial height, transverse chin shift, mandibular base length, SNB, labiomental angle, and any postoperative complication like asymmetric chin, infection/discharge, plate/screw extrusion, paresthesia, nonunion and relapse. In Group A, 5 cases out of 6 who presented with incompetent lip seal

preoperatively, improved after surgery, and only 1 case persisted with incompetent lip seal. Group B had 7 cases of incompetent lip seal preoperatively which improved in all cases with surgery (Table 1).

Mandibular base length, and SNB angle increased significantly in Group B but there were no change seen in Group A. Labiomental angle was significantly reduced in group B (Table 2). Although chin thickness increased in both groups, anterior lower facial height increased significantly in Group B only (Table 3). There was no significant statistical difference in satisfaction score of both groups (Table 4).

No postoperative complications like asymmetric chin, discharge, plate/screw extrusion, tissue allergy reaction and nonunion were observed in any of the group, except for, paresthesia persistent even at 12 weeks follow up in Group A in 2 cases, but improved at final follow up.

4. Discussion

Horizontal osteotomy of lower border of mandibular symphysis through an intraoral approach was first introduced by Trauner and Obwegeser.¹ Harada and Tarokai³ published a case report on augmentation genioplasty with HA blocks as sandwich or onlay graft. Vertical interposition augmentation genioplasty with porous polyethylene has been reported in literature and compared with conventional osteotomy.^{4–6} Others have successfully performed augmentation genioplasty using autologous iliac crest bone graft.^{7,8}

Other modifications made from time to time include sagittal split genioplasty,⁹ M shaped genioplasty,¹⁰ horizontal flip genioplasty,¹¹ oblique mandibular chin-body osteotomy for correction of broad chin,¹² and transverse reduction genioplasty to reduce width of chin.^{13,14} Triaca et al,² introduced chin shield osteotomy as a new genioplasty technique to avoid a deep mentolabial fold and increase labial competence. It has also been reported that genioplasty performed during puberty promotes spontaneous lip closure^{15–17} as was also seen in both our groups where lip competency was achieved after genioplasty.

Table 2 – Change in SNB, labiomental angle, and mandibular base length in the control and experimental groups.

(n = 10)	SNB angle (°)			Labiomental angle (°)			Mandibular base length (mm)		
	Gp A Mean (SD)	Gp B Mean (SD)	t	Gp A Mean (SD)	Gp B Mean (SD)	t	Gp A Mean (SD)	Gp B Mean (SD)	t
IMP	0 (0)	4.1 (1.59)	8.15*	24.8 (3.36)	4.7 (1.49)	15.36*	0 (0)	4.9 (1.59)	9.75*
3 WK	0 (0)	4.1 (1.59)	8.15*	24.6 (3.27)	4.72 (1.48)	17.51*	0 (0)	4.9 (1.59)	9.75*
6 WK	0 (0)	3.73 (1.54)	8.06*	24.58 (3.25)	4.6 (1.46)	17.54*	0 (0)	4.8 (1.59)	9.54*
12 WK	0 (0)	3.70 (1.49)	7.93*	23.87 (3.27)	4.07 (1.36)	17.72*	0 (0)	4.6 (1.54)	9.45*
24 WK	0 (0)	3.56 (1.49)	7.56*	23.02 (3.56)	4.31 (1.57)	15.21*	0 (0)	4.44 (1.53)	9.09*

(n – Total patients; Preop – Preoperative period; IMP – Immediate postoperative period; WK – Week), * significant. SNB: angle between SN plane and point B (Supramentale), Labiomental angle: angle between chin and lower lip, Mandibular base length: perpendicular from supramentale and j point to mandibular plane Go-Gn).

Group A: Control group, Group B: Experimental group.

Table 3 – Sagittal, Vertical, and transverse changes in chin (n = 10).

	Chin thickness (mm)			Anterior lower facial height (mm)			Bony midline shift (mm)		
	Gp A Mean (SD)	Gp B Mean (SD)	t	Gp A Mean (SD)	Gp B Mean (SD)	t	Gp A Mean (SD)	Gp B Mean (SD)	t
IMP	6.85 (1.73)	7.1 (1.83)	0.32	0 (0)	7.3 (2.11)	10.94*	2.05 (2.01)	3.50 (3.34)	1.16
3 WK	6.3 (1.72)	7.1 (1.83)	1.02	0 (0)	7.3 (2.11)	10.94*	2.0 (2.05)	3.50 (3.39)	1.21
6 WK	6.72 (1.74)	7.01 (1.83)	0.36	0 (0)	7.18 (2.15)	10.56*	1.95 (1.90)	3.45 (3.52)	1.24
12 WK	6.50 (1.85)	6.92 (1.82)	0.15	0 (0)	7.09 (2.10)	10.67*	1.80 (1.84)	3.35 (3.27)	1.26
24 WK	6.25 (1.91)	6.80 (1.83)	0.66	0 (0)	6.73 (2.07)	10.28*	1.75 (1.76)	3.29 (2.23)	1.53

(n – Total patients; IMP – Immediate postoperative period; WK – Week), *significant.
Group A: Control group, Group B: Experimental group.

Table 4 – Changes in hard & soft tissue chin and the satisfaction score (n = 10).

(n = 10)	Change in bony Pg			Change in soft tissue Pg			Satisfaction score		
	Gp A Mean (SD)	Gp B Mean (SD)	't'	Gp A Mean (SD)	Gp B Mean (SD)	't'	Gp A Mean (SD)	Gp B Mean (SD)	t
3 WK	10.35 (1.6)	8.6 (1.20)	2.76*	12.10 (1.96)	11.0 (1.13)	1.53	8.0 (0.82)	9.1 (0.32)	1.30
6 WK	9.90 (2.5)	8.8 (1.35)	1.22	10.90 (1.90)	10.8 (1.04)	0.15	9.1 (1.29)	9.7 (8.2)	1.73
12 WK	9.60 (2.4)	8.60 (1.50)	1.11	9.60 (3.01)	8.60 (1.1)	0.98	10.4 (0.84)	10.9 (0.69)	1.76
24 WK	9.30 (2.35)	8.50 (1.40)	0.90	9.10 (2.40)	8.40 (1.31)	0.81	10.9 (0.57)	11.50 (0.52)	1.66

(n – Total patients; IMP – Immediate postoperative period; WK – Week, Pg – Pogonion), *significant.
Group A: Control group, Group B: Experimental group.

Since the osteotomy cut was made inferior to point B in Group A and superior to point B (supramentale) in Group B, SNB was increased only in Group B. Frapier¹⁷ and Sati¹⁸ too observed augmentation of SNB with advancement genioplasty during puberty.

Labiomental angle between the chin and lower lip, when acute, causes deepening of mentolabial fold but a vertically long chin can have an underdeveloped mental–labial fold. Reduction in labiomentall angle was seen in both groups and correlated with the studies of Rosen,¹⁹ who also reported decrease in labiomentall angle after genioplasty. Reduction in labiomentall angle was comparatively more in group A, suggesting more deepening of labiomentall fold. The reported advantage of chin shield osteotomy of avoiding a deepened labiomentall fold was evident from our study.

Mandibular base length²⁰ (perpendicular from supramentale and j point to mandibular plane Go-Gn) was increased postoperatively only in group B. Anterior lower facial height^{21,22} (from point A onto palatal plane to projection of point B on Go-Gn plane) was also increased only in group B postoperatively.

At 24 postoperative weeks, change in hard tissue Pogonion was 10.5% and soft tissue pogonion, 30% in group A; whereas in group B, change was 3% in hard tissue pogonion and 26% in soft tissue pogonion. Change in hard tissue to soft tissue ratio

in group A was 1: 0.74 comparable to Karras et al,²³ who demonstrated a ratio of 1:0.77.

Change in hard to soft tissue ratio in group B of our study was 1:0.87 because of PRP which is known to have many growth factors like transforming growth factor-beta, insulin-like growth factor, platelet derived growth factor, fibroblast growth factor, vascular endothelial growth factor, bone morphogenic protein, platelet-derived angiogenesis factor, platelet factor 4, type I collagen, osteocalcin, osteonectin, osteopontin that promote healing, bone formation and reduce bone resorption. Polido²⁴ predicted that soft tissues of the chin followed bony movement in a ratio of 1:0.88.

Multiple regression test^{5,23} has been used to analyze the psychological factor in explaining the degree of the satisfaction. Postoperative satisfaction was high and increased with time in both groups. Patients with high education and more severe deformities reported greater satisfaction.

5. Conclusion

Chin shield osteotomy technique for genioplasty is a good option for horizontal as well as vertical lengthening of chin and does not cause deepening of the mentolabial fold.

Conflicts of interest

All authors have none to declare.

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