

## *Correction of gummy smile by superior repositioning of maxilla in Bangladeshi people*

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### ABSTRACT

Vertical maxillary excess is associated with gummy smile, incompetent lip, bimaxillary proclination, Angle's class-I or class-II malocclusion with or without retrogenia. After proper evaluation preoperative orthodontic treatment was performed in every cases and superior repositioning of the maxilla by Le Fort-I osteotomy is presented. Three patients with maxillary excess associated with retrogenia or microgenia were treated with this technique in combination with genioplasty. The maxillary segment was repositioned a maximum of 7.0 mm superiorly at point A. The mandible autorotated anterosuperiorly to achieve sound occlusion. Point B moved 1.0–3.0 mm anteriorly and 5.0–8.0 mm superiorly. The pogonion moved 4.0 mm anteriorly in a case done without genioplasty and the pogonion moved maximum 8.0mm in case done in combination with genioplasty. All patients obtained sound occlusion and a good profile after the operation. Almost no skeletal relapse was observed during 3 years of postoperative follow-up. Amount of gingiva showing during smile was ranges from 5.0mm –7.0mm which was 0-2.0mm after superior repositioning of the maxilla.

**Key words : Maxillary superior repositioning; Lefort-1 Osteotomy; Gummy smile; Maxillary excess**

### INTRUCTION

Gummy smile is caused due to maxillary vertical excess or protrusion, all of the cases we found maxillary skeleton is vertically excess than their soft tissue coverage, so interventions for maxillary vertical excess or protrusion require superior repositioning of maxilla.

Some cases of maxillary excess with retrogenia or microgenia have a nearly normal-sized mandibular dental arch. These patients can theoretically be managed with single-jaw maxillary surgery, i.e., maxillary impaction with mandibular autorotation. However, an extremely precise repositioning technique is needed because even a small error will result in malocclusion and relapse. Standard lefort-I osteotomy was applied for the correction of maxillary excess and postoperative skeletal stability was also evaluated.

The objective of this study was to evaluate the postoperative smile line, facial contoure and postoperative stability of the maxilla treated by lefort –I osteomy.

Orthognathic surgery may be performed by means of 'conventional' treatment, or be complemented with clockwise or counterclockwise MMC rotation. 'Con-ventional' treatment is understood to be that where the cephalometric prediction tracing is able to correct antero-posterior maxillomandibular discrepancies through the pre-existing occlusal plane, and the final occlusal plane is determined by the mandibular occlusal plane after its autorotation, which occurs both clockwise and counterclockwise at a superior-posterior point to the condyle, depending, respectively, on the inferior or superior repositioning of the maxilla. Surgical planning that includes MMC occurs independently of a pre-existing mandibular occlusal plane.<sup>2,3</sup>

In bimaxillary surgery cases, the vertical position of the upper incisors, the antero-posterior position of the maxilla, and the angulation of the occlusal plane are taken into account. These factors dictate the position of the mandible and affect both functional and aesthetic results.<sup>4</sup>

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There must be a correlation between clinical evaluation data (facial analysis) and cephalometric analysis so as to aid in the establishment of a surgical treatment plan. However, these data do not always correlate due to the abnormal orientation of the Frankfort plane, which must be corrected. The normal occlusal plane angular relation must be  $8\pm 4$  degree in relation to the Frankfort plane.<sup>5,6</sup>

Autorotation of the mandible – following either the superior or inferior repositioning of the maxilla where the mandible can be repositioned without surgical manipulation – is one of the most stable long-term procedures in orthognathic surgery. This treatment is recommended for patients with excessive exposure of anterior and superior teeth at rest or smiling, or in large inter-labial distance cases, generating labial incompetence. These patients usually present anterior open bite and Angle's Class II or I, where the superior and anterior repositioning of the maxilla with autorotation of the mandible will keep a Class I occlusion, only interfering in aesthetic improvement.

Complementary genioplasty allows optimization of the aesthetic results and the shape of the chin plays an important role in the surgery decision-making process.<sup>7</sup>

## PATIENTS AND METHODS:

### PATIENT SELECTION

Three Bangladeshi females (mean age 26 years, range 22–30 years) who underwent maxillary single-jaw surgery with genioplasty for the correction of maxillary excess were included in this study. They received pre- and post-surgical orthodontic treatment. All were followed for at least 3 years after surgery.

The patients displayed maxillary excess without asymmetry of the maxilla and mandible. Although they had a nearly normal-sized mandibular dental arch, two of them had retrogenia or microgenia. With the use of cephalometric prediction, all of the patients were predicted an optimal maxilla–mandibular complex position and a good profile through impaction of the maxilla and mandibular autorotation combined with genioplasty. Specifically patients in whom the optimal repositioning of the maxilla would result in point A being consistent with the McNamara line and the cusp tip of upper tooth number 1 (U1) being at the same level or up to 2 mm below the predicted stomion were selected. The chin position was determined by consent between the patient and the orthodontist based on the predicted Ricketts' aesthetic line (E-line). The cephalometric analysis used was mainly Burstone's planning.<sup>8</sup>

Exclusion criteria were previous mandibular surgery other

than genioplasty, periodontal disease judged to be severe by the surgeon, previous maxilla-mandibular surgery, and any history of trauma or craniofacial syndrome.

## SURGICAL PROCEDURE

All surgery was performed by a single surgeon (A.A.Masud). Soft tissue dissection was performed in the standard fashion. The lefort-I osteotomy technique followed was that of Bell et al<sup>9</sup>. Ten minutes before surgery the area of dissection was infiltrated with local anesthetic containing a vasoconstriction (epinephrine in a concentration of 1:100,000). Mucosal incision was given in the maxillary buccal sulcus with a no.15 blade. The incision usually started at the buttress area and then carried forward to the center line. Dissection of buccal periosteum was done from anterior around the tuberosity. Then identify the piriform rim and carefully elevate the nasal periosteum from rim, nasal floor and lateral nasal wall. Vertical and horizontal reference marks are scored on either side at the canine and buttress area using a 701 bar. Osteotomy were performed from the piriform rim to the buttress at least 5 mm superior to the apex of the canine and it always parallel to the occlusal plane. Posterior buccal osteotomy was performed on a plane approximately below 3mm lower than the anterior osteotomy extending from the buttress to the tuberosity. Two horizontal osteotomies are connected by using 701 bar. The pterygoid osteotome is placed between the tuberosity and pterygoid plates while the hamulus was palpated palatally with the index finger then taps the osteotome carefully which was directed medially and downward with the pterygoid osteotome still in position, then we used a thin osteotome to complete the osteotomy of the posterior wall of the maxilla. A lateral nasal osteotome was placed on the piriform rim and directed slightly laterally with protection of nasal mucosa. By using ramus retractor subperiosteally in the midline over the anterior nasal spine rest of the periosteum was dissected from the anterior nasal spine and the septal cartilage separated from the anterior nasal spine. Septal cartilage and vomer were separated from the maxillary bone using a nasal septal osteotome. Down-fracture of the maxilla completed by giving downward pressure on the anterior maxilla. By using maxillary mobilizer securely behind the tuberosity total maxilla was mobilized. Medial side of the lateral nasal wall and buccal aspect of the maxilla were visualized by placing two pterygoid retractor on each side and then refined the osteotomies and all bony interference. The remaining part of the nasal septum was removed from the nasal floor.

After maxillomandibular fixation was performed and the maxillomandibular complex (MMC) seated without any bony interference, two miniplates were adapted to the anterior buttress of the maxilla and the MMC is transitionally fixed with several screws. Maxillomandibular fixation is

then released to ensure accurate repositioning of the maxilla. After releasing the maxillomandibular fixation, the mandible should open smoothly. After confirmation of optimal positioning of the maxilla, maxillomandibular fixation is again performed and completion of the internal fixation is done with an additional two miniplates at the posterior buttress. Maxillomandibular fixation is then released, and proper mandibular positioning was reconfirmed by tapping the jaw. Finally, a conventional genioplasty was performed in two cases.

**METHOD OF ANALYSIS**

Subjects were evaluated 1 week before surgery (T0) and 3 year (T3) postoperatively. Lateral cephalograms were taken with the patient oriented to the Frankfort horizontal plane with the teeth in centric occlusion. Postoperative changes in point A, point B, smile line and the pogonion, were evaluated. Linear measurements are illustrated in Fig. 1. Measurements for the x-axis were obtained using a line parallel to the Frankfort horizontal plane. A perpendicular line intersecting the first line at the sella was defined as the y-axis. These x and y axes were transcribed onto each successive radiograph by superimposition on the best fit of the sella, nasion, and anterior and posterior cranial base landmarks. The relevant points were identified on the x and y axes. Movements of these points were represented as linear measurements in millimetres on both axes. On the x-axis, anterior movement was indicated as a positive value and posterior movement as a negative value. On the y-axis, superior movement was indicated as a positive value and inferior movement as a negative value. Pre- (T0) and postoperative (T3) patient profiles were also evaluated by the distance of the tip of the upper and lower lips to E-line.

**RESULTS**

All patients underwent standard lefort –I osteotomy with or without genioplasty . The postoperative results obtained for patient profile were almost within the normal range (Table 1). Surgeons and orthodontists subjectively judged the postoperative aesthetic condition both frontally and laterally to be good, and all patients expressed satisfaction with their appearance. There were no severe complications such as intraoperative haemorrhage, partial or total avascular necrosis of the maxilla, devitalization of teeth, or oro-antral or oronasal fistulas. No patient or orthodontist identified malocclusion after surgery.

Table 1. Pre and Postoperative profile evaluated with Ricketts’ E-line(millimeters)

Case No.	T0		T3	
	Upper lip to E-line	Lower lip to E-line	Upper lip to E-line	Lower lip to E-line
1	1	3	0	0
2	-1	6	0	2
3	3	6	0	0

Positive results are anterior to E-line; Negative results are posterior to E-line. T0: 1 week before surgery; T3: 3 year postoperative.

Table 2. Pre- and postoperative anteroposterior (x-axis) movements (millimeters)

Case No.	T3-T0		
	A-point	B-point	Pogonion
1	4	3	4
2	2	2	8
3	2	1	7

Positive results are anterior movements; Negative results are posterior movements.T0: 1 week before surgery; T3: 3 year postoperative.

Table 3. Pre- and postoperative inferosuperior (y-axis) movements (millimeters)

Case No.	T3-T0		
	A-point	B-point	Pogonion
1	7	7	5
2	4	8	7
3	5	5	6

Positive results are superior movements; Negative results are inferior movements.T0: 1 week before surgery; T3: 3 year postoperative.

Table 4. Amount of superior repositioning (millimeters)

Case No.	Anterior Segment	Posterior Segment
1	7	5
2	5	4
3	5	4

Anterior segment indicate the segment from anterior nasal spine to zygomatic buttress and posterior segment indicate the segment from zygomatic buttress to the most posterior part of the maxilla.

Table 5. Amount of gingiva showing during smile (millimeters)

Case No.	T0	T3
1	7	2
2	5	0
3	5	0

T0: 1 week before surgery; T3: 3 year postoperative.

Table 6. Facial contour Angle (Degrees)

Case No.	T0	T3
1	-20	-15
2	-27	-15
3	-16	-13

Negative result indicates counterclockwise angle

Tables 2 and 3 show the movements of the relevant points during the follow-up period. During operative procedure of lefort-I osteotomy the amount of superior repositioning of the maxilla were ranges from 5-7mm in anterior segment and 4-5mm in posterior segment(table-4). During smile preoperative gum exposure were ranges from 5-7mm and postoperative gum exposure ranges from 0-2mm(table-5). Depending on the new position of the maxilla, the mandible autorotated anterosuperiorly. Point B moved 1.0-3.0 mm anteriorly and 5.0- 8.0 mm superiorly. The pogonion moved 4.0-8.0 mm anteriorly and 5.0-7.0 mm superiorly. Chin advancement with the genioplasty ranged from 5.0 to 6.0 mm. In every cases facial contour angle was changed into normal (table--6).



Fig.1 (a)smile before orthodontic treatment,(b)smile after orthodontic treatment, (c) smile after superior repositioning of the maxilla

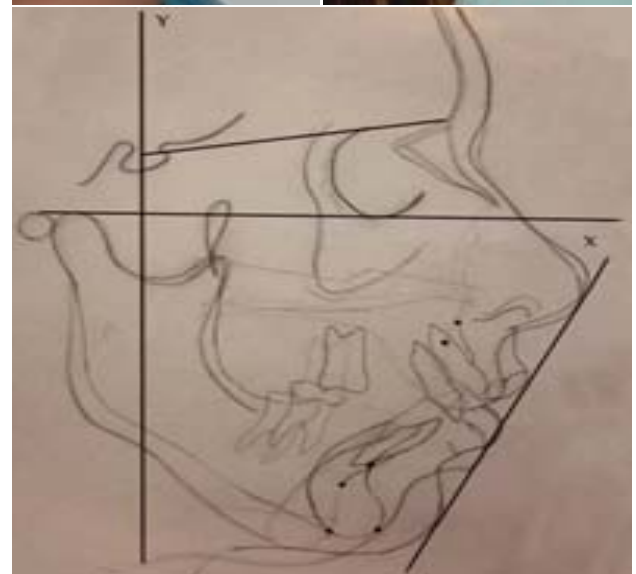


Fig.2 (a)smile after orthodontic treatment, (b) smile after superior repositioning of the maxilla, (c) Preoperative and (d) postoperative profiles of case patient 2. (e) Superimposition of preoperative and postoperative cephalograms. The x-axis follows the Frankfort horizontal plane. The y-axis is perpendicular to the x-axis. The oblique line shows the postoperative Ricketts' E-line. Dot points show point A, point B, pogonion, the cusp tips of upper tooth 1 (U1) and the frontal tips of the upper and lower lips.

## DISCUSSION

Aesthetic and functional results following superior repositioning of the maxilla in orthognathic surgery are related to several factors, such as the type of fixation, surgical technique, direction of surgical procedure and pre and post operative orthodontics.

The maxillary surgical procedure, together with the autorotation of the mandible, corrects labial incompetence and establishes Class I occlusion, reducing mandibular retrognathism. The TMJ function is usually normal in this kind of surgery, without meaningful joint alterations.<sup>5,10</sup>

Superior repositioning of the maxilla decreases the occlusal plane angle, studies have described the restoration of facial harmony, skeletal stability, and occlusal stability in the long-term follow-up when the correct surgical technique and adequate fixation are used. Anatomic alterations include a reduction in the occlusal plane angle and an increase in mentum projection, upper incisor inclination, thus leading to a decrease in the lower incisor inclination.<sup>11</sup>

The use of superior repositioning of the maxilla is increasing, and it has proven to produce better aesthetic/ functional results and a greater stability in the long-term follow-up, mainly due to improvements in surgical techniques and rigid fixation.<sup>5</sup>

Although it is felt that these results were very good in cases of difficult repositioning, the discrepancy in maxillary single-jaw surgery should be zero, with the maxilla perfectly placed on the autorotated mandible. Even a small error in positioning will result in malocclusion and relapse. One of the most important steps in this procedure is reconfirmation of the position of the maxilla before completing rigid fixation. Definition of the correct condylar position under general anaesthesia is very difficult. The position of the maxilla mandibular complex was defined as the posterior-most position of the condyle in the glenoid fossa and this position was confirmed before completion of rigid fixation, releasing maxillomandibular fixation from the fixated position. After the release of repeat maxillomandibular fixation following completion of rigid fixation, reconfirmation of smooth jaw movement is also essential.

In cases of long face with retrogenia or microgenia, a relatively large chin advancement with genioplasty is usually necessary.<sup>12</sup> In this series, 5.0–7.0 mm of chin advancement was performed simultaneously with genioplasty.

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