Problem in the surgical correction of long-face with vertical open bite

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ABSTRACT

Long-face cases usually need both treatment of orthodontic and surgery. The problem appearing in the correction of long-face might be able to be related with some difficult factors such as the crowded teeth and excessive vertical height. A class III malocclusion and excessive open bite can be also followed in long face. This situation might worsen the facial aesthetic condition and increase the difficulty in orthodontic treatment. The orthodontic approach is oriented toward positioning the teeth pre-surgically to facilitate the surgical plan. The form of mandible which has grown in the downward direction in the area of mandible angle makes an extreme vertical open bite. The maxilla is usually presented with a maxillary hypolasia. Double-jaw surgery was done as the correction of the lower jaw alone would produce a flattened face appearance and difficulty in repositioning the mandible to achieve a good facial performance. Several cephalometric points were measured to observe the facial situation progress after surgery. Two cases of long-face are reported, and the same surgical treatments were performed and showed different results.

Key words: *long face surgical correction, excessive vertical hight, occlusal plane angle*

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INTRODUCTION

Tremendous advances in the area of orthognathic surgery for the treatment of dentofacial deformities have been made since the 1970s. Fonseca[1] reported the increased number of patients require surgical correction with an assumption 580.000 individuals in United States have a severe class III malocclusion, with some 12,000 cases being added each year.

Trends in class III surgical treatment indicate that fewer isolated mandibular setbacks, predominant procedure in the 1970s, are being done for correction of this type of malocclusion.[1] A recent study has reported an increased number of two-jaw and maxillary advancement cases for correction of class III dentofacial deformities.[2] Proffit *et al*.[3] in 1990 reported approximately 220,000 individuals with long-face problem severe enough to warrant surgery, with some added to the population annually. A long-face patient can be described as skeletal class I rotated to class II or as skeletal class III rotated to class I. The primary distinguishing characteristic of a long face is a large total face height that is manifested almost entirely in elongation of the lower third, leading to disproportion between facial height and width. A major component of the problem is nearly always an inferior rotation of the posterior maxilla. As the face height increases and the maxilla palatal plane rotates down posteriorly and posterior teeth move down, the mandible tends to rotate downward and backward. For this reason, the vertical disproportion also affects antero-posterior (AP) jaw relationship.[1]

The growth of the mandible rotates down and back during the development of long face condition and this rotation therefore separates the incisors vertically, creating an open bite tendency. In long face, a skeletal correction is necessary to be performed as the malocclusion existed due to two factors as teeth mal-alignment and abnormality of bone growth pattern both in upper and lower jaws. Pre-orthodontic treatment before surgery is obligatory as this treatment sequence has an objective to align each tooth position both in mandible and maxilla and to parallel the curve of Spee in both jaws. These steps are considered to be highly important as it has a main purpose to achieve jaws occlusion during surgical reposition.

Correction of the lower incisors which has tipping lingually as the result of the resting lip pressure caused by mandibular rotation during the development of long-face condition also necessary to anticipate the backward movement of the mandible posteriorly during the mandibular setback which may lead the lower incisors in the more lingual position.

The goal of the surgical treatment is to improve the maxilla and mandible in appropriate proportion situation to build a class I occlusion and relative facial balance with some parameters used, such as a normal difference between SNA and SNB angle known as ANB, maxillary and mandibular height, facial convexity and occlusal plane angle as indicators of the relative antero-posterior position of the jaws as well as to reduce the vertical height.

Mandible reposition after the sagittal split osteotomy is done according to the calculated reposition of the upper jaw after a LeFort I osteotomy procedure. A precise and harmonious position of the maxilla would take as a key to achieve a relative harmonious facial balance. In such cases of a hyploplastic mandible appearance which could be shown after the mandible setback, a genioplasty is necessary to be considered to correct the mandibular angle and performance.

Two cases of long-face are reported, both cases presented with a class III malocclusion, high vertical face height and extreme vertical open bite accompanied the clinical symptoms. Difficulty on chewing, unaesthetic face, mouth breathing, and temporo-mandibular joints pain are the problems presented by patients during they appear to seek for disharmony correction.

Both cases were treated surgically with LeFort I osteotomies as proposed by Bell[4] for repositioning the maxilla and a sagittal split osteotomies. Combination of technique from Dal Pont[5] and Obwegesser[6] were performed in both mandible for upward rotation and posterior setback.

The purpose of this study is to examine the effect of surgical treatment in long-face cases with skeletal class III malocclusion and extreme open bite.

CASES

Two cases of long-face with extreme vertical open bite visited my private practice and asked for facial corrections are reported. One case as shown in case 1 was already reported previously and some of the data presented in case 1 was taken from previous publication,[7] and added with a cephalometric analysis method according to Fonseca[1] to compare another result of surgical correction existed in both cases, which had nearly same clinical symptoms. This article focuses on the result of surgical handling of long-face cases existed with extreme vertical open bite and treated with the same surgical technique but shown with different result.

The cases presented in 20 year-old (case 1) and 32 year-old (case 2) males with long-face who had undergone skeletal surgical correction are reported. These patients were sent by a general practice dentist asked for surgical correction. Both two cases were then sent to an orthodontist for presurgical orthodontic treatment and the surgeries were performed six months after the presurgical orthodontic treatment.

Both cases had nearly the same chief complaints as inability to chew due to their severe open bite, unaesthetic faces, large mandibles, inability to close their mouths, and a mouth breathers. The patients considered that their facial appearance as a priority to be corrected.

Extra oral examination of both cases revealed of long-face with hypotonic upper lips resulting in inability of mouths closure and a significant gummy smile presented in case 1 (figure 1a, b, c; 2a, b, c). Cephalometry and clinical evaluation found with long-face cases accompanied with skeletal class III malocclusions, vertical maxillary excesses and severe anterior open bites with maxillary hypoplasia. The surgical treatment decided were LeFort I osteotomies for maxillary advancement with horizontal and vertical reduction. Bilateral sagittal split osteotomies (BSSRO) was planned for a mandibular setback.

A variety of cephalometric measurement methods were used to evaluate the patient's profile. A combination of Ricket's,[8] Steiner's,[9] Down's,[9] Delaire's[10] and Legan's[11] analyses were used to assess the relative relationship of the maxilla and in addition to the relationship of the maxillary and mandibular teeth.

Other examinations were done pre and post operatively by measuring the other cephalometric references point using: a) Delaire hard tissue analysis with reference planes FM to Clp. With a line perpendicular to this line, done by measuring the upper facial height from N to ANS and the lower facial height from ANS to Me. The distance between ANS and N should be 45% of total facial height and the measurement from ANS to Me along this line should be 55% of total facial height: 1) upper facial height (N-ANS in mm), 2) lower facial height (ANS-Me in mm). b) Legan soft tissue analysis included the ratio distances from G to SN and from SN to Me, according to reference plan 7 degree above the SN plane. The ratio of this distance should be 1 to 1, G-Sn (mm) should be equal to Sn-Me' (mm).

The facial analyses as proposed by Fonseca[1] were also used in this observation, including the maxillary and mandibular depth, the bony chin position which was evaluated in the antero-posterior (AP) dimension by using Sella-Nasion (SN)-pogonion with normal range, 72–88 degrees; mean 80 degrees, SN-B point with normal range 72–88 degrees; mean, 79 degree. Y growth axis with normal range of 53 to 66 degrees; mean 59 degrees.

Case 1: In this 32 year old male the surgical treatment was decided with LeFort I osteotomy for maxillary advancement with horizontal and vertical reduction. A BSSRO was planned for mandibular correction. Fifteen milimeter discrepancy between maxilla and mandible was noted in this case therefore correction of 5 mm in the maxilla forward and 10 mm mandibular setback were planned. Chin correction of 7 mm forward was presumed to be necessary since the surgery predicted would reduce a large amount of the SNB angle value post-operatively and it would interfere with the aesthetic appearance as the chin would loss its prominently, but the patient refused this procedure.

Case 2: In this 20 year old male a surgical treatment using LeFort I osteotomy for maxillary advancement and horizontal and vertical reduction and a BSSRO for mandibular correction were used. Twelve milimeter discrepancy between maxilla and mandible was noted in this case, therefore compensated correction of 5 mm in the maxilla forward and 7 mm mandibular setback were planned. A chin correction was presumed unnecessary to be performed as the patient had a relative extreme norm of SNB angle, therefore after a mandibular setback the chin situation was predicted still in a compromised proportion.

CASES MANAGEMENT

Both cases had received both pre surgical orthodontic and surgery, which Le Fort I and sagittal split osteotomies were performed for maxillary advancement and mandible setback and upward rotation. On a cast models pre operative simulations were done for predictive results on cast model. Surgical templates were prepared in two steps individual occlusal splints for maxillary advancement and mandibular setback.

The surgical results in case 1 and 2 were analyzed on their pre and post operative vertical relationships on their cephalometric photographs. In each patient, pre and post operative radiographs were taken in their centric relation with lips repose and were traced on 0.003-inch acetate tracing paper. The result of pre and post operative measurements on both patients presented as shown in table 1 to 4.

By Ricket's analysis as shown in table 1 and 3, the facial axis decreased from 101 to 95 degrees in case 1, and in case 2 increased from 85 to 87 degrees. The facial angle decreased in case 1 from 98 to 84 degrees, and in case 2 found increased from 83.5 to 88 degrees. The lower facial height had decrease in case 1 from 42 to 34 degrees and in case 2 no significant changed was found from 25 to 26 degree post operatively. The mandibular arch angle increased from 29 to 40 degrees in case 1 and decreased from 75 to 59 degree. The mandibular plane angle in case 1 showed with no change, but in case 2 had increased from 33 to 40 degrees. The total facial height increase from 48 to 50 degrees in case 1, and significant decreased found in case 2 from 122.5 to 84 degrees. The inclination of occlusal plane increased from 18 to 20 degrees in case 1 and decrease from 24 to 23 degrees in case 2.

The result of measurement by Delaire's analysis showed, the N-ANS in case 1 had slightly increased from 5.0 mm to 5.5 mm and in case 2 decreased from 5.6 to 5.1 mm. The ANS to Me had decreased in case 1 from 9.8 to 8.7 mm.

Measurement of facial soft tissue height proportion which should be 1 to 1 in proportion, showed that the G to Sn remain stable from 8.8 to 8.7 mm pre operatively and and from Sn to Me' decreased from 9.3 to 8.7 mm in case 1. In case 2 the G to Sn had decreased from 9.7 to 7.8 and the Sn to Me' decrease from 10.0 to 8.1 mm.

The table 2 and 4 show the result of measurement by Steiner's analysis, some changes had noted as of the increased of SNA from 70 to 78 degrees in case 1 and in case 2 found that SNA had decreased from 101 to 94 degrees. The SNB changed from 81 to 77 degrees in case 1 and in case 2, the SNB decreased form 100 to 93 degrees. The ANB had improved in case 1 from –11 to 2 degrees, and in case 2 only slightly had observed from 1.5 degrees pre operatively to 1 degree pos-operatively. The relation between upper and lower central incisors changed from 145 to 134 degrees in case 1, and in case 2 increased from 125 to 130 degrees.

In Down's analysis the facial angle (FH-NP) had decreased from 88.5 to 88 degrees in case 1 and in case 2 increased from 85 to 90 degrees. The facial convexity (NAP) decreased in both cases, in case 1 a significant decreased was noted from –23 degrees to + 1 degree, and in case, decreased from 2 degrees to 0 degree. The Sella-Nasion (SN) to Pogonion (Pog) angle in case 1 decrease from 100 to 90 degrees and in case 2 no change on this angle was observed both pre-and post- operatively, constant from 94 to 94 degrees. The mandibular plane angle (FH-GoGa) decreased from 45 to 35 degrees in case 1 as well as had found in case 2 from 55 to 41 degrees. The Y-FH axis increased in case 1 from 64 to 66 degrees and different result found in case 2 which found decreased from 74 to 60 degrees. The central incisors angle decreased from 142 to 138 degrees in case 1 and in case 2 increased from 123 to 132 degrees. The SN-B point angle decreased from 81 to 77 degrees in case 1, and in case 2 showed had decreased from 100 to 95 degrees.

In Fonseca's analysis of the maxillary depth (FH-NA) increased in both cases, in case 1 had increased from 78 to 90 degrees, and in case 2, from 84 to 90 degrees. A different situation was observed in the mandibular depth as in case 1 which had a stable mandibular depth pre-and post-operatively in 88 degrees, but in case 2, the mandibular depth had increased from 86 to 90 degrees.

The chin position in case 1 (figure 1d, e) shows less prominent post operatively as the Pogonion (Pog) point is located far behind the Nasion (NS)-A line, which it should be located on this line or slightly anterior from this line. The surgical intervention in case 2 resulted a different situation as shown in case 1 as the Pogonion (Pog) located in a line of NS-A (figure 2d, e).

DISCUSSION

Excessive face height was noted as clinical problem long before anything substantial could be done about it. As wrote by Profit *et al.*[3] that primary distinguishing characteristic of the long-face is a large total facial height that is manifest almost entirely in elongation of the lower third, leading to disproportions between facial height and width.

In respect to facial proportion, the surgery had successfully changed the patients profile dramatically, showed with the changes of some cephalometric values, which had shifted nearly into relative normal values in facial axis, facial angle, lower facial height, SNA, SNB, ANB, relation between upper and lower incisors, facial convexity (NAP), A-B plane angle (AB-NP), mandibular plane angle (FH-GoGn), Y-FH axis and SN-B point.

The facial angle, facial axis, and the SNA and SNB had changed the facial situation into relative good facial performance in both cases, both in its cephalometric values and clinical appearance.

The facial convexity (NAP) should be considered important as this value reflected the facial situation whether in concave or convex appearance. In both cases the NAP had decreased, in case 1 from –23 degrees to +1 degree, and in case 2 decreased from +3 degrees to 1 degree represented an acceptable lateral facial appearances.

The A-B plane angle (AB-NP) also represented the facial lateral views, the surgery in case 1 had increased this angle from –14 to +3.5 degrees and in case 2 slightly changed had noted from 2 degrees to 0 degree. The surgery resulted positive facial appearances in both cases showed by the increase of these angles from convex to concave faces.

The relation between lower incisors to upper incisors in both cases showed within the normal values as shown in case 1 increased from 123 to 132 degrees and in case 2 decreased from 145 to 134 degrees, the incisors procumbency in both cases had entered a normal range, and presented good inter-arch relationships.

The ANB had significant changed in case 1 from –11 degrees to +2 showed an improvement in the relationships between the maxilla and the mandible in remarkable situation. In case 2 the ANB had changed from 0 to +1 degree means preoperative mandible position was in the rotated down position as usually showed in long face cases therefore the position of the B point was not extremely away from the A point. By maxillary advancement mandible rotation, the ANB was not changed much.

Problem occurs in case 1, which the facial axis had shifted to 95 from 101 degrees. The decrease in facial axis angle represented posterior rotation of the mandible or as a result of backward movement of the symphysis. It can also be shown in the value of inclination of occlusal plane angle which had increased from 18 to 20 degrees in case 1 represented the maxillo-mandibular complex had rotated in clockwise rotation therefore the patient had lost his chin prominently. This situation sometimes can not be avoided since the mandible had rotated following the position of the maxilla. The downward movement of the symphysis can be avoided by reducing the degree of the clockwise rotation and change the direction with more upward movement of the anterior and posterior part of the maxilla during its reposition with the occlusal line keeps parallel to the Champer's line. An extreme posterior upward movement should be considered, as this movement allow the mandible turn in more downward position.

The situation given in case 2 was divers, the facial axis remains stable post-operatively represented the mandible had moved backward and upward and slightly upward rotated in the anterior teeth during a maxillo-mandibular reposition, shown by the decrease of the inclination of the occlusal plane therefore the chin situation in case 2 gave more prominent facial feature then as given in case 1. This assumption supported by the data given by the Facial angle (FH-Npog), in case 1 dropped from 98 to 84, the same situation also shown in the SNB angle which had dropped from 81 to 77 degrees. The SNB value in case 1 exhibited a strong decreased angle from 81 to 77 degrees in comparing to the SNA situation which had increase significantly from 70 to 78 degrees. The surgical intervention in case 1 resulted slightly facial disharmony situation as the Pog point is located far behind the NS-A line. Therefore in case 1 further surgery of chin correction presumed to be necessary. In case 2 although the SNB showed decreased in its norm but the chin clinical appearance was found undisturbed as the Po point is located in the acceptable line of NS-A, and this situation might be existed due to the large value of SNB shown pre-operatively.

Correction of dentofacial deformities often requires double-jaw surgery to achieve a high quality functional and aesthetic result. Cephalometric and clinical interrelationship should be highly considered in the diagnosis and treatment planning procedure for preparing in correction of dentofacial deformities. One of the surgical treatment goals is to correct the height of the occlusal plane angles. Since the occlusal plane has significant influence on function and aesthetic, particularly when double-jaw surgery is performed.

The occlusal plane angle is the angle formed by Frankfort Horizontal (FH) and a line tangent to the cusp tip of the lower premolar and the buccal grove of the second molar. An increased occlusal plane angle is usually reflected in an increased mandibular plane angle and a decreased occlusal plane angle correlates with the decreased of mandibular plane angle. Traditional management in double-jaw surgery, regardless of steepness of the pre-surgical occlusal plane, either maintains the pre-surgical occlusal plane angulation, establishes the occlusal plane by auto rotation of the mandible, or selectively increases the occlusal plane relative to FH to improve stability.[1] In both cases the occlusal plane angles were found high pre-operatively, 30 degrees in case 1 and 39 degrees in case 2. The surgical treatment had decreased both values to 24 and 27 degrees respectively. A decreased occlusal planes usually correlates with a decreased of the mandibular plane angles, as it is shown in case 1, had decreased from 48 to 45 degrees as well as shown in case 2 which had decreased from 56 to 41 degrees.

The maxillary and mandibular depth are two angle would be corrected, as a small values in the maxillary depth would be shown clinically with a hypoplastic maxilla and a small angle of the mandibular depth would be shown with a hypoplastic mandible. In both cases the surgery had corrected the maxillary depth pleasantly, increased into normal values, as shown in case 1 which had increased from 78 to 90 degrees and in case 2 from 84 to 90 degrees. The mandibular depth as shown in case 1 presented a stable value in 88 degrees, and in case 2 a better situation showed with the increase of its norm from 85 to 89 degrees.

The mandibular depth had shown in case 1 presented a normal norm according to Fonseca,[1] but it is not clinically satisfying while the patient showed with lost of his mandible prominent, therefore a genioplasty actually necessary to be performed. The mandibular setback had changed the facial angle (FH-Npog) norm too extreme in comparing with the result as shown in the facial axis (angle BaN-PtmGn lines), 84 to 95 degrees. Another cause suspected in case 1 is the angulation of the occlusal plane angle which had slightly increased from 18 to 20 degrees, means the mandible had rotated into downward in direction during the maxillo-mandibular rotation, therefore this surgical rotation had decreased the chin prominently.

The Y axis is defined to be the direction of down growth and forward facial growth. The surgical treatment showed had reduced in some degrees, in case 1 from 68 to 66 degrees and in case 2 from 76 to 66 degrees represented the mandible had rotated backward and upward following the position of the maxilla, therefore the previous long face appearance obviously disappeared.

The position of the mandible related to Sella Tursica-Nasion line showed by the SN-B point angle. In case 1 the SN-B point angle had decreased from 81 to 77 degrees this situation had brought the chin into retrograde mandible condition therefore a chin advancement should be performed to compensate this low degrees of he SN-B point angle. In case 2 a high degrees of this angle was found, and the mandibular setback had decreased this angle from 100 to 97 degrees, which shown above normal norm, but clinically the situation is still acceptable.

According to Legan's soft tissue analysis, in both cases the distance from G to Sn and fro Sn to Me should be 1:1,[10] the surgery had successfully achieved this objective. By Delaire's analysis, the total hard tissue facial height achieved a good facial height proportion.

The occlusal plane angles play as an important role in double-jaw surgery as it is related with significant aesthetic influence as this angle related to the facial type changes. Theoretically the relation of the occlusal plane angle to the facial aesthetic can be explain as wrote by Fonseca,[1] in low and occlusal plane (LOP) would produce a brachephalic face type, therefore surgical intervention to increase in occlusal plane angulation may be indicated. In high occlusal plane angle (HOP) would produce a dolichocephalic facial type, the surgical correction may be indicated, which include a counterclockwise rotation of maxillomandibular complex. The LOP and HOP can be shown illustratively in figure3a and figure 3b.

In both cases the surgical interventions were failed to decreases the value of occlusal plane angle in entering of a normal ranges but a clinical acceptable face still can be seen in both cases. In case 2 a better facial situation is seen as the surgery in case 2 was mentioned carefully to the value of the facial proportion between upper and lower face and in case 1 the surgery had brought the occlusal plane angle in slightly increased, shown with the chin had rotated in downward direction.

In long-face correction, a genioplasty should always be considered as it might be needed to compensate the result of mandibular set back and the downward mandibular rotation.

It concluded that in treating of long-face cases, a pre-operative planning should be made by considering the facial proportion as proposed by Legan,[10] as it is sensitive in resulting of unbalance face due to over correction of the height of facial vertical dimension.

Changing of the long-face case directly into short face should not be done as a drastic changing of the facial height would be resulted a compressed face. A proportional acceptable face would be more acceptable as an extreme vertical reduction which only based on the mathematical calculation might produce a disproportion dimension in the lower third of the face area. In mention to the facial proportion, the upper and lower vertical height proportion changing should be made with consideration during the surgical procedure to ovoid a facial disproportion.

The theory given by Fonseca[1] for LOP and HOP cases should be considered as it is related to the result of the surgery in aesthetic result.

An alternative method of maxilla reposition after a Le Fort I osteotomy can be done by moving the maxilla forward as predicted pre-surgically and repotioned in the upward direction. The posterior part of the maxilla should not too strong upward repositioned, but should move the whole maxilla vertically with the occlusal line keeps parallel to a Champer's line. The position of the four upper incisors teeth and upper lip also be used as guidance in positioning the four upper incisor teeth. This technique might be used to ovoid the chin rotated too downward as might given when a clockwise rotation movement is used and too strong rotated during the maxillomandibular complex movement.

Figure 1a. Pre-operative facial appearance.

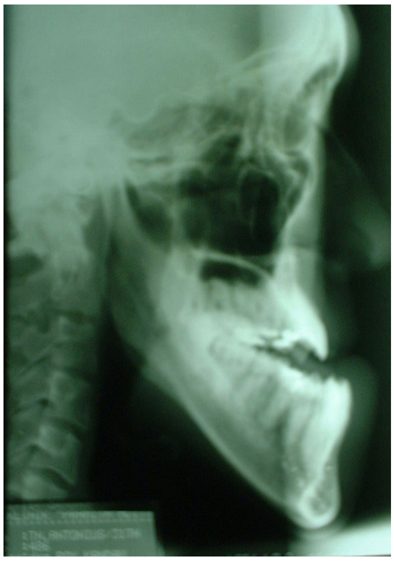

Figure 1b. Pre-operative cephalometric x-ray.

Figure 1c. Pre-operative occlusion.

Figure 1d. Post operative prifile taken one year after surgery.

Figure 1e. Cephalometric after surgery.

Figure 2a. Pre-operative facial profile.

Figure 2b. Pre-operative panoramic radiograph.

Figure 2c. Pre-operative occlusion.

Figure 2d. Post operative profile taken fourteen days after surgery.

Figure 2e. Post operative panoramic view.

Table 1. The sum of Ricket's Fonseca's, Delaire's and Legan' cephalometric measurement for case 1

Table 1	Ricket's, Fonseca's, Delaire's and Legan's cephalometric measurements for case 1		
	Mean	Presurgical	Post surgical
Facial axis (angle BaN-PtmGn lines)	90° ± 3°	101°	95°
Facial angle (Angle FH-Npog, anatomic porion)	88° ± 3°	98°	84°
Mandibular plane (angle FH-GoGa)	25° ± 5°	44°	44°
Lower facial height (angle ANXi-XiPM)	47° ± 4°	42°	34°
Mandible arch (angle DCXi-XiPM)	26° ± 4°	29°	40°
Total facial height	-	48°	50°
Inclination of occlusal plane	8° ± 4°	18°	20°
Maxillary-depth (FH-NA)	90° ± 3°	78°	90°
Mandibular dept (FH-NB)	88° ± 3°	88°	88°
N-ANS	–	5.0 mm	5.5 mm
ANS-Me	–	9.8 mm	8.7 mm
G-Sn	–	8.8 mm	8.7 mm
SN-Me[1]	–	9.3 mm	8.7 mm

Table 2. The sum of Steiner's and Down's cephalometric measurements for case 1[7]

Table 2	Steiners cephalometric measurements for case 1					
	Mean Caucasoid	Interval Caucasoid	Mean Surabaya	Interval Surabaya	Presurgical	Post surgical
SNA	82°	78°–86°	84.3°	79°–89°	70°	78°
SNB	80°	76°–84°	81.4°	74°–89°	81°	77°
ANB	2°	0°–4°	3°	–	–11°	± 2°
Relation between $\underline{1} - \overline{1}$	131°	120°–150°	119.7°	105°–133°	145°	134°
Downs cephalometric measurements for case 1						
Facial angle (FH–NP)	82°	78°–86°	84.3°	–	88°	88°
Facial convexity (NAP)	0°	-8.5– +10°	6.1°	–	–23°	+1°
A–B plane angle (AB–NP)	–4.6°	–9°–0°	–4.6°	–	–14°	+3.5°
Sella–Nasion (Sn)–Pogonion	–	72°–80°	–	–	100°	90°
Mandibular plane angle (FH–GoGa)	21.9°	17°–28°	27.5°	–	45°	35°
Sn – Bpoint	80°	72°–88°	–	–	81°	77°
Y– FH Axis	59°	53°–66°	65.5°	–	68°	66°
$\underline{1} - \overline{1}$ angle	135.4°	130°–150°	–	–	145°	134°

Table 3. The sum of Ricket's, Fonseca's, Delaire's and Legan's cephalomentric measurement for case 2

Table 3	Ricket's, Fonseca's, Delaire's and Legan's cephalometric measurements for case 1		
	Mean	Presurgical	Post surgical
Facial axis (angle BaN-PtmGn lines)	90° ±3°	85°	88°
Facial angle (angle FH-Npog, anatomic porion)	87.3°±3°	83.5°	88°
Mandibular plane (angle FH-GoGa)	26° ±4°	33°	40°
Lower face height (angle ANXi-XiPM)	47° ±4°	25°	26°
Mandible arch (angle DCXi-XiPM)	26° ±4°	75°	59°
Total facial height	–	122.5°	84°
Inclination of occlusal plane	–	24°	23°
Maxillary-depth (FH-NA)	90° ±3°	84°	90°
Mandibular dept (FH-NB)	88° ±3°	86°	90°
N – ANS	–	5.6 mm	5.1 mm
ANS – Me	–	8.4 mm	7.9 mm
G – Sn	–	9.7 mm	7.8 mm
SN –Me[1]	–	10.0 mm	8.1 mm

Table 4. The sum of Steiner's and Down's cephalometric measurements for case 2

Table 4	Steiner's cephalometric measurements for case 2					
	Mean Caucasoid	Interval Caucasoid	Mean Surabaya	Interval Surabaya	Presurgical	Postsurgical
SNA	82°	78°–86°	84.3°	79°–89°	101°	94°
SNB	80°	76°–84°	81.4°	74°–89°	100°	93°
ANB	2°	0°–4°	3°	–	1°	+1°
Relation between 1- 1	131°	120°–150°	119.7°	105°-133°	125°	130°
	Down's cephalometric measurements for case 2					
Facial angle (FH-NP)	87.8°	82°–85°	84.8°	–	85°	90°
Facial convexity (NAP)	0°	–8.5-+10°	6.1°	–	3°	1°
Mandibular plane (angle FH-GoGa)	21.9°	17°–28°	27.5°		55°	41°
Y–FH Axis	59°	53°–66°			76°	66°
1- 1 angle	135.4°	130°–150°	–	–	123°	132°
SN–B point	80°	72°–88°	–	–	100°	93°
Sella-Nasion (Sn)-pogonion	76°	72°–80°	–	–	100°	94°
Y-FH Axis	59.5°	53°–66°	65.5°	–	74°	60°

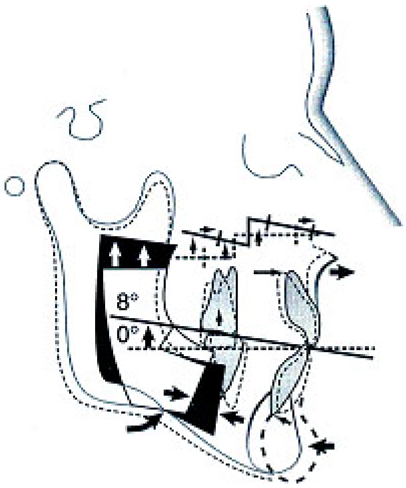

Figure 3a. In surgical increase of the occlusal plane the chin rotates posteriorly relative to incisor tips, and the perinasal area advance. The posterior facial height decreases, the maxillary incisor angulation decreases, and the mandibular incisor increases.[1]

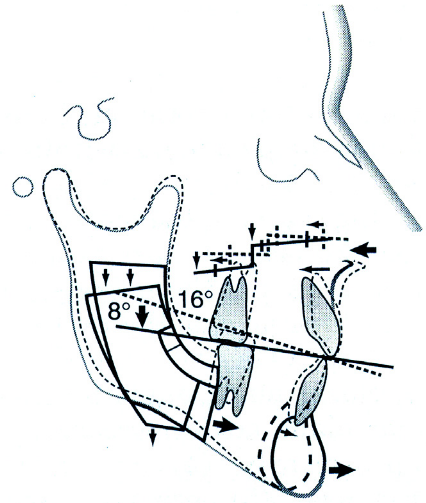

Figure 3b. The surgical decrease of the occlusal plane results in increased projection of the chin, decreases prominence of the perinasal areas, increased maxillary incisor angulation, decreased mandibular incisor angulation, and increased oropharyngeal airway.[1]

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