



Cephalometric evaluation of soft tissue changes following Anterior Maxillary Osteotomy setback in Southern Dravidian population

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ABSTRACT

Introduction: Anterior Maxillary Osteotomy (AMO) is one of the commonly done orthognathic surgical procedure in maxilla. Though a lot of research have been done in the Caucasian population regarding soft tissue changes after AMO, there are only few studies for the southern Dravidian population. The purpose of this study was to evaluate the soft tissue changes in association with AMO setback in the southern Dravidian population
Materials and methods: The study included a series of 10 patients of age group 20–40 years who underwent AMO. Lateral cephalograms were taken for each patient 2 weeks before and 6 months after the surgery. Three parameters namely, nasolabial angle, upper lip protrusion and interlabial gap were used to evaluate the soft tissue changes.
Results: Mean values of pre and post-surgery were taken for nasolabial angle, upper lip protrusion and interlabial gap and were compared. Soft tissue changes in all the three parameters were found to be statistically significant.
Conclusions: From the limited evidence of the study, it can be concluded that soft tissue changes following AMO setback in southern Dravidian population and the Caucasian population are almost similar.

1. Introduction

Orthognathic surgery has been widely accepted over the past few decades as the preferred method of correcting moderate to severe skeletal deformities including facial aesthetics. Recognition of aesthetic changes and prediction of the final facial profile play an important role in treatment planning of orthognathic surgery, since the facial profile produced by orthognathic surgery is what the patients want.^{1–4}

Anterior Maxillary Osteotomy (AMO) is mainly indicated for anteroposterior excess, correction of anterior open bite, protruded maxillary teeth with normal inclination to alveolar bone and to reduce prominent upper lip. Literature says that soft tissue changes are associated with orthognathic surgery and every investigation has attempted to find out the changes in the soft tissues after the surgery.⁵ Prior to an orthognathic surgery, the prediction of soft tissue changes is important for the process of treatment planning.

Changes in soft tissue morphology depends on several factors.⁶ Most authors^{7–9} suggest that within 6 months after the orthognathic surgery,

there is stabilization of soft tissues; but, continued changes in soft tissue have also been reported several years after surgery.¹⁰

Soft tissue evaluations, the standard or classic lateral cephalometric skeletal analyses have to be done to evaluate soft tissue changes. It is a well-established fact that contour of facial bone is largely influenced by the race.¹¹ Hence, it is logical to expect that the response of soft tissue to bone movement is also different from race to race. There is no study regarding the soft tissue changes following AMO in southern Dravidian population so far to the knowledge of authors. Therefore, the present study aimed to evaluate the soft tissue changes in association with AMO setback in southern Dravidian population.

2. Materials and methods

A total of 10 patients were included in this study after pre-operative evaluation and obtaining an informed consent in their vernacular language. Ethical clearance was obtained from the Institutional Review Board. Patient between 25–40 years of both sexes indicated for AMO

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setback were included in the study. Medically Compromised individuals, subjects with cleft lip and palate deformity, facial asymmetry or associated syndromes were excluded.

Pre-operative lateral cephalogram was taken 2 weeks before the surgery and Post-operative lateral cephalogram was taken 6 months after the surgery. Clinical evaluation was done using lateral cephalogram in centric occlusion with lips in repose. A single operator, an oral surgeon who had training in cephal tracing hand traced all the lateral cephalograms. A tracing sheet and a lead pencil was used for tracing. The soft tissue analysis used in this study is the Burstone and Legans' Cephalometrics for Orthognathic Surgery (COGS) analysis.¹² The cephalometric landmarks were Columella point (Cm), Subnasale (Sn), Labrale superius (Ls), Labrale inferius (Li), Soft-tissue pogonion (Pog), Stomion superius (Stms) and Stomion inferius (Stmi).

The Lateral cephalometric measurements evaluated (Fig. 1) were as follows.

1. Nasolabial angle - Angle formed by the line joining the Subnasale (Sn) to Columella (Cm) and the line joining the Subnasale (Sn) to Labrale Superius (Ls) in degree (°)
2. Upper lip protrusion - A line is drawn from Subnasale (Sn) to soft tissue Pogonion (Pog). Protrusion is the perpendicular linear distance from this line to the most prominent point of lip (Ls) in millimeter (mm).
3. Inter-labial gap - Distance between Stomion superius (Stms) and Stomion inferius (Stmi) in millimeter (mm).

The intra-rater reliability was measured using Intraclass Correlation Coefficient (ICC) and the score ranged from 0.80 to 0.90 which showed good intra-rater reliability.

2.1. Surgical technique

A standard AMO setback surgical procedure according to Cupar method was followed for all the patients.¹³ Under General Anaesthesia, an incision was placed in maxillary labial vestibule, 5 mm away from the mucogingival junction extending from first premolar on either side. Maxillary first premolars were extracted intraoperatively. Palatal tunnelling was done. Full thickness mucoperiosteal flap was reflected. Reflection of nasal mucosa was done.

Bone cutting was done by reverse cutting saw (NSK, Japan). From the pyriform rim, the horizontal osteotomy cuts were placed. This cut is then laterally extended. Thus, through the extraction sockets, the horizontal cut is joined with the vertical osteotomy cuts bilaterally. Trimming of the nasal septum was done if needed to prevent its buckling. Posterior repositioning of 5 mm was obtained in all the patients. The osteotomized segments were stabilized with 1.5 mm Stainless Steel (SS) L plates and

1.5 × 6 mm SS screws (SK Surgicals, India) bilaterally. A hole was drilled through the anterior nasal spine using 701 bur (SS White, USA) and alar cinch suturing was done with 3–0 Prolene suture (Ethicon, India) to prevent alar base widening. Primary closure in a V–Y fashion was done with 3–0 Vicryl (Ethicon, India) sutures which prevents shortening of lip length.

Postoperatively, antibiotics, analgesic and steroid were given parenterally for 2 days for all the patients. Other standard postoperative care was given. All the patients were discharged on 3rd day and followed up regularly.

2.2. Statistical analysis

Data was collected, coded and fed in the SPSS version 23 (IBM Statistics, USA) for the analysis. Paired *t*-test was used to determine the difference between Pre- and Post-surgical soft tissue changes. *p*-value less than 0.05 was considered statistically significant.

3. Results

The sample consisted of females (n = 6) and males (n = 4), with a mean age of 29 years (range 25–40 years). All patients had no complications after surgery. The three parameters - Nasolabial Angle, Upper lip protrusion and Interlabial gap were evaluated and comparison was done between the pre surgical and post-surgical values in a group of ten patients as given in Tables 1–4. All the 3 parameters showed statistically significant difference after the surgery (*p* < 0.001) (Fig. 2).

4. Discussion

Maxillary orthognathic surgery has a significant impact in the nasolabial region and the upper lip morphology. Factors like soft tissue handling, direction of the skeletal movement result in changes in the overlying skin and subcutaneous tissue. The changes in soft tissue following AMO results in increase of nasolabial angle. There is

Table 1
Measures of Pre and Post-surgical – Nasolabial Angle, Upper lip protrusion and Interlabial gap.

Parameters		Sample size	Mean
Nasolabial Angle (°)	Pre-Surgical	10	90.1
	Post-Surgical	10	98.9
Upper lip protrusion (mm)	Pre-Surgical	10	8.85
	Post-Surgical	10	5.65
Interlabial gap (mm)	Pre-Surgical	10	6.15
	Post-Surgical	10	3.97

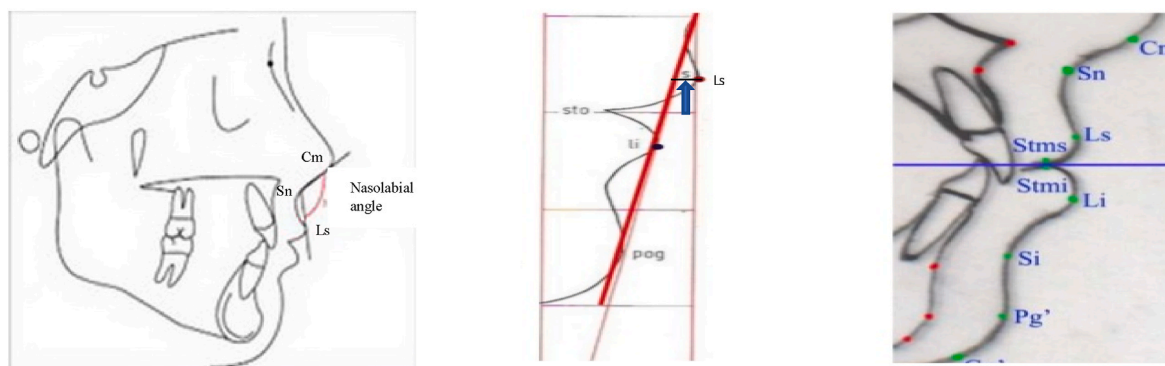


Fig. 1. Lateral cephalometric measurements (Left) Nasolabial angle measurement = The angle formed by the line joining the Subnasale (Sn) to Columella (Cm) and the line joining the Subnasale (Sn) to Labrale Superius (Ls); (Middle) Measurement of upper lip protrusion = The perpendicular linear distance (Blue arrow) from a line joining Sn and soft tissue Pogonion (Pog) to the most prominent point of lip (Ls); (Right) Inter-labial gap measurement = Distance between Stomion superius (Stms) and Stomion inferius (Stmi).

Table 2
Comparison between Pre and Post-surgical – Nasolabial angle.

	Mean ± Standard deviation	95% Confidence interval		t-value	p-value
		Lower	Upper		
Pre – Post	-8.80 ± 2.35	-10.48	-7.12	-11.854	<0.001

<0.001 – Highly significant.

Table 3
Comparison between pre and post-surgical – upper lip protrusion.

	Mean ± Standard deviation	95% Confidence interval		t-value	p-value
		Lower	Upper		
Pre – Post	3.20 ± 0.75	2.66	3.74	13.443	<0.001

<0.001 – Highly significant.

Table 4
Comparison between pre and post-surgical – interlabial gap.

	Mean ± Standard deviation	95% Confidence interval		t-value	p-value
		Lower	Upper		
Pre – Post	2.18 ± 0.78	1.62	2.74	8.806	<0.001

<0.001 – Highly significant.

lengthening of upper lip and the interlabial gap decreases. AMO segment can be moved multidirectionally. The increase in the nasolabial angle occurs due to the posterior rotation of lip around subnasale and due to the posterior movement of the anterior nasal spine. The nasolabial angle decreases during superior maxillary movement because of the widening of the alar base and increases during posterior maxillary movement.^{14,15} The nasal changes do not depend upon the changes in upper lip angulation. The upper lip completely follows the maxillary incisor movement.

Increase in the nasolabial angle and decrease in the upper lip protrusion and interlabial gap were the changes observed in our study. Assessment of soft tissue changes following AMO in Caucasian population has been done by many studies.^{14,16,17} Nasolabial angle is one of the soft tissue landmarks which shows great change after undergoing AMO. Two components are considered to predict the change in the nasolabial angle. First is the columella angle (i.e., nasal tip upturning) changes. The second is the upper lip inclination changes. The most commonly seen effect in maxillary setback procedures is increase in the nasolabial angle.^{16,18,19}

Park and Hwang²⁰ stated an increase in the nasolabial angle ranging from 94.96 ± 9.67 to 109.03 ± 9.08 in a 30 patient group. Similarly, in a review by Jayaratne et al.,²¹ evaluation of facial soft tissue response to anterior maxillary osteotomies was done. It was found that there was an increase in the nasolabial angle ranging from 8.9° to 18° with reduction in the labial prominence. All these studies showed similar results obtained in our study where the mean nasolabial angle two weeks before surgery was found to be 90.1° and 98.9° after six months of surgery. Our study shows that anterior maxillary osteotomies result in increase of nasolabial angle and improve the facial aesthetics of the subjects. Similar finding was reported by other studies.^{22–24}

Changes in the upper lip protrusion from a mean value of 8.85 mm–5.65 mm was found to be statistically significant when compared between the pre and the post-surgery which is similar to a study conducted by Ayoub AF et al.²⁵ where the evaluation of adaptation of soft tissue profile to anterior maxillary intrusion in ten adult patients was done by comparing preoperative and 6-month postoperative

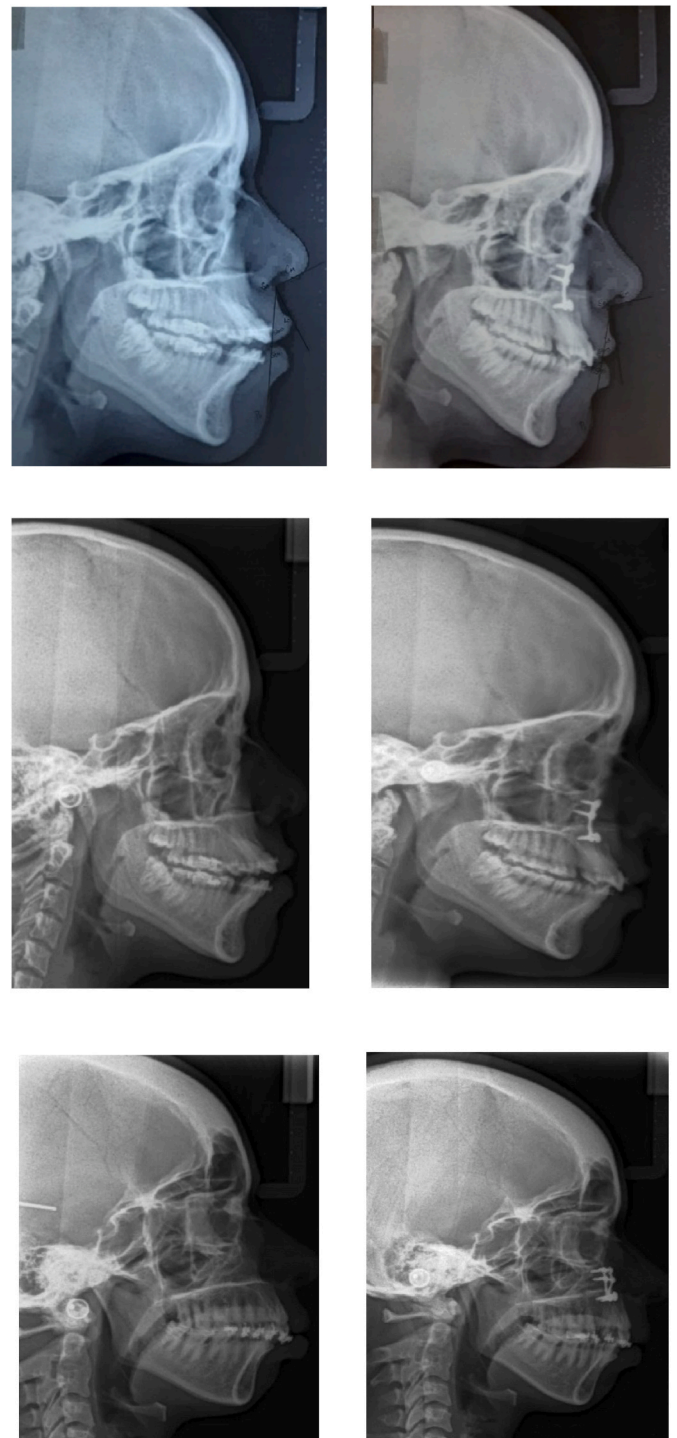


Fig. 2. Preoperative (Left) and Postoperative (Right) lateral cephalogram of 3 patients
Notice the increase in nasolabial angle, reduction in upper lip protrusion and interlabial gap.

cephalograms. Some studies stated that the upper lip responded variably to the direction and amount of maxillary positioning.^{26,27}

A reduction in the interlabial gap has been observed in the present study from a mean value of 6.15 to 3.97 mm which shows an improvement in the facial aesthetics of the patient. A study by Daif²⁸ also shows similar reduction in the interlabial gap which was found to be around 56% after AMO using Wunderer technique.

A change in the upper lip and nasolabial region is to be expected

favourably following AMO. The posterior repositioning has resulted in increase of nasolabial angle, decrease in the upper lip protrusion and interlabial gap which is significant. Thus, subjects with acute nasolabial angle will be benefited with AMO. The main goal is to maximize the soft tissue esthetics. The technique is simple with limited relapse.

Dravidian population refers mostly to natives of South India. All the study samples are derived from the southern part of Dravidian area. Most of the research studies have focussed on the soft tissue changes following AMO in the Caucasian population. This is the first study to address the soft tissue changes following AMO in the Dravidian population to the knowledge of authors. The ratio of increase in nasolabial angle was $+0.1^0:1$ as well as the ratio of decrease in upper lip protrusion and interlabial gap was $-0.36:1$ and $-0.35:1$ for every 1 mm of bony setback in our study. This amount of movement is approximately same as that of Caucasian population.^{29,30} The limitation of the study is the smaller sample size and hence, more research is needed in this direction with larger sample size to corroborate the findings.

From the limited evidence of the study, it can be concluded that the amount of soft tissue changes in Southern Dravidian population closely follows as that of Caucasian population.

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