

Lip Changes Incident to Aging and Skeletal Modifications

¹Santosh Kumar, Head and Professor Kothiwal Dental College, Moradabad, U.P.

²Syed Shafaq, Post Graduate Student Kothiwal Dental College, Moradabad, U.P.

³Shikha Jain³, Professor Kothiwal Dental College, Moradabad, U.P

⁴Fatima Alam, Post Graduate Student Kothiwal Dental College, Moradabad, U.P.

Corresponding Author: Syed Shafaq, Post Graduate Student Kothiwal Dental College, Moradabad, U.P.

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Abstract

Appearance, is one of the primary functions of the face.¹ Clinical orthodontists recognize that most persons who seek orthodontic treatment do so because of a desire for improvement in facial harmony. Harmonious facial esthetics and optimal functional occlusion have long been recognized as the two most important goals of orthodontic treatment. The orthodontist should be well acquainted with the soft tissue changes that may result from orthodontic treatment.

Keywords: Lip changes, esthetic concern, aging, growth modification, orthognathic surgery.

Introduction

Angle was one of the first to write about facial harmony and the importance of the soft tissue integument. In 1944, Tweed gave special attention to esthetics. Upto that point in time, most of the studies dealt with skeletal analysis. Facial appearance at the completion of treatment is obviously of paramount importance to contemporary orthodontists^{1,2}. Over the years, a number of analyses have

been advocated in an attempt to quantitatively evaluate the esthetics of lateral facial profiles

Normal Lip Position

According to Charles J. Burstone normally, two postural positions of the lips can be observed. The lips are relaxed & part in the relaxed lip position, loosely hanging with no effort made at lip contraction. The lips are lightly touching in order to produce an anterior seal of the oral cavity in the closed-lip position

Relaxed-Lip Position³ (Figure 1) In theory, the relaxed-lip position represents a state in which there is no contraction of lip musculature.

Normal interlabial gap.0-3mm



Figure 1: Normal interlabial gap. Relaxed lip position showing small space or gap between upper and lower lip

Three methods have been successfully utilized for relaxing the upper and lower lips.

1. The mandible may be lightly jiggled in an opening and closing manner, as if one is attempting to establish centric occlusion. The amount of space between the upper and lower lips is carefully checked when the teeth lightly touch during successive elevations of the mandible.
2. 'The upper and lower lips, particularly the lower lip, may be lightly stroked with the fingers. In many instances, as the stroking continues, it will be seen that the lips relax and a space forms between the upper and lower lips.
3. instructing the patient to relax his lips. verbal instructions may be helpful in establishing a relaxed-lip position.

Closed-Lip Position³ effective lip seal facilitates swallowing, protects the teeth and, the gingivae, and adds certain retaining forces to maintain the position of the anterior teeth. There may or may not be a small amount of flattening in the area of the chin which is associated with contraction of the mentalis muscle.

Methods to Determine Normal Lip Position

Various authors used different analytical approach to measure the lip position. Most of them used cephalometric tracing of patient cephalogram. Various popular methods are:

1. **Steiner's S1-** (Figure 2) line from the middle of the S shaped curvature between the tip of the nose and sub-nasale to the soft tissue pogonion⁴.
2. **Rickett's E-** (Figure 3) is the line drawn from the tip of the nose to the soft tissue pogonion⁴.
3. **Burstone's B-** (Figure 4) line was drawn from soft tissue sub-nasale to soft tissue pogonion⁵.
4. **Sushner's S2-** (Figure 5) line drawn from soft tissue nasion to soft tissue pogonion⁵.
5. **Holdaway's H-** (Figure6) line is drawn tangent to the upper lip from soft tissue pogonion. 'H' line angle is taken between the nasion-point B line and H line⁶.
6. **Merrifield 'Z'** (Figure7) angle is taken between a line from soft tissue pogonion to the most procumbent lip, and the Frankfort horizontal plane⁵.

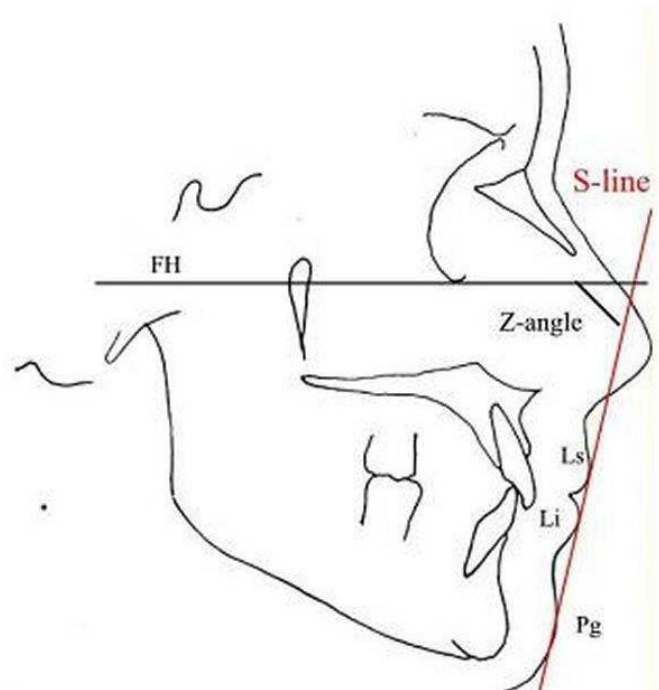


Figure 2: Steiners Line

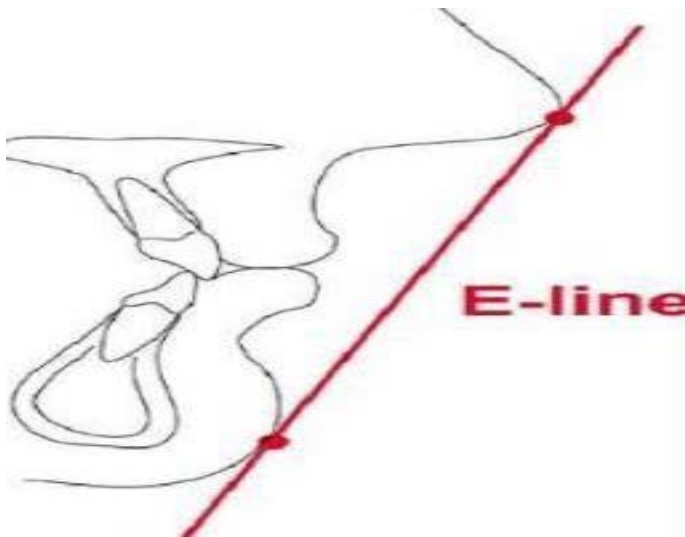


Figure 3: Ricketts E-Line

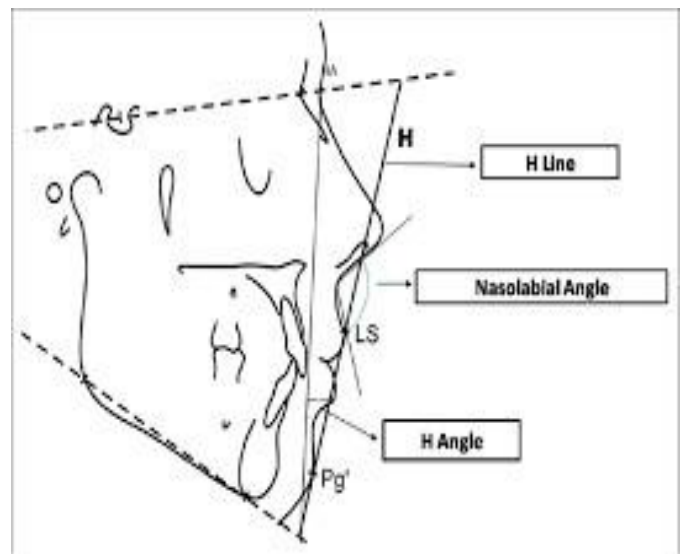


Figure 6: Holdaways Line

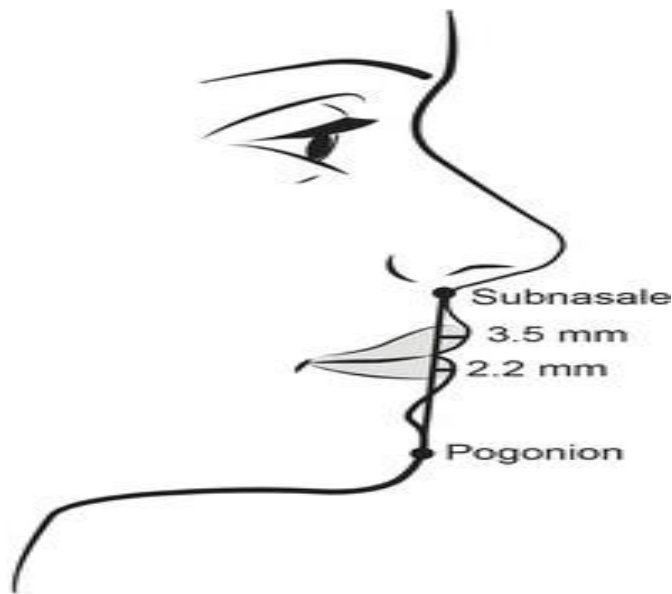


Figure 4: Burstone line

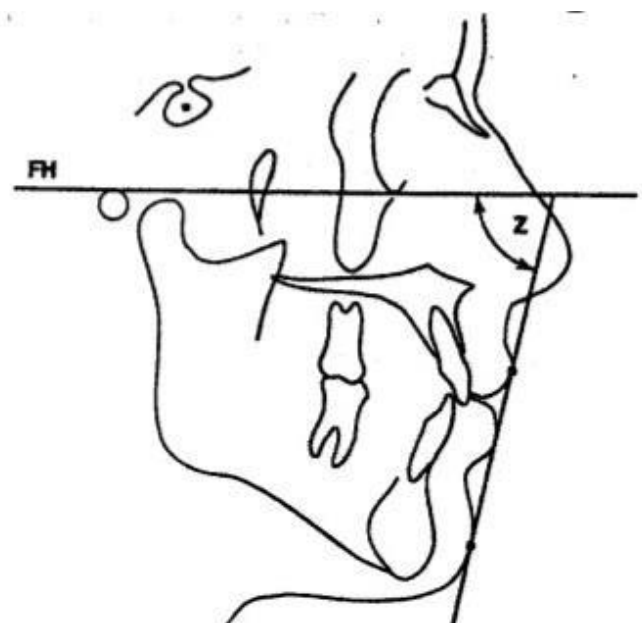


Figure 7: Merrifield Z angle

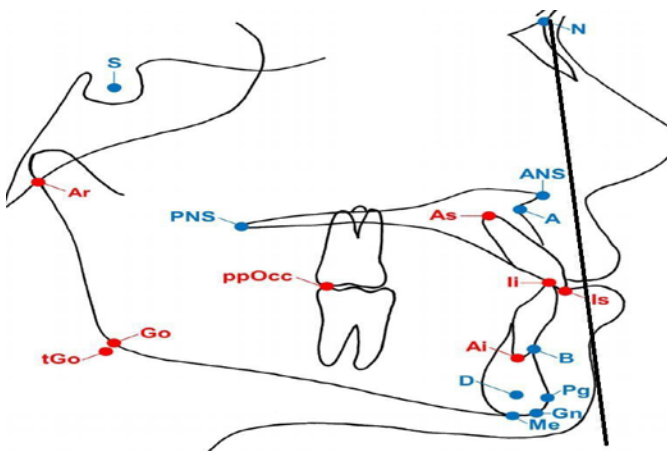


Figure 5: Sushners Line

Age Related Changes in Lips

With growth, both the skeletal and integumental chins assumed a more forward relationship to the cranium. The bony facial profile tended to become less convex with age. These changes can have some effect on the configuration of the facial profile. It also was demonstrated that the soft tissue nose continues to grow in a downward and forward direction from 1 to 18 years of age.

The upper and lower lips were found to increase in length as a function of growth. After the full eruption of the

maxillary central incisors, the upper lip was found to maintain a fairly constant vertical relationship to prosthion and the incisal edge of the central incisors. Similarly, the lower lip showed the same relative stability in its vertical relationship to infradentale and the incisal edge of the mandibular central incisors.⁷ Study has demonstrated marked growth changes in the lips between the ages of 4 and 20 years. The lower lip is elevated between the ages of 9 and 11, and there is a reduction in lip separation.⁸

In Subtelny's study⁷, it was found that the upper lip attained a greater thickness in the vermillion region than over point A. In both males and females, the upper lip increased in thickness from ages 1 to 14. After the age of 14 yrs, the lips continued to become thicker in males but not in females. Similarly, in the lower lip the gain in thickness was greater at vermillion border than at pogonion or point B. Lip thickness increase for males from ages 1 to 18 yrs was around 7 mm while for females it was around 6 mm.

Mamandras⁹ in his study of lip thickness found that the female lip thickened till the age of 14 yrs after which it remained the same till the age of 18 yrs and beyond that it showed thinning. Males attained maximum lip thickness by age of 16 yrs; after that they too showed thinning.

Nanda et al¹⁰. slightly differed from the above findings as he found that lip thickness increased uniformly from age 7 to 18 yrs and females attained full lip thickness by age 13 yrs with slight thinning starting then. In males, however, the thickness continued till the age of 18 yrs.

Effect of Growth Modification on Lip Position

It seems clear that at least Caucasians prefer a straight profile¹¹. Therefore, one of the goals of functional treatment is to attain a straighter profile from a starting retrognathic profile, characteristic of Class II division 1 patients.¹²

Activator

No changes in the naso-labial (SnLs SnNBt) and labio-mental (SiLi SiM') angles were observed (Looi and Mills, 1986)¹³, but a mild protrusion (1.8 degrees) of menton was reported (Cozza *et al.*, 2004)¹⁴. Neither the tip (Forsberg and Odenrick, 1981) nor the base (Looi and Mills, 1986) of the nose underwent any change. Some studies (Looi and Mills, 1986;) reported upper lip retrusion (-1.1 to -3 mm) but others no change (Mamandras *et al.*⁹, 1989; Cozza *et al.*, 2004¹⁴). Nanda studied changes in the soft tissue profile between the ages of 7 and 18 years and found that most soft tissue growth changes at the nose, lips, and chin showed sexual dimorphism. They reported that growth of upper lip was completed in 93 per cent of girls and in 82 per cent of boys by 7 years of age. The rates for the lower lip were 89 and 85 per cent, respectively.

Jasper Jumper

An increase in the nasiolabial angle, a more retruded position of Labrale Superius relative to the vertical reference plane, and a protrusion of Labrale Inferius relative to Esthetic Plane (E-plane) were found. No changes were found in the H-angle, upper lip relative to the E-plane, and lower lip relative to the vertical reference plane¹⁵.

Herbst

All studies^{12,16-18} reported significant changes in the facial angles related to a soft tissue menton protrusion. Regarding the nose-base angulation, no significant changes were found¹⁸. Subnasale, but not the nose tip, was more retrusive after treatment¹⁸. Whereas one study reported a retrusion, another¹⁶ reported a protrusion. Studies^{12,17,18} consistently reported no change to the lower lip and the soft tissue menton.

Effect of Orthognathic Surgery on Lip Position

One can go as far as saying that so important is the position of the soft tissues that during orthognathic planning one should consider the proposed final position of the soft tissues first and then plan skeletal movements accordingly. It is important to understand the relationship between the movement of the facial soft tissue envelope and the underlying skeletal bases during orthognathic surgery.

Soft tissue changes with maxillary surgery

Le Fort I surgery: The major effects of Le Fort I surgery is on the following structures: Nose (nasolabial angle, alar bases, nasal tip, supratip depression and dorsal hump); Upper lip; Paranasal regions. In almost all cases, a Le Fort I osteotomy results in widening of the alar bases.¹⁹ The significant factor contributing to these changes is the soft tissue dissection rather than the skeletal movements themselves. Periosteal elevation will sever important muscular attachments (zygomaticus major, levator labii superioris, levator labii superioris alaeque nasi and nasalis) leading to muscular retraction, alar flaring and shortening, and flattening and thinning of the upper lip.^{20,21}

Maxillary advancement

The Le Fort I advancement leads to alar base widening and there is an elevation and widening of the nasal tip, leading to an increase in the supratip depression, and a lowering of the columella. In patients with an already upwardly inclined nasal columella, elevation of the nasal tip can result in an increase in nostril exposure,²² which may be detrimental to facial aesthetics. If the nasal dorsum is convex in shape, nasal tip elevation can lead to accentuation of this convexity. Conversely, if there is a nasal dorsal hump before surgery, elevation of the nasal tip may improve the nasal appearance.

Maxillary superior repositioning (impaction)

With maxillary impaction, similar changes occur to those with maxillary advancement such as widening of the alar bases, elevation and widening of the nasal tip and deepening of the supratip nasal depression. Also, secondary to the effects of soft tissue dissection, there may be thinning, shortening and flattening of the upper lip, which can lead to a reduction in vermilion exposure.

Maxillary inferior repositioning (setdown)

Inferior maxillary repositioning can also help to reduce the prominence of the chin point by causing clockwise (or backward) autorotation of the mandible. Inferior maxillary movement may lead to drooping of the nasal tip, alar base and columella.¹⁹ The upper lip may flatten and thin with downward movement of the maxilla. Finally, setting down the maxilla will cause autorotation of the mandible with a resultant increase in lower anterior facial height and posterior movement of the chin point relative to the forehead and lower lip. According to envelop of discrepancy the value upto which maxillary inferior repositioning can be achieved is 15mm.²³

Maxillary set-back

The effects of a set-back may include a reduction of nasal tip and upper lip support. This may lead to a reduction of the supratip depression and an increase in the nasolabial angle. There may be widening of the alar bases due to soft tissue dissection.

According to envelop of discrepancy the value upto which maxillary set back can be done is 15mm.²³

Soft tissue changes with mandibular surgery

Bilateral sagittal split osteotomy (BSSO) The main indications for the BSSO are for the correction of mandibular retrognathism, prognathism and asymmetry. A recent systematic review on the profile changes after BSSO advancement concluded that there was poor

evidence on the short and long term effects of advancement.²⁴

Mandibular advancement

With mandibular advancement alone, one can expect a downward and forward repositioning of soft tissue pogonion with a resultant reduction in facial convexity, increase in the lower anterior facial height and increase in throat length. The increase during the planning stages of treatment. Submental-cervical surgical procedures may be required as adjunctive procedures. According to envelop of discrepancy the value upto which mandibular set back can be achieved is 25mm.²³

Conclusion

The hard and soft tissue changes in the adolescent group reflected significantly greater growth and treatment changes, both horizontally and vertically, compared with adults. Prosthion and infradentale showed the strongest relationship to upper and lower lip retraction, respectively, suggesting that the region immediately apical to the crown is singularly most important when evaluating lip retraction. Upper and lower lip retraction can be predicted with moderately high levels of accuracy using hard tissue treatment changes and pretreatment soft tissue characteristics. .

Growth of the chin and nose after completion of orthodontic treatment could alter judgments made on young subjects with considerable potential for posttreatment growth.

Orthognathic operations improved facial symmetry, particularly in skeletal Class III orthognathic patients treated by bimaxillary operation. In Class II patients operative changes increased facial soft-tissue asymmetry. Precautions should be taken during maxillary impaction and mandibular advancement to avoid asymmetry of the nasal tip and chin prominence. The new landmark-based 3D analysis of facial asymmetry is an invaluable

diagnostic tool for the assessment of soft-tissue asymmetry in patients with dentofacial deformities. The software that we used is available only for collaborative research and is not obtainable commercially

Orthodontic treatment following fixed functional appliances result in an improvement of the facial convexity was found. Changes produced by fixed functional appliances seem to restrict the forward movement of the upper lip. No change in the anteroposterior position of the lower lip and soft tissue menton was found. Soft tissue changes are similar between nongrowing young adult and growing adolescent samples

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