FACIAL CHANGES WITH AGE: AN ORTHODONTIST'S PERSPECTIVE

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ABSTRACT

A primary objective of seeking orthodontic treatmentis to improve dental esthetics. Although ideal occlusion should certainly remain the primary functional goal of orthodontics, the esthetic outcome is also critical for patient satisfaction and therefore essential to the overall treatment objectives. The growth, maturation and aging of the perioral soft tissues have a profound effect on the appearance of both resting and smiling presentations. The increase in the percentage of young adults seeking orthodontic treatment has stimulated interest in assessing facial growth during late adolescence. This paperreviews the literature based on the changes in perioral soft tissue with growth, maturation and aging as they have a profound effect on the appearance of both resting and smiling presentations.

KEYWORDS: Esthetics, Lip Length, Lip Thickness, Nose, Chin, Aging

INTRODUCTION

The facial profile changes throughout life as a result of normal growth and aging. Aging acts by changing the skin through two distinct basic processes: intrinsic and extrinsic. Intrinsic aging is inevitable, not beyond voluntary control, and reflects the genetic background of the subject. Extrinsic aging is mainly caused by sun exposure but also by smoking, excessive use of alcohol, and poor nutrition, so in some ways it can be prevented. Numerous people have investigated and quantified the frontal and profile changes that occur with the soft tissue of the face during growth, maturity, and aging.[1]

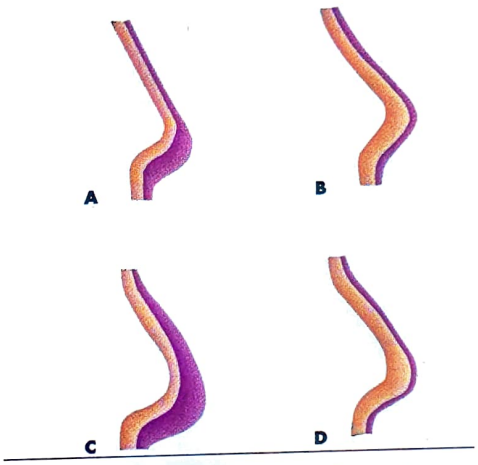

Fig 1: Examples of male and female nasal growth patterns (orange colored area illustrates growth between the ages 10-13; magenta colored area depicts growth between the ages of 13 and 16. A: Class I male B: Class I female C: Class II male D: Class II female

Esthetics is one of the prime concern for a patient to undergo orthodontic treatment and an orthodontist's treatment outcome will ultimately affects a patient's appearance for the rest of their life, hence the burden on the orthodontist is to not only understand the dentoskeletal growth and development, but also soft tissue growth and maturation[2]. The contemporary orthodontist evaluates patients in 4 dimensions: transverse, vertical and sagittal, and time. Since growth can be either a friend or a foe, it is important to determine the timing, magnitude and direction of facial growth. Although the percentage of adult patients has increased in recent years, the majority of treatment is still directed toward pre-adolescent and adolescent patients. These individuals are undergoing significant growth changes in their occlusion, facial skeleton, and profile.

The growth, maturation and aging of the perioral soft tissues have a profound effect on the appearance of both resting and smiling presentations. Orthodontic patients can be categorized as preadolescent, adolescent and adult. In preadolescent patients, the facial soft tissues are still growing and the treatment predictions must take this into account. Adolescent patients or those at the point of pubertal onset have experienced the maximum velocity in the growth of the skeletal subunits and have roughly achieved their facial soft tissue look. In adults, nuances in the aging of perioral and facial soft tissues become increasingly important[3]. Therefore, understanding the changes that occur in the integumental profile, through the normal process of growth and aging, in the various craniofacial skeletal types is essential[4]. This paper is an attempt to understand and give us an insight about the changes which are generally witnessed during maturation stages of human life.

SOFT TISSUE CHANGES TILL TEENAGE

The balance between the size of the lips,

nose and chin are essential to balanced facial appearance.The relationship between the lips, nose and chin can be altered by both growth and orthodontic treatment. It is imperative, therefore, that the orthodontist have an understanding not only of the changes incident to orthodontic treatment but also of the amount and direction of growth expected in the facial structures.

1) THE LIP

a) Vertical lip growth:

In one of the earliest quantitative studies on the soft tissue facial growth, Subtelny[5] measured longitudinal soft tissue growth changes of the upper and lower lips, the nose and the soft tissue chin. The upper lip showed rapid increase in length from approximately ages 1-3 years, but the rate of incremental growth was markedly reduced between 3-6 years. The average growth curve again showed an upswing at 6 years of age, with the increment in length occurring at about the same rate that was evident from ages 1-3. A progressive increase in length continued to be reflected by these measurements until 15 years, and then the vertical growth of lips seemed to slow appreciably. On average the growth curve for the upper lip was quite similar to the growth curve projected by Scammonet al.[6] for the general body-growth curve.

Lip separation at rest is common in growing individuals. Vig and Cohen7 documented that that the vertical skeletal and dentoalveolar growth in adolescents between ages of 4 and 20 years was generally concluded before the completion of the vertical lip growth.

Mamandras[8] concluded in his study that most of the maxillary lip length in females was achieved by 14 years. In males the curve for vertical lip growth appeared to flatten by the age of 18 but clearly was not complete **(Table 1)**. Furthermore, vertically mandibular lip length growth persisted longer than maxillary lip length in females, which completed by age 16. The incremental percentage was greater in males than in females and was also not entirely complete by age 18 **(Table 2)**.

In another study done by Genecov9 on different subject population (Bolton Brush Sample) it was found that males between age of 7-17 years had a greater increase in upper lip length than females in the same period.

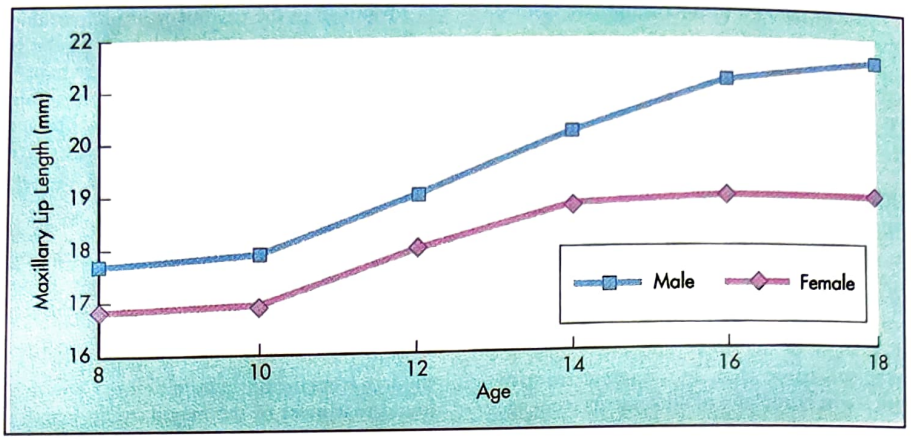

Table 1: Maxillary Lip Length changes from ages 8-18

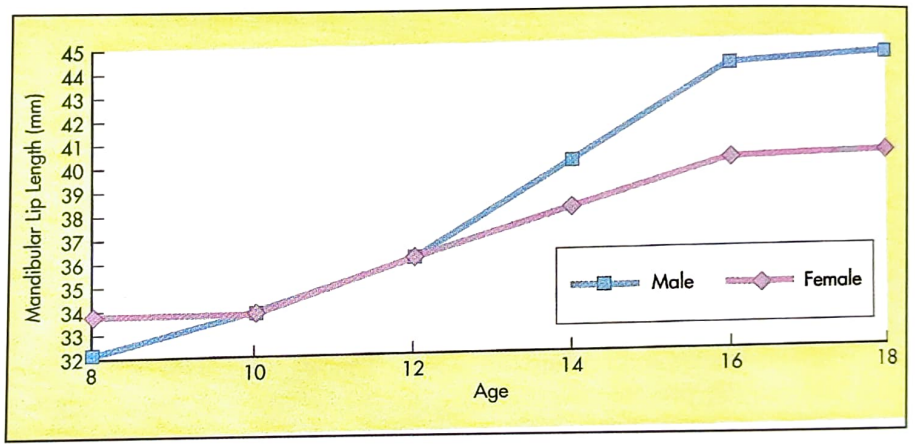

Table 2: Mandibular Lip Length changes from ages 8-18

THE CLINICAL SIGNIFICANCE

1. Most lip incompetent children at the age of 6 experience "self correction" by age 16. In the age group 6 to 8 years, lip incompetence is often subjectively related to short lips, when in reality it is probably the function of incomplete soft tissue growth and should be considered normal in most adolescents.
2. The interaction of this growth differential between the lips and dentoskeletal components offers an advantage in the treatment of unfavourable tooth - lip inter-relationships. Vertical growth of lips is age and gender related. The growth of vertical height of lips has great influence in the treatment outcomes relative to resting lip postures, resting incisor position, and smile lines.

b) Lip thickness during growth:

Subtenly[5] observed that in both males and females the upper lip attained a proportionately greater thickness in the vermillion region than at the region overlying point A. The increase in thickness seen at the vermilion border was approximately equal to the increase in length of the lip. In both male and female subjects from ages 1-14 years the upper lip was observed to increase in thickness. After the age of 14 years the males continued to show increase in upper lip thickness, whereas upper lip did not become discernibly thicker in the females. Similarly the lower lip thickness was greater in the vermilion region than at the Pogonion and point B. When the subjects of 1-18 years were examined the measurements from the most anterior point of the vermillion border of

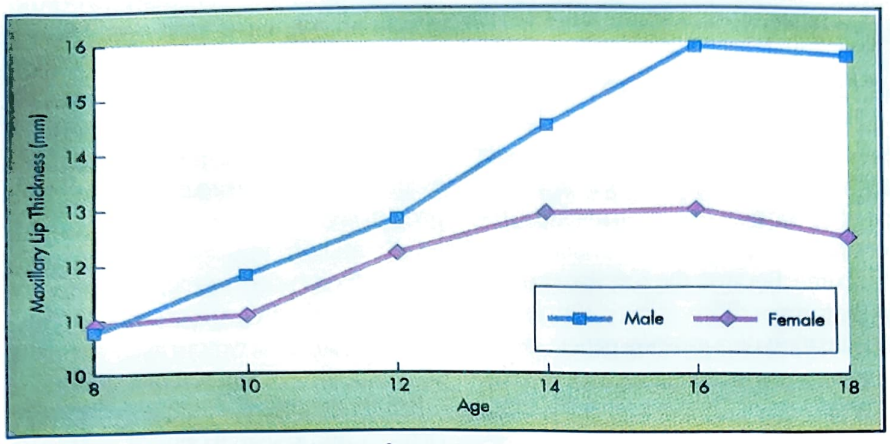

Table 3: Maxillary lip thickeness changes from ages 8-11

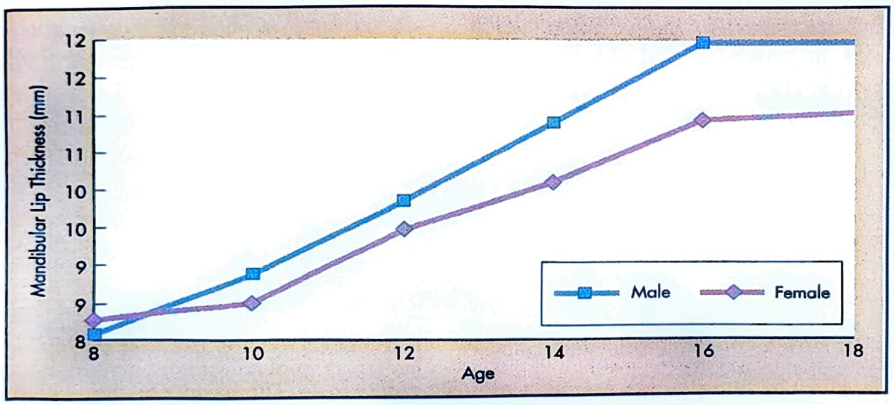

Table 4: Mandibular lip thickness changes from ages 8-11

the lower lip showed an average increase of 7mm for the male patients and 6mm for the female patients

Mamandras[8] also examined lip thickness during growth and found that, in the female the maxillary lip was at its maximum thickness by 14 of age years and remained the same until 16 years, after which lip thinning occurred. In the male, maximum lip thickness was attained around 16 years of age after which it began to become thinner **(Table 3)**. The horizontal thickness of the lower lip completed its growth in both males and females by 15 years **(Table 4)**.

Nanda in his study found that the upper lip thickness increased rather uniformly from ages 7-18; females experienced the attainment of full lip thickness at the age 13, with slight thinning beginning at that age. In males, however, the lip thickness continued on an upward curve until age 18.

THE CLINICAL SIGNIFICANCE

The differential in lip thickness between the two sexes may mean the treatment result of extraction therapy on the facial profile. Because females lips do not thicken much during puberty, any extraction treatment plan for females with straight to convex profiles should considered with caution. The analysis of lip fullness on 12 to 13 years old male should also include the fact that although the lips will become thicker, the rate of nasal growth is proportionally higher, therefore lip fullness relative to nose will decrease.

2) NASAL GROWTH AND ITS CONTRIBUTION TO THE PROFILE

Facial harmony in orthodontics is determined by the morphological relationships and proportions of the nose, lips, and chin. Because the balance among these three anatomical structures can be altered by both growth and orthodontic treatment, it is clinically important for the orthodontist to understand not only the changes that occur with treatment but also the amount and direction of growth expected in the facial structures.

It has been demonstrated that the nose grows in a downward and forward direction5, 10. The depth of the nose, as measured from the soft tissue facial plane line, shows a linear increase until the age of 15 years, after which it levels off and shows further signs of increase after the age of 17 years. Nose length also increases linearly from 3 to 13 years of age. After the age of 13, the increase in nose length is irregular.By 7 years of age, the length of the nose is 90 percent complete in girls, in boys only 67 percent of the total nose length is established.In females, most soft tissue nasal growth is complete by 12 years of age and is followed by a decrease in growth velocity after that. On the other hand, in males, nasal growth exhibits an increase in velocity after the age of 12 years and continues to grow until 17, resulting in greater dimensions. Furthermore, during adulthood, males show a greater magnitude of growth in the nose compared to females, while in both sexes the tip of the nose shows growth changes well into late adulthood, with the nasolabial angle becoming more acute with age, more so in males than females. The growth of the nose affects the overall convexity of the facial profile. As a general rule, after the age of 13 we can expect the nose to grow and the overall soft tissue profile to become more convex with time until adulthood. In an attempt to correlate malocclusion type with nose characteristics, Chaconas10 concluded that Class I subjects tend to have straighter noses, while Class III subjects showed a tendency toward a concave configuration of the nose along the dorsum.The configuration of the dorsum of the nose in Class II subjects also followed the general convexity of the Class II face.[1] **(Figure 1)**

THE CLINICAL SIGNIFICANCE

An orthodontist evaluating a Class II female at age 12 could reasonably expect that only minimal increase in nasal projectionwould

occur over next two years. However, in a male of similar age, any procedure that resulted in upper lip retraction might, in combination with several millimetres of expected anterior nasal growth, produce a less optimal final relationship between the lips and nose.8Also the nose seems to become more prominent with increasing age, and orthodontist should carefully evaluate orthodontic treatment which changes the position of the lips in cases where there is a risk of distortion of the facial proportions.

3) THE CHIN

In the analysis of the third major soft-tissue mass of the face, orthodontists have data on bony -chin projection. Genecov et al's9 study documented that soft-tissue chin thickness in females from ages 7 to 9 was greater than in males, 1.7 mm versus 10.8 mm measured from Pogonion (Pg) to soft tissue Pogonion (Pg'). But females had only a 1.6 mm increase up to age 17, whereas males had a 2.4 mm increase in tissue thickness over this period As a result, both sexes had similar (13.3mm) soft-tissue chin thicknesses at age 17.

Nanda's17 in his study on longitudinal soft-tissue and hard-tissue growth, used 3 linear measurements in the chin area: (1) soft tissue thickness at pogonion (measured from Pg to Pg'), (2) thickness of the bony symphysis, and (3) skeletal length of the mandibular corpus from the posterior border of the symphysis to a posterior reference plane. The later measurement reflected the amount or anterior displacement of pogonion produced by skeletal growth. In both sexes, all three distances increased continuously, with males showing large incremental changes than females. The size of the mandibular corpus for both sexes was approximately the same age 7 years, and the curves progressed parallel to each other until 15 years, when the male sample had larger changes than the female sample. In other words, the males experienced more mandibular growth, which resulted in increased projection of the chin, although the soft-tissue thickness of the chin itself was roughly parallel. Therefore increased chin projection seen in the male during growth is more due to mandibular growth than to soft tissue changes 1.

THE CLINICAL SIGNIFICANCE

In adolescent patient with marginal lip fullness, orthodontic placement of the upper incisors becomes very important. In this type of case incisor retraction to reduce the overjet may result in an undesirable esthetic outcome. Because the soft tissue of the face matures at different rates, simple profile evaluation on a growing patient would not be appropriate in many cases for making judgement of the expected facial form.

SOFT TISSUE CHANGES IN MATURING AND AGING FACE

What happens to the face after adolescence, in adulthood and older age? It is common knowledge that the soft tissue of the face changes (ages) over our lifetime. There are many reasons orthodontists should be knowledgeable about the effects of aging on the face.

Firstly, as we are designing treatment in the adolescent, the orthodontist is usually the first professional to make decisions on how a patient will look for the rest of his or her life. Obviously corrected anterior teeth in the adolescent may appear over retracted 20 years later. Then, if the patient is cosmetically concerned, the effects of the orthodontic treatment can be improved only by facial soft tissue surgery, orthognathic surgery, or even a combination of the two. Evaluation of the patient's desire for orthodontic treatment should include a description and quantification of dental problems but should also include frontal and profile analysis.

Secondly, the explosion of demand for adult orthodontic treatment increases the need for understanding the facial again process. Orthodontic treatment that diminishes lower facial height, reduces lip projection, decreases maxillary incisor show, or deepens the lateral nasal grooves should be avoided if possible. If these changes are necessary to attain the desired occlusal treatment goals, the patient should be informed of the effect that treatment may have on the face. The patient should interact with the orthodontist in deciding whether or not to actually pursue treatment or he or she should ask the orthodontist to coordinate treatment with the facial plastic surgeon for comprehensive functional and esthetic treatment plan.

Lastly, the continued improvement of orthognathic surgical planning and techniques makes jaw surgery a more viable patient choice in the treatment of dentoskeletal deformity. With the decrease in the morbidity of orthognathic surgery and the improved comfort associated with rigid fixation, patients are more likely to pursue surgical improvement of malocclusions.

Hunter studied 64 subjects from the Denver Child Research Council and reported that 88% of them exhibited facial growth after the age of 18.1

Formby et al. studied white males and 23 white females between the ages of 18 and 42. These subjects had class I occlusions and were considered "normal" subjects. The general soft-tissue changes in males between the ages of 18 and 42 included the following findings:

- The profile straightened, and the lips became more retrusive
- There was decreased lip thickness with slightly increased lower lip thickness
- The nose increased in size in all dimensions
- There was increased soft-tissue thickness at pogonion

The soft-tissue changes in females between the ages of 13 and 42 included the following findings:

- The profile did not become straighter, and the lips did not become more retrusive.
- There was decreased upper lip thickness with slightly increased lower lip thickness (as in the males)
- The nose also increased in size in all dimensions
- There was decreased soft-tissue thickness at Pogonion

Now that we have discussed the face from adolescence to adulthood, what happens as the patient ages into mid-adulthood (20 to45) and get older (45 to 83)?

Behrentsdocumented significant skeletal changes from ages 17 to 83. Soft-tissue changes found in Behrents' study of the subjects from ages 17 to 83 included lip changes, nasal changes1.

LIP CHANGES

The lips followed the statistical curves established in earlier studies and became less prominent and also ended to become located more inferiorly. Thus, the "thinning" of the lips was majorly due to change in drape and to a lesser extent due to soft-tissue shrinkage. That is, the upper lip tended to rotate down and back from the base of the nose. This would naturally imply that less maxillary incisor would be exposed at rest and on smile, and this was confirmed in the study by Vig and Brundel.[7]

NASAL CHANGES

There was an increase in nasal projection, and the nasal tip moved more inferiorly. The plastic surgery literature on aging, while not quantifying the changes, has always described a decrease in the vertical position (or "droop") of the nasal tip.

With the decrease in lip prominence and lowering of the nasal tip, the nasolabial angle became more acute.

CONCLUSION

As we have observed that significant changes in soft tissue profile occur throughout life,an in-depth knowledge of normal growth changes and its effect on aging of face is necessary.Orthodontist's treatment outcome not only effect occlusion, functionand esthetics but also facial form.Thereforeduring treatment planning the age of the individual and soft tissue considerations should be given adequate importance and notmerely overshadowed by skeletal discrepancy.

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USING REMINERALIZING AGENTS DOESN'T NECESSARILY HELP TEETH RECOUP THEIR ENAMEL AFTER WHITENING PROCEDURES.

A new study indicates that following in-office teeth whitening with 35 to 38 percent hydrogen peroxide, the teeth generally don't regain their enamel. There are several studies that show bleaching with large quantities of hydrogen peroxide can change the makeup of the enamel.
This information appears in ActaOdontologicaScandinvica.
To compile the data, the research team bleached 60 bovine incisors with hydrogen peroxide containing 35 percent calcium or calcium-free 35 percent hydrogen peroxide. The teeth were later exposed to artificial saliva, sodium fluoride gel or a nanohydroxyapatite-based agent.
The makeup of the enamel was then studied after 24 hours and 14 days after treatment. People that were exposed to the nanohydroxyapatite-based agent showed the highest microhardness after 24 hours. The microhardness level, however, was not the same after 14 days. Also, the morphology for all of the samples after 14 days showed many abnormalities

Minor Impact After Whitening