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AGE CHANGES IN ADOLESCENT SOFT TISSUE PROFILE AND ORTHODONTICS - A CONTEMPORARY REVIEW

Orthodontology

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ABSTRACT

The demand for early orthodontic treatment especially in the adolescents (10-18 years) owing to the compromise in facial attractiveness has escalated in recent times. The emerging soft tissue paradigm has placed greater emphasis on clinical examination of soft tissue function. The soft tissue profile can be manipulated during the course of orthodontic treatment and these changes should be planned in accordance with the other components of the dentofacial region to achieve optimum treatment results. Patients who have prominent profiles in childhood often develop better and straighter profiles in adulthood. Treatment results should be planned keeping in mind the patient's profile well into adulthood. Hence, a contemporary sound knowledge of the underlying age changes of soft tissue profile to aid in decision making while formulating a treatment plan in adolescents is paramount.

KEYWORDS

Adolescent, Age Changes, Soft Tissue, Profile, Contemporary, Growth.

INTRODUCTION

The shape of human skeleton is beautified by the drape of soft tissue. Soft tissue drape adds an aesthetic dimension to the otherwise bare skeleton. Aesthetic improvement is the single most important demand of the patients undergoing orthodontic treatment.[1]

One aim of orthodontic treatment is to harmonize a poor profile and to maintain a good one. Before this desire can be fulfilled, detailed knowledge of the normal growth changes of the face is essential. Burstone (1959) and Subtelny (1959) have shown that soft tissue, within limits, has its own growth potential. It is important to locate these growth areas, and to try to determine the amount of growth, and to ascertain at what age it occurs.[2]

The changes in soft tissue profile due to alterations implemented by treatment and concomitant growth are one of the obvious overt changes that the orthodontist is given credit for or held responsible for by the patient and the family.[3]Lack of information about the possible growth changes will make the effect of treatment hazardous and the results difficult to predict.

In the background of extensive existing literature pertaining to this topic, this article aims to provide a quick overview to ascertain the age changes taking place in the adolescent soft tissue profile to give a better perspective while arriving at a suitable treatment plan.

Soft Tissue Profile

Facial harmony in Orthodontics is determined by soft tissue profile of the patient, which is governed by the morphologic relationships, and proportions of the nose, lips, and chin.[4]

Most of the patients approach for orthodontic treatment mainly due to the presence of facial disharmony including facial deformity and malalignment of the teeth, or both. Patients have the least interest regarding changes occurring in bone or the angulations of the teeth as exhibited in a cephalometric radiograph, rather they have keen interest in visual changes which can be seen in the form of improvement in the protrusion of the lips, curl of the lower lip and the apparent growth or the forward displacement of the chin.[5] Soft tissue profile is currently one of the most critical areas of interest in the selection of orthodontic treatment after the advent of the soft tissue paradigm. Primarily through lateral cephalometric radiographs and photographs, soft tissue profile is studied extensively in orthodontics, because the soft tissue outline largely governs the aesthetics of the face.[5] Until the end of the 1950's, a common perception was that the integument profile followed passively the underlying hard tissue, although later studies demonstrated that the soft tissues have independent growth potential.[5,6] Furthermore, the variations in thickness, length and tonicity of the soft tissues may have an effect on the position and relationship of the facial structures.[5,7]

The turn of the 20th century has seen the arousal of soft tissue paradigm. Diagnosis and treatment planning are the keystones to orthodontic treatment and not the treatment procedure by itself. Hence, it is important to understand the role and importance of profile and soft tissue in arriving at treatment plan.[1]

1) Growth changes in nose

Nose is the most prominent structure in the profile of the face and it continues to grow downward and forward at a proportionately greater degree than any other structure in the facial profile. Increase in nose size takes place both in the horizontal and vertical direction but it is the anteroposterior dimension of nose that provides a gender difference.[1]

Prahl Anderson et al suggested that growth of nose occurs for a longer period in male than female. There is a spurt in growth of nose at puberty for boys. Girls do not seem to show this spurt at 12 years. The tip of the nose in girls grows relatively more upward than in boys.[8] Increase in length of the nose was the highest and most rapid. The increase in overall facial length receives a major contribution from the increase of midface-length of the nose. Increase in length of the nose is about 1 to 1.5 millimetre (mm) per year, increase in width of the nose is about 0.5 mm per year.[1] An analysis of growth changes in soft tissue profile by Meng et al, 1988 from 7 to 17 years divided the nose height into upper and lower nose height. The increase in the length of upper: lower nose height was in the ratio of 3:1.Increase in upper and lower nose height is seen in both males and females but a significant increase in upper nose height occurred in males more than the females and thus led to the increased upper anterior facial height in males.[8,12] Nose height attained adult value by around 15 years for females but beyond 18 years for males.[9]

While studying growth of the nose, it also became obvious that there is a difference in the amount of growth of the horizontal and the vertical dimensions of the nose. In most instances, the nose tends to grow longer vertically to a greater extent than it does horizontally. Females show a greater increase in nose depth than males. From 9-15 of years, nose grows anteroposteriorly about one millimetre per year. Depth variation in nose is the main reason for profile changes in late adolescence and adulthood.[10,11] In a study of the development of the nose and the facial profile by Genecov in patients from age 7 to 18 years, it was seen that nose grows greater in anteroposterior length, 5 to

6 mm in females from 7 to 12 years, but in males increase from 7 to 12 years is just about 4 mm. From the age of 12 to 17 years, males showed an increase in anteroposterior growth of about 4 to 5 mm whereas in females the increase was 1 to 2 mm only.[12] However, males continued to show growth in length of the nose even after 17 years of age. Ultimately, the nasal projection in men is greater than women because men continue to show growth in the part even after the females have stopped growing. The nose tends to become more prominent with age.[2] (Refer to fig.1)

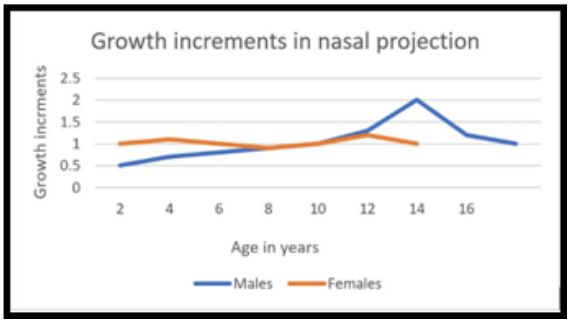

Fig. 1 – Growth Increments In Nasal Projection (In Mm) In Males And Females Over A Period Of 6- 18 Years12

Nose depth (Nanda et al) attains 85 percent of adult value for males at 7 years but almost 90 percent of the adult value for female children of the same age. The sagittal growth of the soft tissue of the nose is independent of the underlying skeleton and continues to grow even after the growth of the skeleton is complete.[11] A study by Chaconos shows that Class I subjects had a straighter and sharper nose, class II subjects were found to have more elevated nasal bridges. The shape of the dorsum also followed the facial profile; class II subjects had a more convex dorsum, class I subjects a straight one and class III subjects a concave dorsum.[13] Buschang et al, studied the growth of the nose relative to skeletal maxillary growth. Growth of nose in relation to point A and ANS(anterior nasal spine) is not equal but closely related.[14]

The nasolabial angle decreases slightly from 7 to 18 years in both males and females. The mean at 7 years was 107.8 ± 9.4 degrees for males and 114.7 ± 9.5 degrees for the females. At 18 years, the mean was slightly reduced to 105.8 ± 9.0 and 110.7 ± 10.9 degrees respectively.[8,15]

2) Growth changes in lips

The contribution of the lips to the profile is indispensable. Lips are major predeterminants of the final soft tissue profile because lips can be manipulated during the course of the orthodontic treatment. Hence, an optimum balance between the normal growth of the lips and ascertaining the changes that will take place due to the various orthodontic procedures is essential to obtain satisfying results.[15]

Growth of the lips is found to follow the general body growth of Scammon's curve with the soft tissues and muscular tissues. In studying the growth of lips, the following points should be noted: length of the lips, the thickness of the lips, lips in profile, position or relation of the lips to underlying skeletal tissues.[1] The equilibrium theory of tooth position has been developed to explain the linguofacial position of the teeth. While in the buccal segments the cheeks completely enclose the dentition, the lips do not necessarily do so anteriorly. It has long been held by orthodontists, that the relationship between the lips and the incisors is a critical factor in the stability of overjet reduction. Lip morphology is thus of considerable significance in tooth positioning, quite apart from its obvious importance in the facial profile.[16] Both upper and lower lips grow more than the skeletal lower face in children. In both absolute and proportional terms, the lower lip grows more than the upper lip.[15]

Subtelny reported that the lips tend to increase in length and thickness as a result of growth until approximately age 15 years and that, after the full eruption of the maxillary and mandibular central incisors, a constant vertical relationship was maintained to the edge of the incisors.[17,18] Genecov et al. showed in his study that males between the ages of 7 and 17 years had a greater increase in lip length than females in the same period. The males experienced little more than 2mm in the vertical growth of the upper lip whereas in females it was less than an mm.[12] In a study of soft tissue growth in the 7 to 18 years age group by Nanda, the length of the upper lip was found to increase at an annual average value of 2.7 mm in males and 1.15 mm in females. Lower lip height (measured from lower lip stomion to soft tissue B point) increased by 4.2 mm in males and 1.5 mm in females. (Ref to fig. 2)

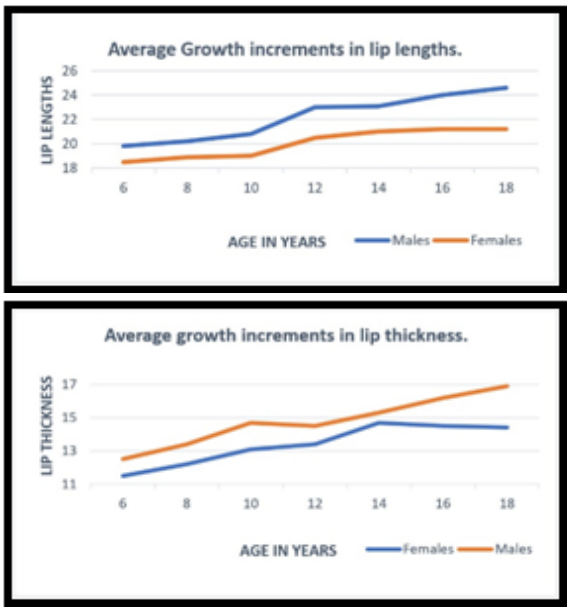

Fig.2 – Average Growth Increments In Lip Lengths And Thickness (in Mm) In Males And Females Over A Period Of 6-18 Years.[18]

Increase in length of the upper and lower lip in males is about twice the amount that occurs in females.[18,19] Prahl Anderson et al measured the distance between the tip of the upper incisor and the lowermost point of the upper lip. In girls, this distance is larger and increases more than in boys which is suggestive of a higher lip line in girls.[8] The average thickness of upper and lower lips is 11.5 and 12.5 mm respectively.

According to Nanda et al, The increase in the thickness of upper lip at point A was 4.7 mm for males and 3.5 mm for females and at labrale superius, it was 3.7 mm ad 0.7 mm respectively. The lower lip thickness increased at labrale inferius by 2.4 mm and 1.4 mm in males and females respectively and 2.8 mm and 1.6 mm at point B respectively. The horizontal measurement shows a spurt in boys after 12 years but girls do not show the spurt, the velocity of thickness decreases after the age of 13 years.[18] Mamandras in his study of lip thickness found that female lip thickened till the age of 14 years after which it remained the same till the age of 18 years and beyond that, it showed thinning. Males attained maximum lip thickness by age of 16 years; after that, they too showed thinning. [15,19] However, Nanda was of the opinion that an increase in lip thickness continued till the age of 18 years in males.[18] (Ref to fig.2)

3)Growth of the soft tissue chin

Chin is an important part of the profile that leads to straightening of the profile. The prominence of soft tissue chin depends on the underlying skeletal chin.[1]

Genecov et al.'s study documented that soft tissue chin thickness in females from age 7 to 9 years was greater than males. Females only had a 1.6mm increase until the age of 18 while the males had a 2.4mm increase in soft tissue drape over the chin. As a result, both sexes had a similar soft tissue thickness at age 17.[12] Nanda et al, studying the soft tissue profile found out that thickness of chin in males is 2.4 mm while that in females is 1.5 mm.[18] Prominence of the chin is more in males than females. Increased chin projection seen in the males was due to the mandibular growth than the increase in soft tissue chin thickness.[15]

According to Singh, the thickness of soft tissue chin varies with every facial type. Thickness of soft tissue chin was greater in brachyfacial type than the dolicofacials.[20] Subtelny measured the increase in soft tissue thickness over the chin to be 2.4 mm in males and 1 mm in females over a 15-year period.[21] According to Mauchamp et al, The amount of soft-tissue growth at pogonion was 1 mm. in females and 3 mm. in males. This increase is slightly larger than that found by Subtelny.[22] (Ref. fig.3).

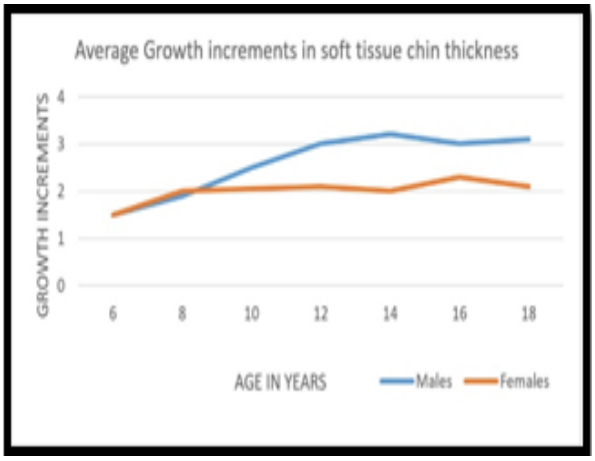

Fig.3– Growth increments in soft tissue chin thickness (in mm) in males and females over a period of 6-18 years. [12,20,22]

4) Profile Changes

According to Subtelny, with the continued growth of chin, the skeletal profile straightens but soft tissue profile remains slightly convex owing to the continued growth of nose. This proves that soft tissue growth is largely independent of skeletal growth.[1,21] According to Bishara et al, the changes in males and females were similar in both magnitude and direction. However, the timing of the greatest changes in the soft tissue profile occurred quite earlier in females (10 to 15 years) than in males (15 to 25 years). The nose continues to grow downward and forward along with forward growth of the chin. This leads to relative retrusion of lips with age. In Females, the nose continues to grow, but the chin does not grow as proportionately and owing to the posterior rotation of the mandible, develop a convex profile. However, in males, the chin continues to grow substantially in proportion with the growth of the nose leading to a straighter profile.

RESULTS

There was a consensus on the growth changes in various soft tissue structures suggesting that the nose continues to grow downward and forward with increasing prominence with age, but the period of growth is greater in males. The lips increase in length and thickness until the period of active growth after which it undergoes thinning. Lip lengths are greater in males as compared to females. The growth of the soft tissue chin is proportionate in both males and females, however due to increased mandibular growth, it appears to be more prominent in males. Males tend to develop straighter profiles in adulthood as compared to females.

DISCUSSION

The key to understanding the growth changes in soft tissue profile lies in its implications in Orthodontic diagnosis and treatment planning.

Patients with a larger nose should be re-evaluated for the decision to extract, keeping in mind the progressive retrusion of lips with age which can be accentuated by extraction and worsen the profile. On the other hand, in an adolescent with an inherently small nose, it may be advisable to institute procedures which will cause the lips to retract.[2]

Hence, when an orthodontist plans the treatment of a 12 year old girl with a Class II, small nose and protrusive lips, he should expect only minimal increase in nasal projection and not substantial growth of the chin. Thus, it would be wise to extract. However, in a male of the similar age, any procedure that results in lip retraction, in combination with the anterior nasal growth and growth at the soft tissue chin might produce a less than an optimal relationship of the lips and profile.

Significant increase in the length of the lips in males may point towards a non-extraction treatment plan. On the other hand, due to the decreased thickness of lips in females, the extraction of first premolars can lead to dished in profiles. It would be reasonable to assume that individuals would appear less protrusive as they age, and hence orthodontic treatment of children should be done keeping in mind the growth changes and should not be treated to meet the adult standards. Esthetic standards, therefore, must vary for children and for adults. Facial types also need to be considered because long-face and short-face individuals have different growth and maturational patterns.[7]

CONCLUSION

We often overlook the importance of soft tissue balance in adulthood while planning treatment in adolescents leading to compromised post-treatment profiles. Hence, a contemporary sound knowledge of the underlying age changes of soft tissue profile to aid in decision making while formulating a treatment plan in adolescents is paramount.

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