Original Article

Soft Tissue Characteristics in Different Types of Growth Pattern in North Indian Population: A Cephalometric Study

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ABSTRACT

Aims: To evaluate and co-relate lower anterior facial height and soft tissue characteristics in different growth pattern.

Materials and Methods: Three hundred thirty three Indian adults of age group 18years to 30 years were selected. Standardized lateral cephalometric radiograph was taken for each subject and then the sample was divided into 3 groups according to vertical pattern, Horizontal, Average and Vertical Facial types. Fourteen linear measurements were recorded on each lateral cephalometric radiograph.

Results: Upper lip thickness (Ls-U1),soft tissue thickness at Point B, lower lip height (St-Ils), lower soft tissue facial height and (Sn-Ms) and lower anterior facial height (Ans -me) were found to be statistically significant .

Conclusions: The soft tissue cover particularly vertical parameters of face are influenced by the underlying skeletal pattern.

Keywords: Soft Tissue Thickness ,Lower Anterior Facial Height, Cephalometrics

INTRODUCTION

 The two most important goals of orthodontic treatment are to achieve a good functional occlusion and to improve facial esthetics. As early as 1907, Angle emphasized the importance of soft tissue and facial esthetics in orthodontic treatment.[1] He believed that the harmony and the balance of the face depended largely on the form and the beauty of the mouth. Even though the concept of beauty has changed over the centuries and differs from one population to another, it has always been a subject of interest and importance to the peoples of all cultures.[2]

A proportionate relationship among different facial structures is the key to an aesthetic and pleasing facial appearance.[3] There is a paradigm shift of orthodontic diagnosis from hard tissue evaluation to soft tissue evaluation as the soft tissue profile can develop in more out of proportion to their underlying skeletal structures and still be in balance and harmony.[4] Skeletal and dental relationships are the underlying foundation of the soft tissue. However, a foundation that is harmonious does not suggest the overlying tissue of the face will be in harmony and esthetic.[5]

The prominence of the lips and nose are important. Lip thickness, strain, fullness are usually determined because the decision of dental extraction will depend on these factor in addition to the facial type, skeletal and dental patterns.[6]

Faces are often classified within the vertical dimension into high, low and normal angle groups. The types of faces are influenced by the vertical growth patterns, presence of bad oral habits, development of alveolar processes, eruption of teeth and the action of the soft tissues (lips, cheek and tongue).[7] Long face has

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excessive vertical facial growth and typically associated with anterior open bite and an increased maxillary/mandibular plane angle, sella-nasion/mandibular plane angle and gonial angle. Short face has decreased vertical growth and typically accompanied by deep bite, reduced facial heights and decreased mandibular plane angle. Average face has normal vertical pattern angles.[8]

Due to an increasing awareness on the need for orthodontic treatment as patients seek to improve their facial esthetics, a scientific understanding of anterior face proportion is also necessary.[9] Hence the aim of this study is to take all these aspects into consideration to compare the soft tissues and lower anterior facial height in different types of growth pattern.
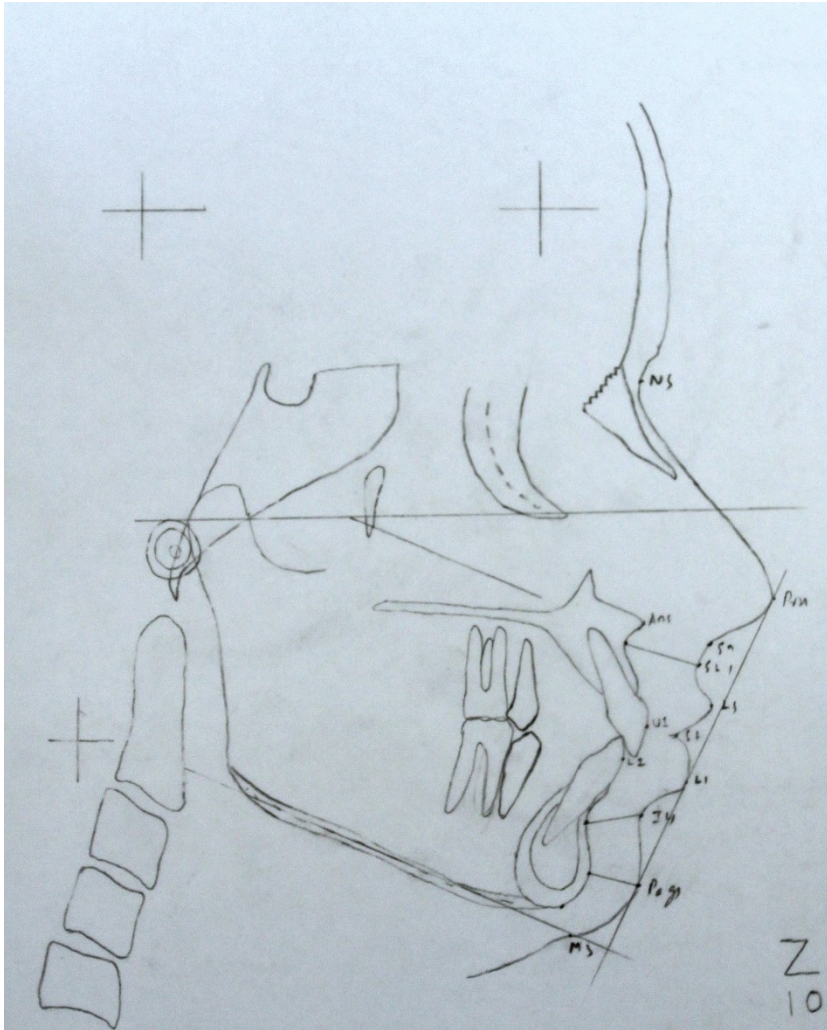
MATERIALS AND METHODS

This was a cross sectional study involving the collection and analysis of lateral cephalometric radiographs. Patients aged between 18 – 30 years who reported to the Department of Orthodontics, Saraswati Dental College for treatment were selected as subjects. The subjects were then finalized after checking the inclusion and exclusion criteria. Informed consent was obtained from patients regarding the purpose, procedures and possible complications of the study.

All procedures performed in this study involving human participants were in accordance with the ethical standards of the Institutional Human Ethics Committee, Lucknow (IHEC).

Inclusion Criteria

- Age between 18 to 30 years
- All intact permanent dentition
- No significant medical history
- No history of facial cosmetic surgery or orthognathic surgery

Exclusion Criteria

- Previous history of orthodontic treatment
- Cranial or facial malformation and history of craniofacial trauma

Pre-treatment standardized digital lateral cephalograms of 333 patients were taken with the teeth in centric occlusion and Natural Head Position. While recording the lateral cephalograms, the patients were placed in the standing upright position and asked to look directly into the reflection of their own eyes in a mirror directly ahead in the middle of the cephalostat.[10] The Frankfort Horizontal plane was parallel to the floor and the teeth in centric occlusion. The head of the patients were fixed by the two ear

Figure 1: Cephalometric reference points & lines

rods. The head was erect and centered in the cephalostat which was oriented to the cassette in Natural Head Posture, NHP. All of the cephalograms were recorded with the similar exposure parameters (KvP - 80, mA-10 exposure time 0.5 sec) with 100% magnification and the same machine (Kodak 8000C Digital and Panoramic System Cephalometer Rochester).

The x-rays were printed using Fujifilm medical dry imaging film (8 x 10 inches in size) and the Fujifilm dry pix plus printer. These cephalograms were hand traced using a sharp 4H pencil on acetate tracing paper using X- ray viewer.

All the relevant structures and landmarks were marked (Fig. 1).

The horizontal soft tissue measurements; anterior nose depth; soft tissue thickness at point A; soft tissue thickness at labrale superius; soft tissue thickness at labraleinferius; soft tissue thickness at point B; soft tissue thickness at pogonion; upper lip to E -line; lower lip to E-line

The vertical soft tissue measurements: upper facial height; Upper lip height; Lower lip height.; Chin height; Lower facial height; Skeletal lower anterior facial height.

The samples were divided into 3 groups:
Group 1: Horizontal growth pattern (FMA ≤ 20°)

Group 2: Average growth pattern (FMA 21° – 25°)

Group 3: Vertical growth pattern (FMA > 25°)

All the above-mentioned parameters were measured in the cephalograms. Measurements were compiled, compared within the 3 groups and between genders and the results obtained using statistical analysis.

STATISTICS

To control the errors in tracing and analysis, Dahlberg's (1940),[11]formula was applied. A master file was created and the data was analyzed using SPSS software (version 26). Group differences were analyzed with ANOVA. Probability that the result is true of <0.05) was considered as statistically significant after assuming all the rules of statistical tests (p <0.05). For multiple comparisons, a post – hoc Tukey Honestly significant difference test was used.

RESULTS

Upper lip thickness (Ls-U1),soft tissue thickness at Point B, lower lip height (St-Ils),lower soft tissue facial height and (Sn-Ms) and lower anterior facial height (Ans -me) were found to be statistically significant . Results for comparing variables among the 3 groups of facial types are presented in Table (1).

DISCUSSION

Facial esthetics is considered as one of the main goals of orthodontic treatment and increased emphasis has been placed on it in recent years by both patients and orthodontists since the soft tissue outline largely determines the esthetics of the whole face.[12]Anwar et al.[13]stated that vertical facial form is an important element of orthodontic assessment. Large variations are found in the vertical dimension and these affect the clinician's approach to successful diagnosis, treatment planning, and mechanics.

The mean value for Sn-Prn in horizontal, average and vertical growth pattern was 16.054 mm, 16.054 mm and 16.354 mm respectively. This depicts that the value were almost the same showing an insignificant between the three growth pattern. This result was in congruence with the works done by Al-Sayagh et al.[12] They stated that most of the differences among the 3 group of facial types were in the vertical soft tissue measurement.

While considering the three group pattern the Point–A value also showed an insignificant difference. This was supported by Al-Sayagh et al.[12]and Blanchette et al.[14]Similar to Sn-prn, Point A showed gender dimorphism with male exhibiting a greater value (16.043) than their female (13.325) counterpart. These results were in accordance with Taki et al.[15], Al-Sayagh et al.[12], Basciftci et al.[16] and Blanchette et al.[14].

On comparing horizontal and average growth pattern lower lip thickness at point B was insignificant (p=0.985). However the difference was significant on comparing the lower lip thickness of vertical growth pattern with other groups. Lower lip thickness at point B for vertical growth pattern was significantly higher than its corresponding counterpart. This result was

Table 1: This table showing the significant difference among the three groups of growth pattern (horizontal, average and vertical) with respect to the following parameters.

S. No.	Landmark	Comparison	Sum of Squares	Df	Mean Square	F	p
1.	Sn-Prn	Between Groups	6.642	2	3.321	.693	0.501
		Within Groups	1576.524	329	4.792		
		Total	1583.166	331			
2	Point-A	Between Groups	13.285	2	6.643	1.279	0.280
		Within Groups	1713.459	330	5.192		
		Total	1726.745	332			
3	Point-B	Between Groups	66.961	2	33.480	7.986	0.000
		Within Groups	1383.568	330	4.193		
		Total	1450.529	332			
4	Pogs	Between Groups	10.384	2	5.192	1.098	0.335
		Within Groups	1560.811	330	4.730		
		Total	1571.195	332			
5	Ls-U1	Between Groups	45.988	2	22.994	4.566	0.011
		Within Groups	1661.928	330	5.036		
		Total	1707.916	332			
6	Li-L1	Between Groups	24.006	2	12.003	2.109	0.123
		Within Groups	1877.820	330	5.690		
		Total	1901.826	332			
7	UL-Eline	Between Groups	60.883	2	30.441	4.612	0.011
		Within Groups	2178.360	330	6.601		
		Total	2239.243	332			
8	LL-Eline	Between Groups	207.134	2	103.567	5.592	0.004
		Within Groups	6093.623	329	18.522		
		Total	6300.756	331			
9	Ns-Sn	Between Groups	40.547	2	20.273	.810	0.446
		Within Groups	8257.441	330	25.023		
		Total	8297.988	332			
10	Sn- St	Between Groups	19.213	2	9.607	.969	0.381
		Within Groups	3272.757	330	9.917		
		Total	3291.970	332			

S. No.	Landmark	Comparison	Sum of Squares	Df	Mean Square	F	p
11	Ils-MS	Between Groups	11.586	2	5.793	.267	0.766
		Within Groups	7172.739	330	21.736		
		Total	7184.324	332			
12	St-Ils	Between Groups	68.835	2	34.417	5.520	0.004
		Within Groups	2057.423	330	6.235		
		Total	2126.258	332			
13	Sn-Ms	Between Groups	500.547	2	250.273	3.627	0.028
		Within Groups	22771.784	330	69.005		
		Total	23272.330	332			
14	Ans-_Me	Between Groups	1086.613	2	543.306	20.005	0.000
		Within Groups	8962.414	330	27.159		
		Total	10049.027	332			

supported by Al-Sayagh et al.[12] and Blanchette et al.[14]

On comparison between the three groups of growth pattern Pogs showed in insignificant difference. This was accordance with Al-Sayagh et al.,[12] Al-Mashhadany et al.,[7] Macari et al.[8] and Somaiah et al.[5] Somaiah et al [5] and Macari et al.[8] stated that soft tissue thickness was statistically significantly different at Gn and Me but did not at Pog. This suggested the presence of a differential extension between hard and soft tissues during growth. Contrasting to the above results was the work done by Subramaniam et al.[17] They stated that hypodivergent individuals have an increased chin thickness when compared to hyper or normo-divergent individuals..

Upper lip thickness did show significant difference on comparing the horizontal (11.66) and vertical growth pattern (12.55) with vertical growth pattern showing the higher value. This was against the results published by Al-Sayagh et al.[12]. This can be attributed to the variation in sample size, location and the ethnic origin that was taken in the study.

Lower lip thickness at Li showed an insignificant difference between the three groups. This was supported by work done by Al-Sayagh et al.[12] and Al-Mashhadany et al.[7] On comparing the three groups there was a significant difference in upper lip to E line value between horizontal growth pattern and its respective counterparts. In horizontal growth pattern the upper lip was behind the E line by an average of 2.099 mm in the average growth pattern the mean value was -1.225 mm indicating the upper lip to be slightly behind E line whereas in the vertical growth pattern it was similar to average pattern showing the value of -1.162 mm. However lower lip to E line did show a significant difference on comparing the horizontal and average growth pattern with the lower lip behind the E line in horizontal growth pattern while it is ahead in the two groups. These results were against the study done by Al-Sayagh et al.[12]

Comparison of upper facial height (Ns-Sn) showed an insignificant difference between the growth patterns. This was supported by Al-Sayagh et al.[12] They stated that upper facial height did not show any compensatory mechanism for increase vertical growth.

Upper lip also showed an insignificant difference between three growth pattern. Contrasting the results done by Blanchette et al.[14] and Jeelani et al.[3] They stated that subject with long faces were likely to have long upper lips this could by a compensatory mechanism to perform lip seal in patient with vertical growth pattern.

Lower lip height showed a significant between horizontal and vertical growth pattern with vertical growth pattern having longer lower lip.

The only insignificancy was found between average and vertical growth pattern. This result was supported by the studied done by Al-Sayagh et al.,[12] Blanchette et al.[14] and Jeelani et al.[3] They stated that the longer lower lip in long face group could have been a compensatory mechanism for the subject to perform lip seal. Lower lip height also showed a gender dimorphism with males show higher value than females. This was supported by Al-Sayagh et al.,[12] Blanchette et al.[14] and Kalha et al.[18]

Comparison of chin height between the three growth patterns showed insignificant difference. Contrary to the results that were done by Al-Sayagh et al.[12]and Reveiro et al.[19]. They stated that the long face subject showed the largest chin height. This lead to inference that soft tissue chin height was affected by skeletal vertical pattern. This can be considered as compensatory mechanism for subject with increase pattern to perform a lip seal. This difference in opinion may be attributed to variance in sample size and allocation

Soft tissue lower facial height showed significant difference when vertical growth pattern was compare with horizontal and average growth pattern with long faces showing a greater value. This was supported by the work done by Al-Sayagh et al.[12] They stated that this could be a compensatory mechanism for subject with increased vertical pattern to perform a lip seal.

Soft tissue lower facial height did show gender dimorphism with males showing a greater value than females .This was supported by Al-Sayagh et al.[12] and Kalha et al.[18]. They stated that the increased lower lip length as the possible reason for supporting a higher value for males.

CONCLUSION

Most of the soft tissue variables showed a significant difference between the three growth patterns. Upper lip thickness, soft tissue thickness at point B, lower lip height, lower soft tissue facial height and lower anterior facial height (skeletal) were higher for the vertical growth pattern. This is considered as natural way of compensating to mask the condition and to provide normal facial appearance with proper lip seal.

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