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Original Article

Cephalometric Differences In Male And Female Characteristics of Facial Soft Tissue Thickness In Various Orthodontic Malocclusions

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ABSTRACT

Objective: To compare the mean facial soft tissue thickness between males and females in different malocclusion groups.
Study Design: Cross-Sectional Study.
Place and Duration of Study: Armed Forces Institute of Dentistry, Rawalpindi Pakistan, from Jan 2020 to Jan 2021.
Methodology: Cephalometric radiographs of 230 patients were used to measure soft tissue thickness at seven landmarks: the glabella, subnasal region, labrale superius, labrale inferius, sulcus labrale superius, labiomentalis, and soft tissue chin.
Results: Of 230 patients, 39% were of Class I, 21% of Class II/1, 26% of Class II/2 and 13% of Class III. The gender ratio was the same in all skeletal classes. The mean age of 230 patients was 18.36±2.29 years. The mean ANB angle and UI were 4.02±3.22 and 25.95±8.86. The mean ANB angle and UI significantly differed between skeletal classes. In contrast, the mean age of patients of different skeletal classes was not significantly different, with a p-value of 0.433. The mean FSTT measured from subnasal area (A-NS), sulcus labrale superius (RR-SLS), labrale superius (J-LS), labrale inferius (I-Li) and chin (Pg-Pg1) was significantly different between skeletal classes (p value <0.001).
Conclusion: The facial soft tissue thickness was thicker in class III. The FST measured through the labrale superius (J-LS) of male patients was thicker than that of female patients in all skeletal class patients.

Keywords: Cephalometric data, Facial soft tissue thickness. Skeletal patterns, Soft tissue thickness

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INTRODUCTION

In orthodontic literature, more proportional and symmetrical faces are considered more aesthetic. Therefore, orthognathic surgery is often offered to patients with marked asymmetry or disproportionality of facial features.[1,2] Distance from the skull to facial soft tissue is the major focus of craniofacial identification.[3] Facial soft tissue thickness (FSTT) provides a means for measurement of the thickness of soft tissue that envelopes the skull bones. There have been attempts to describe the mean values of FSTT, especially in forensic literature. However, individual variations in FSTT are prevalent in different populations.[4] Cephalometry is an invaluable tool that helps orthodontists gain better insight into the underlying skeletal relationships affecting the dentoskeletal pattern.[5]

Various studies have been conducted on the variations in facial soft tissue thickness among different populations.[6-8] For the Pakistani population, Jeelani *et al*. conducted research on the variations in FSTT among different skeletal classes, and they came to the conclusion that in all skeletal classes, FSTT is greater for males than females and patients with class II and class III malocclusion had a greater predilection for this gender dimorphism.[9]

More studies on the variability of FSTT are required in our Pakistani population to have better insight into the relation of FSTT to the underlying skeletal jaw relationships and the gender dimorphism that influences the variations in the FSTT.[10] The objective of our research is to identify the relationship between male and female characteristics of FSTT to the underlying skeletal jaw relations utilising cephalometric data and to categorise the FSTT measurements according to various sagittal endoskeletal patterns according to both genders. Furthermore, our study also aims to compare the FSTT values of the subjects in the same malocclusions classes.

METHODOLOGY

The cross-sectional study was conducted at theArmed Forces Institute of Dentistry, Rawalpindi, Pakistan from January 2020 to January 2021 after approval by the Ethical Committee (letter no. 918/Trg,

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dated 06-01-2020). The sample size was calculated using the WHO sample size calculator, taking the mean postoperative pain after intramuscular Diclofenac sodium of 0.54±0.658 and after rectal Diclofenac sodium of 1.38 ± 0.907.[11]

Inclusion Criteria: The study included patients of either gender, aged 19 to 70, who presented in the Outpatient Department with acute herpetic neuralgia.

Exclusion Criteria: Pregnant females, patients with a known allergy to Bupivacaine or Methylcobalamin, patients with a localised abscess at the site of injection, patients with known diabetes mellitus (BSR>186mg/dl) or ischemic heart disease or any previous history of arrhythmia, trauma, or previous orthodontic treatment and orthognathic surgery were excluded.

This study utilised lateral cephalograms, which were obtained for the patients undergoing orthodontic treatment at AFID. Patients were categorised into four groups according to Steiner's ANB angle and the inclination of maxillary central incisors. Group-I consisted of subjects with an ANB angle between 2-4, with a class I skeletal relationship. Group-II consisted of subjects with a skeletal jaw relationship of Class-II with ANB of more than 4 and a dental relationship of Class-II Division I with maxillary incisor inclinations of more than 22. Group-III consisted of subjects with skeletal jaw relationship of Class-II with ANB more than 4 and dental relationship of Class-II division II with maxillary incisor inclination less than 22. Grou-III consisted of subjects with class III skeletal jaw relationship with ANB of less than 1.

On the cephalometric radiograph, the ANB angle was traced first, along with upper incisor inclinations. After that, the following landmarks were traced: Posterior Nasal Spine (PNS), which denotes the posterior limit of the hard palate; Anterior Nasal Spine (ANS), which denotes the anterior-most point on the maxillary bone and by connecting ANS and PNS, an ANS-PNS plane was drawn which represents the basal plane of the maxilla. All the readings for soft tissue thickness were measured parallel to the ANS-PNS plane. Seven landmarks from the Burstone analysis were utilised to measure the FSTT.;FSTT at Glabellar area (G-G1): [Linear distance between G point (represents the most prominent point on the frontal bone) and G1 point (represents the soft tissue analogue of the G point).FSTT at Subnasal area (A-SN): The linear distance between the A point (the Deepest point on the curvature extending from the ANS to the Prosthion point) and subnasale. FSTT at sulcus labrale superius (PR-SLS): Linear distance between Prosthion point (Denotes the most inferior point on the maxillary alveolar process between central incisors) and SLS point (Denotes the deepest midline point located on the outline of superior labial sulcus). FSTT at labrale superius (J-LS): Linear distance between J point (Denotes the most labial point on upper incisors) and labrale superius (Point taken on the surface of the upper lip). FSTT at labrale inferius (I-Li): Linear distance between point I (Denotes the most labial point on the lower incisors) and labrale inferius (Point taken on the surface of the lower lip). FSTT at sulcus labiomentalis (B-SLI): Linear distance between point B (Denotes deepest point located on the mandibular symphysis) and labiomental sulcus (SLI) FSTT at chin (PG-PG1): Linear distance between hard tissue pogonion (Pg point) and the corresponding soft tissue pogonion (Pg1 point)] (Figure).

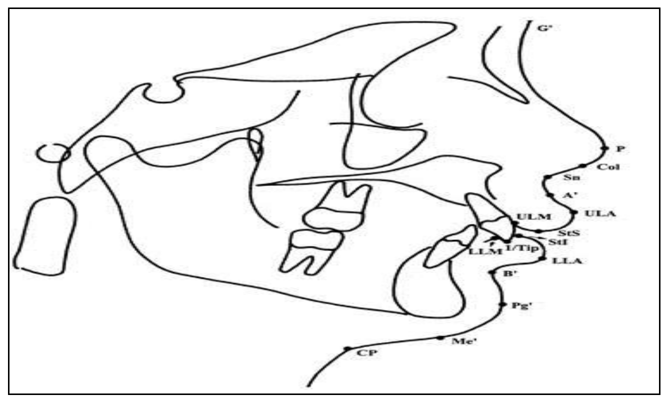

Figure: Soft tissue landmark:Soft tissue glabella (G'), Pronasale (P) , Columella (Col), Subnasale (Sn), Soft tissue A point (A'), Upper lip mucosa side opposite A' (ULM), Upper lip anterior point (ULA), Stomion superius (Sts), Stomion inferius (Sti), Tip of upper incisor (1/Tip), Lower lip mucosa opposite B' (LLM), Lower lip anterior point (LLA), Soft tissue B point (B'), Soft tissue Pogonion (Pg'), Soft tissue menton (Me') and Cervical point (Cp)

Data was analysed using the Statistical Package for the Social Sciences (SPSS) version 23.00. Mean±SD was calculated for continuous variables. Frequency and percentage were calculated for categorical variables. The Independent sample t-test was used to compare mean facial soft tissue thickness between males and females at each skeletal class. The p value ≤ 0.05 was considered significant. ANOVA test was used to compare mean FSTT between skeletal classes at each distance.

RESULTS

Of 230 patients, 39% were of class I, 21% of class II/1, 26% of class II/2 and 13% of class III. The male and female patients were equal in all skeletal class groups. The average age of the patients was 18.36±2.29 years. In male patients, the average age of the patients of malocclusion Group I, II/1, II/2 and III was 18.42±2.26, 18.76±2.57, 19.07±2.2 and 18.27±2.28, respectively, with *p* value 0.601. In female patients, the average age of the patients of malocclusion Group I, II/1, II/2 and III was 17.93±2.05, 18.08±3.07, 17.5±1.25 and 19.67±2.38, respectively, with *p* value 0.021.

The mean ANB angle was 4.02±3.22. The mean ANB angle in malocclusion groups I, II/1, II/2 and III was 2.50±0.94, 5.98±3.12, 6.12±1.87 and 1.13±4.88, respectively, with *p*-value <0.001. The result was the same with the stratification of gender. In male patients, the mean ANB angle in malocclusion Groups I, II/1, II/2 and III was 2.22±0.88, 5.36±3.73, 6.33±2.09 and -2.80±2.11, respectively, with *p* value 0.001. In female patients, the mean ANB angle in malocclusion Groups I, II/1, II/2 and III was 2.78±0.93, 6.60±2.27, 5.90±1.63 and 5.07±3.43, respectively, with *p*-value <0.001 (Table-I).

Table-I: Comparison of Facial Soft Tissue Thickness at Different Points Between Different Skeletal Classes (n=230)

Facial Soft Tissue Thickness points	Skeletal Classes				*p*-value
	Class I	Class II/1	Class II/2	Class III	
Glabellar area (G-G1)	5.51±0.97	5.54±0.97	5.43±0.83	5.50±1.01	0.941
Subnasal area (A-SN)	16.07±3.73	15.02±2.39	13.92±2.68	18.50±9.08	<0.001
Sulcus labrale superius (RR-SLS)	12.18±1.92	12.18±2.07	10.23±2.35	11.77±2.47	<0.001
Labrale superius (J-LS)	12.41±2.99	11.7±1.83	11.15±2.43	11.33±3.12	0.027
Labrale inferius (I-Li)	14.63±2.73	14.66±2.77	13.45±2.15	14.13±3.35	0.042
Sulcus labiomentalis (B-SLI)	11.83±2.39	12.2±1.75	12.35±3.24	13.13±3.53	0.145
Chin (Pg-Pg1)	11.66±2.33	12.24±2.67	10.28±1.38	13.57±4.12	<0.001

The mean UI was 25.95±8.86. The mean UI in malocclusion groups I, II/1, II/2 and III was 28.49±8.23, 29.76±6.4, 17.68±6.56 and 28.53±7.83, respectively, with *p*-value <0.001. The result was the same with the stratification of gender. The results show that the mean FSTT measured from the subnasal area (A-SN) was significantly different in Class III patients with respect to other skeletal classes, with p values of 0.009, 0.001, and 0.001 compared to the patients of Class I, Class II/1, and Class II/2.

The FSTT measured from sulcus labral superius (RR-SLS) was significantly different for class II/2 patients with respect to other skeletal classes patients, i.e., Class I, Class II/1 and Class III, with *p*-value <0.001, <0.001 and 0.002, respectively.

Surprisingly, the mean FSTT measured from labral superius (J-LS) was found to be very low in class II/2 as compared to the patients of other skeletal classes but significantly as compared to class I patients with a p-value of 0.005. Similarly, the mean FSTT measured from labral inferius (I-Li) in class II/2 patients was significantly low compared to the patients of class I and class II/1 with p values of 0.009 and 0.02. The mean FSTT measure from the chin (Pg-Pg1) was significantly different in class II/2 and class III patients compared to class I and class II/1 at a 5% significance level.

Table II mentions a detailed comparison of mean FSTT measures from different points between males and females with stratification of the skeletal class.

DISCUSSION

The findings of our study showed that there was a difference in soft tissue thickness measured at different landmarks for different classes of malocclusions. The greatest soft tissue thickness at the glabellar region was found in Class III and Class II division II patients, whereas soft tissue thickness at the subnasal area was greatest for Class III patients. The soft tissue thickness for sulcus labrale superius was greatest in Class I and III patients. Soft tissue thickness at the labral inferius was greatest for class I patients, whereas soft tissue thickness at the labiodental sulcus was greatest for class III patients. Soft tissue thickness at the chin was greatest for class III patients.

The variations in soft tissue thickness for different malocclusions indicate how soft tissues compensate for underlying skeletal structures.[12-14] In some cases, soft tissue compensates for the skeletal discrepancy in such a manner that the discrepancy is camouflaged to a great extent. This can explain some of our study's findings. The skeletal class III pattern is caused by either maxillary retrognathism, mandibular prognathism, or a combination.[15] Thus, greater soft tissue thickness at the upper labial sulcus and upper lip tends to mask some of the underlying jaw discrepancy in class III patients.

higher in females. In contrast, the rest of the facial soft tissue thickness values were higher for males. In skeletal Classs III patients, all the facial soft tissue thickness values taken in our study were higher for males.

Table-II: Comparison of Facial Soft Tissue Thickness Between Male and Female at Different Points in Skeletal Classes (n=230)

Skeletal Class	Facial Soft Tissue Thickness	Male	Female	*p* value
Class I	Glabellar area (G-G1)	5.49±1.24	5.53±0.63	0.830
	Subnasal area (A-SN)	16.00±2.54	16.13±4.66	0.867
	Sulcus labrale superius (RR-SLS)	12.51±1.80	11.84±1.99	0.099
	Labrale superius (J-LS)	13.38±2.99	11.44±2.69	0.002
	Labrale inferius (I-Li)	15.29±2.87	13.98±2.45	0.022
	Sulcus labiomentalis (B-SLI)	11.47±1.80	12.2±2.83	0.147
	Chin (Pg-Pg1)	11.62±1.98	11.69±2.66	0.893
Class II/1	Glabellar area (G-G1)	5.64±1.11	5.44±0.82	0.474
	Subnasal area (A-SN)	16.20±2.52	13.84±1.55	<0.001
	Sulcus labrale superius (RR-SLS)	12.92±1.73	11.44±2.14	0.01
	Labrale superius (J-LS)	12.28±1.90	11.12±1.59	0.024
	Labrale inferius (I-Li)	15.28±3.39	14.04±1.84	0.116
	Sulcus labiomentalis (B-SLI)	12.68±1.11	11.72±2.13	0.053
	Chin (Pg-Pg1)	13.16±2.67	11.32±2.39	0.014
Class II/2	Glabellar area (G-G1)	5.33±0.48	5.53±1.07	0.357
	Subnasal area (A-SN)	15.67±0.48	12.17±2.84	<0.001
	Sulcus labrale superius (RR-SLS)	11.00±2.88	9.47±1.33	0.011
	Labrale superius (J-LS)	12.67±0.96	9.63±2.53	<0.001
	Labrale inferius (I-Li)	14.33±0.96	12.57±2.62	0.001
	Sulcus labiomentalis (B-SLI)	14.33±2.92	10.37±2.17	<0.001
	Chin (Pg-Pg1)	9.67±0.48	10.90±1.69	0.001
Class III	Glabellar area (G-G1)	5.67±1.05	5.33±0.98	0.375
	Subnasal area (A-SN)	20.87±8.50	16.13±9.3	0.157
	Sulcus labrale superius (RR-SLS)	12.73±2.02	10.80±2.57	0.03
	Labrale superius (J-LS)	13.07±2.31	9.60±2.90	0.001
	Labrale inferius (I-Li)	14.47±3.25	13.80±3.53	0.595
	Sulcus labiomentalis (B-SLI)	13.4±3.98	12.87±3.14	0.687
	Chin (Pg-Pg1)	14±4.5	13.13±3.80	0.573

A few other studies have also attempted to categorise the variations in FSTT among different skeletal classes. Utsono *et al*. conducted a study in Japanese females in which they found differences in FSTT at sub nasale, stomion, labrale superius, pogonion and labiomentale in different skeletal classes.[16] In another study by Kamak *et al*. on Turkish people, there were significant differences in FSTT at labiodental and labral superius and common among different skeletal classes.[17]

Our study also demonstrated the variations in FSTT among different genders in various classes of malocclusion. In skeletal Class I patients, soft tissue thickness at labrale inferius and labrale superius was greater in males than in females. In skeletal Class II division I patients, all facial soft tissue thickness values except for the facial soft tissue thickness in the glabellar region were higher in males. In skeletal Class II division II patients, facial soft tissue thickness at soft tissue chin and glabellar region was significantly

In a study conducted by Hamid *et al*. in the Sudanese population, males were found to have the thickest soft tissues at points rhinion, labiomentale, labrale superius and labrale inferius in all class I, II, III skeletal jaw relationships and sub nasale in class I and III skeletal jaw relationships.[18] In another study conducted by Eftekhari-Moghadam *et al*., gender differences were found in skeletal class II and class III subjects at glabella, rhinion and lip region.[19] In contrast to these studies, our study did not measure facial soft tissue thickness difference at point rhinion.

As shown by the results of our study, gender is one of the main determinants of facial soft tissue thickness in different classes of jaw relationships. This should be considered when formulating a customised treatment plan for orthodontic patients.

One limitation of our study is that an unequal number of males and females were taken for each category of skeletal classes. This may have made some of our observations conflict with the results observed in other studies.

CONCLUSION

Facial soft tissue thickness (FSTT) at glabellar region, subnasal region, labrale superius, labiomental sulcus and soft tissue chin were greatest for skeletal class III patients. FSTT at labrale inferius was the greatest for skeletal Class I patients. Patients with skeletal Class II division II had comparatively higher FSTT at the glabellar region. In skeletal Class I patients, FSTT at labrale superius and labrale inferius was higher for males. For skeletal Class II division I patients, all FSTT values except for at the glabellar region were higher for males. For skeletal Class II division II patients, FSTT values except at the chin and the glabellar region were higher for males. For skeletal Class III patients, all FSTT values were higher for males.

Conflict of Interest: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

NA & EA: Data acquisition, data analysis, drafting the manuscript, critical review, approval of the final version to be published.

RN & MI: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

TI & TA: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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