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Assessment of soft tissue thickness difference between Class I , Class II ,Class III Skeletal malocclusion -" A retrospective study"

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I. INTRODUCTION

The human face is the most characteristic and recognizable part of a human body. A proportionate relationship among the different structures of a face is the key to its esthetic and pleasing appearance[1].Changes in the morphology of facial soft tissues have been a major concern of orthodontic patients, especially for female adults[2].The facial profile is determined not only by the dental and skeletal characteristics but also by the soft tissue thickness'Soft tissue analysis in orthodontics, not only plays important role to assess facial esthetics rather it is very important step in determining the treatment outcome.Though maximum information obtained from hard tissue analysis, it is not enough to reconstruct a proper face completely, soft tissue analysis also has immense value in treatment planning.

It was previously thought that the configuration of the soft tissue profile was primarily related to the basic skeletal configuration. However, there have been reports to indicate that the soft tissue acts independently of the basic dentoskeletal base, since the soft tissue is very variable in thickness, and is considered to be the main factor in determining a patient's orthodontic treatment planning major consideration was given to dental and skeletal tissues however today a lot of studies show that soft tissue plays important role in determining final facial profile after treatment hence both hard and soft tissue together in a harmony gives a productive treatment outcome[3].

Different racial groups consist of different soft tissue thickness according to their own characteristics. Soft tissues are one of the causative factors of Class II malocclusion, for example, Class II div 1 malocclusion may be due to hypotonic upper lip or may be due to retroclined lower incisors, because of hyperactive lower lip[4].

Various studies have been conducted at different population to determine the soft tissue thickness in different classes of skeletal malocclusion and a study by Basciftciet al[5]. Whostudied among Turkish adults found that there was a significant difference between genders for soft tissue chin thickness and upper lip thickness. Similarly, HasanKamak[7] conducted a study on soft tissue thickness among skeletal malocclusion in Turkish population and found that soft tissue thicknesses were found to be greater for men than for women. Statistically significant differences among the skeletal groups were found in both men and women at the following sites: Labrale superius, stomion, and Labrale inferius.The study conducted by HajimeUtsunotoruKageyama[6] in 2011 among Japanese female population stated that facial soft tissue thickness in Class I, Class II , Class III skeletal malocclusion showed significant variation and greatest difference in soft tissue thickness was found between classes II and III, with class I being intermediate.

In Indian population,AvneshSachan , AditSrivatsen and Chatvedi (2012)[8] analysed the soft tissue norms using lateral cephalogram considering 11 soft tissue landmarks and concluded that women has more convex soft tissue profile than men. Men have more prominent nose than women and men have morethicker soft tissue than women. Furthermore, SM Asif and Muralidharreddy (2016)[9]conducted a study on soft tissue measurements in various skeletal malocclusion in Karnool, Andhrapradesh in which Class II malocclusions showed a marked increase in facial contour angle, upper and lower lip protrusion, increased mentolabial sulcus depth and lower face throat angle. Class III malocclusions exhibited decreased nasolabial angle and facial contour angle. Lower face throat angle was increased in Class I skeletal malocclusions. No similar studies have been done in Tamilnadu, with this background and hence the present study was designed.

II. MATERIAL AND METHODOLOGY

This retrospective study was conducted in patients who reported to the Department of

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Orthodontics &DentofacialOrthopaedicsVivekanandha Dental College for Women, Thiruchengode. Ethical clearance was obtained from Institutional Ethical Committee (EC/NEW/INST/2020/512) .The sample size of 54 patients taken using the formula.

n= {[Z1-α/2+Zβ]2 ×[σ12+ σ22}/d2

Z= confidential interval, σ= standard deviation, d= error, β=0.84, α=95%, n=18.10.

The inclusion criteria ofpre-treatment lateral cephalogram between age group of 10 to 25 years taken in Standardized lateral cephalogram. Patients with history of previousorthodontic treatment or orthognathicsurgery,previous history of trauma to maxillofacial structures and Congenital deformities and post treatment radiograph were excluded.

Patients were exposed to Lateral Cephalogram in Natural Head Position NHP with Frankfort Horizontal Plane parallel to floor and maximum intercuspation and lips at rest . The radiographic system uses a charged couple device sensor chip as an image receptor . The exposure parameters of digital radiographs are 80,000 Kv,10.00 Ma and 5.74 seconds .15,560 m Gycem.

Tracings were done manually using a 3H pencil on acetate tracing paper with the help of an X-ray viewer, skeletal and soft tissue features were traced onto acetate sheets from the X-ray images.

The lateral cephalograph readings were classified into three skeletal classes based upon the Steiner'sANB angle that indicates the positional relationship between the maxilla and mandible. Categorised as, Skeletal Class I with ANB angle 2–4, Skeletal Class II with ANB angle greater than 4 and Skeletal Class III with ANB angle less than < 2. The sample size of 54 patients with Skeletal malocclusion of class I, II, III were taken and divided into 3 groups as group I, II, III with 18 patients each.

On the grouped sample the soft thickness was evaluated. The Frankfurt Horizontal Plane (FHP) was considered and Linear measurements were measured and soft tissue thickness was measured from this ten landmarks. They were Glabella (Gl), Nasion (N), Rhinion (Rh), Sn (subnasale), Labrale superius (Ls), Labrale inferius (Li), Labium Mentale (Lm), Pogonion (Pog), Gnathion (Gn). The ten landmarks were as follows,

1 Gl: Linear distance measured from soft tissue prominence on the forehead to most prominent point on the frontal bone.

2 N: Linear distance measured from soft tissue nasion to the point nasion

3 Rh: Perpendicular distance measured from cartilage of the soft tissue to the intersection of the nasal bone.

4. Sn; Linear Distance measured between A point and subnasale

5 Ls: Linear Distance measured between prosthion and the most prominent point of the upper lip

6 St: Linear Distance measured between the stomion and the most prominent point of the upper Incisor.

7 Li : Linear Distance measured between infradentale and the most prominent point of the lower Lip.

8 Lm-: Linear Distance measured from labiomentale sulcus to point B.

9 Pog : Linear distance measured between soft tissue pogonion to bony pogonion.

10 Gn;- Linear distance measured between soft tissue gnathion to bony gnathion.

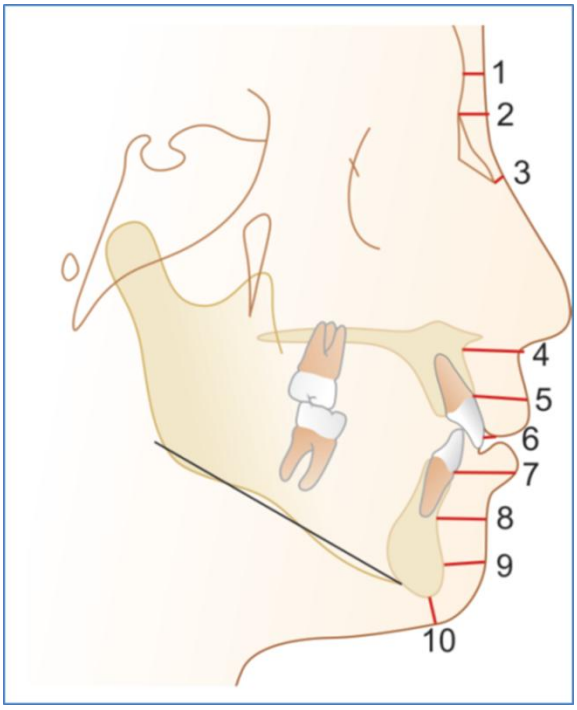

Fig 1- Soft tissue landmarks -Glabella , Nasion , Rhinion , Subnasale Labrale superious , Stomion , Labrale inferious , Labiomentale , Pogonion , Gnathion .

III. RESULTS

The data collected were analyzed using SPSS version 25(SPSS Inc.,Chicago USA). The statistical comparison of the cephalometric soft tissue thicknessmeasurments among the three groups was done using the Kruskal Wallis test. Glabella, Labrale superius and Labrale inferius showed highly significant values of 0.011,0.017 and 0.028 respectively. This indicates that among

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the 3 skeletal patterns there are variations in the soft tissue thickness of the glabella, Upper and lower lip (Table:1)

Cephalometric points	GROUP	Mean ± SD	p value
Glabella	Group 1	5.42 ± 1.295	0.011*
	Group 2		
	Group 3		
Nasion	Group 1	5.46 ± 0.946	0.405
	Group 2		
	Group 3		
Rhinion	Group 1	2.89 ± 0.945	0.161
	Group 2		
	Group 3		
Subnasale	Group 1	14.87 ± 2.788	0.449
	Group 2		
	Group 3		
Labrale superius	Group 1	14.52 ± 2.523	0.017*
	Group 2		
	Group 3		
Stomion	Group 1	4.13 ± 2.111	0.147
	Group 2		
	Group 3		
Labrale inferius	Group 1	14.40 ± 3.182	0.028*
	Group 2		
	Group 3		
Labiomentale	Group 1	11.76 ± 2.510	0.197
	Group 2		
	Group 3		
Pogonion	Group 1	9.43 ± 2.872	0.948
	Group 2		
	Group 3		
Gnathion	Group 1	7.52 ± 2.827	0.133
	Group 2		
	Group 3		

p value ≤ 0.005* - highly significant

Table 1- Comparison of soft tissue thickness between Group 1, Group 2, Group 3 skeletal Malocclusion.

Mann Whitney U test was carried out to evaluate the intergroup comparison between Group 1 and Group 2 ,Group 2 and Group 3 and Group 3 and group 1, in which showed that soft tissue thickness of Glabella was highly significant with a p value of 0.005 and 0.018 respectively when compared with value when comparing Class II and Class III skeletal malocclusion,

Class I and Class III skeletal malocclusion indicating that the soft tissue thickness at glabella shows variations in the thickness but it was not significant in comparison with class I and Class II skeletal malocclusion.

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Rhinion thickness showed significant p value of 0.046* on comparing skeletal Class II and skeletal Class III indicating that the thickness of the bridge of the nose varies in Class II and class III malocclusion. Labrale superiusshowed a significant value of 0.006* upper lip in Class I and III, Labrale inferius showed a significant value of 0.009* lower lip in Class II and III and in Gnathion it was significant between Class II and III with 0.042.(Table 3)

Cephalometric points	Group	p value
Glabella	Group 1 Group 2	0.947
	Group 2 Group 3	0.005*
	Group 1 Group 3	0.018*
Nasion	Group 1 Group 2	0.325
	Group 2 Group 3	0.598
	Group 1 Group 3	0.228
Rhinion	Group 1 Group 2	0.397
	Group 2 Group 3	0.046*
	Group 1 Group 3	0.353
Subnasale	Group 1 Group 2	0.449
	Group 2 Group 3	0.598
	Group 1 Group 3	0.210
Labrale superius	Group 1 Group 2	0.190
	Group 2 Group 3	0.092*
	Group 1 Group 3	0.006*
Stomion	Group 1 Group 2	0.287
	Group 2 Group 3	0.058*
	Group 1 Group 3	0.325
Labrale inferius	Group 1 Group 2	0.279
	Group 2 Group 3	0.009*
	Group 1 Group 3	0.095*
Labiomentale	Group 1 Group 2	0.360
	Group 2 Group 3	0.115

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	Group 1 Group 3	0.202
Pogonion	Group 1 Group 2	0.774
	Group 2 Group 3	0.786
	Group 1 Group 3	0.949
Gnathion	Group 1 Group 2	0.821
	Group 2 Group 3	0.042*
	Group 1 Group 3	0.154
p value ≤ 0.005* - highly significant		

Table 2: Intergroup comparison done between groups among Skeletal Class I, Class II, ClassIII using Mann Whiney U test.

Table 3 shows the correlation of each cephalometricmeasurments among the three Groups (skeletal classesClass I, Class II and Class III) was done using the Spearman's correlation. A significant correlation was seen in Labrale superiusamong Group 1 ,Group 2 ,Group 3(Class I, Class II , Class III) indicating that the thickness of the upper lip was increased significantly in Class II and Class III

VARIABLE		Group 1	Group 2	Group 3
Glabella	Group 1	1		
Glabella	Group 2	-0.083	1	
Glabella	Group 3	0.201	0.197	1
Nasion	Group 1	1		
Nasion	Group 2	0.128	1	
Nasion	Group 3	0.006	0.121	1
Rhinion	Group 1	1		
Rhinion	Group 2	-0.408	1	
Rhinion	Group 3	0.093	0.179	1
Subnasale	Group 1	1		
Subnasale	Group 2	0.307	1	
Subnasale	Group 3	0.238	-0.082	1
Labrale Superius	Group 1	1		
Labrale Superius	Group 2	0.186	1	
Labrale Superius	Group 3	-0.121	0.499*	1
Stomion	Group 1	1		
Stomion	Group 2	0.099	1	
Stomion	Group 3	-0.427	-0.149	1
Labrale inferius	Group 1	1		
Labrale inferius	Group 2	0.089	1	
Labrale inferius	Group 3	-0.123	-0.154	1
LabioMentale	Group 1	1		
LabioMentale	Group 2	0.228	1	
LabioMentale	Group 3	0.141	0.218	1
Pogonion	Group 1	1		
Pogonion	Group 2	-0.380	1	

Pogonion	Group 3	0.115	-0.121	1
Gnathion	Group 1	1		
Gnathion	Group 2	-0.245	1	
Gnathion	Group 3	0.117	-0.148	1
p value ≤ 0.005* - highly significant				

Table 3- Co- relation of soft tissue thickness between Group 1, Group 2, Group 3 skeletal Malocclusion using Spearman's correlation.

IV. DISCUSSION

The present study was taken up with the objective of assessment of soft tissue thickness in various skeletal malocclusion. As the young individuals attain, their emotional stability their self-perception of dentofacialesthetics alters based on theirsoft and hard tissue. Malocclusion and its severity influences the entire facial esthetics and appearance.

It was previously thought that the configuration of the soft tissue profile was primarily related to the basic skeletal configuration. However, there have been reports to indicate that soft tissue acts independently of the basic dentoskeletal base, since soft tissue is very variable in thickness, and is considered to be the main factor in determining a patient's final facial profile[1].

In this study we have cephalometrically evaluated the soft tissue thickness in different skeletal malocclusion at 10 different points by using standardized lateral cephalograms from available records in the Department of Orthodontics and Dentofacial Orthopaedics, Vivekananda Dental College For Women .

The method of evaluation followed in the study was same method used by Utsuno et al's study which was done in Japanese population[6] .

According to the study done by Kunnat et al[3], the soft tissue thickness at pogonion decreased with increased mandibular protrusion and the soft tissue thickness at gnathion increased with retraction of mandible but our study shows that there was no significant difference in soft tissue at pogonion ,menton between study groups. Similarly there was no soft tissue thickness at gnathion.

In this present study soft tissue thickness of Class I and Class II and Class III were measured at 10 different points . Differences were seen in three points of lower facial region and glabella region , especially in Class II and Class III area . Labrale inferius was less thicker in Class III than Class II patients whereas Labrale superius was thicker in Class II than in Class III. Our study results were similar to that of the HasanKamak et al[7] done studies on Korean population by assessing 10 different cephalometric points in different skeletal malocclusions in male and female stated that this difference in finding might be due to the angulation of the maxillary and mandibular central incisors influenced the soft tissue thickness of Labrale superius , Labrale inferius and Stomion.

In class III patients, the mandibular incisors are tipped lingually and maxillary incisors labially which might push the upper lip upward and outward. In contrast when mandibular incisors are tipped labially and maxillary lingually,the maxillary anterior teeth may push the lower lip outward and downward influencing, the thickness of Labrale inferius,Stomion and Labrale superius. In this present study glabella ,rhinion showed significant difference in class II and class III patients ,whereas the study done by Utsuno et al on Japanese female population with different malocclusion showed upper face region (Gls-Gl, Ns-N, and Rh) did not show any significant differences among the study groups suggesting that there is no variation in the soft tissue depth when it is tightly adherent to the bone[6].

Some similarities and differences may be due to racial differences as our review literature tells about the differences in soft tissue thickness varies in people with different ethnic and racial groups .

V. CONCLUSION

Among the 10 Cephalometric Soft tissue thickness significant differences were seen at Labrale inferius, Labrale superius, rhinion, glabella, stomion region. The results of the present study shows that there is a strong relationship between soft tissue thickness of the face and skeletal pattern. Similar studies with larger sample size among the ethinic population will give us more knowledge regarding the soft tissue thickness variations among the ethinic and racial groups.

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