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Correlation between gender and soft tissue characteristics of face among south Indian population of various skeletal malocclusion

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ABSTRACT

Every face is unique and this variation also exists between genders. This forms the basis of sexual dimorphism. The aim of this study was to determine the correlation between gender and soft tissue of face among the south Indian population. The study sample comprised 30 lateral cephalograms collected between the time period of June 2019 - March 2020, which were divided into 3 groups. FACAD software was used for the analysis of lateral cephalograms to obtain six variables, namely: glabella area (G-G_1), subnasal area (A-Sn), Upper lip thickness (J-Ls), Lower lip thickness (I-Li), Labiomental sulcus thickness (B-Sm), Chin area (Pg-Pg_1). The obtained results were tabulated and statistically analysed using SPSS software version 23. One-way ANOVA and post hoc tests were performed between the skeletal malocclusions. Independent t-test was done to compare the variables between the two genders. The obtained results show a mean increase in all the variables of Class II except Lower lip thickness, which was maximum in Class I skeletal malocclusion. The results of One-way ANOVA, however, was statistically insignificant. Hence, soft tissue characteristics can provide vital information on sexual dimorphism and also aid in the diagnosis of various malocclusions in orthodontics.

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INTRODUCTION

Face is the esthetic and appealing part of the body. The first thing a person recalls from memory is the face of another person (Perović and Blažej, 2018). Variations in the skeleton can easily be reflected by variations in the soft tissue surrounding it, due to its proximity. Dentoskeletal structures and the facial soft tissue thickness together constitute the facial profile.

Skeletal malocclusions are the discrepancies of the skeletal structures of the face due to genetic, environmental conditions or both. It can be due to the prognathism of a specific jaw or retrognathism of the opposing jaw or a combination of both. Based on this combination, they can be classified as Class I, Class II and Class III (Ardani *et al.*, 2018; Mahendran, 2017).

Apart from adding to the esthetic appeal to the face, the soft tissue also effectively compensates for the skeletal defects, hence masking it in minor discrepancies. The soft tissue is also affected by the position of the tooth and its inclinations. Lateral cephalogram is a supplemental aid that can be used to analyse hard and soft tissue structures 2-dimensionally (Al-Jame *et al.*, 2006; Al-Azemi *et al.*, 2008). A well taken lateral cephalogram usually records both these structures adequately, enabling the examiner to visualize the soft tissue characteristics with ease.

There is a difference in the morphology of male and female hard and soft tissue structures. This is referred to as sexual dimorphism. Females are believed to retain most of their prepubertal traits, whereas male undergoes enormous changes in terms of soft tissue characteristics as well (Hsiao *et al.*, 2010). Hence, the purpose of this study was to compare the correlation between gender and soft tissue characteristics of various skeletal malocclusions of the south Indian population.

MATERIALS AND METHODS

The retrospective study consisted of 30 lateral cephalograms, collected between the time period of June 2019 - March 2020. These lateral cephalograms were divided into 3 groups, namely,

Group A - Class I skeletal pattern

Group B - Class II skeletal pattern

Group C - Class III skeletal pattern

Each group contained 10 radiographs, pertaining to their skeletal relationship. The data was collected from the Saveetha Institute of Medical and Technical Sciences (SIMATS) university database. Ethical approval was obtained from the institutional review board. FACAD software was used for the analysis of the lateral cephalograms. Points were plotted using this software to obtain linear measurements. The plotted points were verified and approved by the other authors. The following variables were taken into consideration,

1. Glabella area: G-G1
2. Subnasal area: A-Sn
3. Upper lip thickness: J-Ls
4. Lower lip thickness: I-Li
5. Labiomental sulcus thickness: B-Sm
6. Chin area: Pg-Pg1

Linear measurements of all the aforementioned variables were obtained. The obtained results were subjected to statistical analysis using SPSS software version 23. One way ANOVA, post hoc and Bonferroni tests were performed to compare the variables between malocclusion. Independent T-test was done between genders to compare the soft tissue characteristics of the face.

RESULTS AND DISCUSSION

The descriptive statistics showing the mean and standard deviation of the variables within the malocclusion is depicted in (Table 1). Class II skeletal group showed the maximum thickness of all the soft tissue variables, except Lower lip thickness (**I-Li**), which is shown to be thickest in Class I skeletal groups. Class III skeletal pattern exhibited the least thickness of soft tissue characteristics of the face.

The mean and standard deviation of variables between gender is shown in (Table 2). Males showed increased thickness of all the variables except soft tissue gonion and pogonion thickness, which were thicker in females.

The results for One way ANOVA is shown in (Table 3). When comparing the groups between each other, the results were insignificant.

(Tables 4, 5 and 6) show the results for the independent t-test, which are statistically insignificant.

Previously, our team had conducted numerous clinical trials (Samantha, 2017; Kamisetty, 2015) , in vitro studies (Krishnan *et al.*, 2015; Rubika *et al.*, 2015), Finite element studies (Sivamurthy and Sundari, 2016; Krishnan *et al.*, 2018) and a couple of prospective studies (Kumar *et al.*, 2011; Felicita *et al.*, 2012); Over the past 5 years. Now we are focusing on this retrospective study, done with the data obtained from our vast database. The idea for this study stemmed from the current interest in our community on the soft tissue paradigm shift (Dinesh, 2013; Felicita, 2017a; Felicita and Felicita, 2018).

Orthodontic treatment has always been directed towards the treatment of the face, rather than the skeleton (Viswanath, 2015; Felicita, 2017b). Although skeletal tissues are also considered important, the final outlook of the soft tissue dictates the success/failure of the treatment (Albarakati, 2011). This study was aimed at providing a standard for male and female soft tissue characteristics, as it will aid in the diagnosis and effective treatment planning (Vikram, 2017; Jain, 2014). The soft tissue in conjecture with the hard tissue norms are helpful in establishing ideal facial esthetics and occlusion (Kamak and Celikoglu, 2012).

The finding of our retrospective study shows that the thickness of glabella, subnasale, upper lip, labiomental sulcus and chin are maximum in Class II skeletal pattern, followed by Class I skeletal pattern. Lower lip thickness, however, is thickest in Class I skeletal pattern, followed by Class II skeletal pattern. Class III showed the least thickness of all the variables. This is in accordance to the results

Table 1: Descriptive statistics showing mean and standard deviation between malocclusions

		Descriptives							
		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean			
						Lower Bound	Upper Bound	Minimum	Maximum
G-G'*	Class I	10	5.270	.9866	.3120	4.564	5.976	3.7	6.8
	Class II	10	5.510	1.0082	.3188	4.789	6.231	4.2	6.8
	Class III	10	4.010	1.1070	.3501	3.218	4.802	2.4	5.5
	Total	30	4.930	1.2023	.2195	4.481	5.379	2.4	6.8
A-Sn**	Class I	10	13.890	3.3017	1.0441	11.528	16.252	7.2	18.8
	Class II	10	14.850	1.7784	.5624	13.578	16.122	12.7	18.0
	Class III	10	13.720	4.5672	1.4443	10.453	16.987	7.3	20.0
	Total	30	14.153	3.3308	.6081	12.910	15.397	7.2	20.0
J-Ls***	Class I	10	7.320	1.3323	.4213	6.367	8.273	4.7	9.2
	Class II	10	9.410	2.9335	.9277	7.311	11.509	6.2	15.8
	Class III	10	9.000	3.0467	.9634	6.821	11.179	5.1	13.0
	Total	30	8.577	2.6359	.4813	7.592	9.561	4.7	15.8
I-Li****	Class I	10	11.650	2.5247	.7984	9.844	13.456	7.4	15.2
	Class II	10	11.620	2.1343	.6749	10.093	13.147	7.8	14.2
	Class III	10	10.360	3.3450	1.0578	7.967	12.753	5.9	14.3
	Total	30	11.210	2.6904	.4912	10.205	12.215	5.9	15.2
B-Sm*****	Class I	10	10.830	1.9351	.6119	9.446	12.214	6.9	13.8
	Class II	10	13.110	3.3418	1.0568	10.719	15.501	8.1	18.8
	Class III	10	8.970	2.6094	.8252	7.103	10.837	4.6	11.9
	Total	30	10.970	3.1155	.5688	9.807	12.133	4.6	18.8
Pg-Pg'******	Class I	10	10.210	2.5519	.8070	8.384	12.036	6.6	13.5
	Class II	10	11.060	2.1849	.6909	9.497	12.623	7.3	14.1
	Class III	10	8.550	2.5864	.8179	6.700	10.400	4.8	11.5
	Total	30	9.940	2.5889	.4727	8.973	10.907	4.8	14.1

*Glabella area ; **Subnasal area ; ***Upper lip thickness ; ****Lower lip thickness ; *****Labiomental sulcus thickness; ******Chin area

Table 2: Descriptive statistics showing mean and standard deviation between genders

Group Statistics					
	Sex	N	Mean	Std. Deviation	Std. Error Mean
G-G’*	Male	15	4.860	1.2141	.3135
	Female	15	5.000	1.2288	.3173
A-Sn**	Male	15	14.520	3.6163	.9337
	Female	15	13.787	3.1009	.8006
J-Ls***	Male	15	9.153	3.0064	.7762
	Female	15	8.000	2.1544	.5563
I-Li****	Male	15	11.640	2.9354	.7579
	Female	15	10.780	2.4455	.6314
B-Sm*****	Male	15	11.327	3.4654	.8948
	Female	15	10.613	2.7972	.7222
Pg-Pg******’	Male	15	9.327	2.2789	.5884
	Female	15	10.553	2.8079	.7250

*Glabella area; **Subnasal area; ***Upper lip thickness; ****Lower lip thickness; *****Labiomental sulcus thickness ; ******Chin area

Table 3: Compare between three malocclusions by One way ANOVA

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
G-G’	Between Groups	12.984	2	6.492	6.057	.007*
	Within Groups	28.939	27	1.072		
	Total	41.923	29			
A-Sn	Between Groups	7.425	2	3.712	.319	.730**
	Within Groups	314.310	27	11.641		
	Total	321.735	29			
J-Ls	Between Groups	24.529	2	12.264	1.871	.173**
	Within Groups	176.965	27	6.554		
	Total	201.494	29			
I-Li	Between Groups	10.842	2	5.421	.735	.489**
	Within Groups	199.065	27	7.373		
	Total	209.907	29			
B-Sm	Between Groups	85.992	2	42.996	5.938	.007*
	Within Groups	195.491	27	7.240		
	Total	281.483	29			
Pg-Pg’	Between Groups	32.594	2	16.297	2.720	.084**
	Within Groups	161.778	27	5.992		
	Total	194.372	29			

*Glabella area and labiomental sulcus thickness show statistical significance between three groups, as p value is <0.05; **Subnasal area, Upper lip thickness, Lower lip thickness show statistical insignificance between three groups, as p value is >0.0

Table 4: Independent t test between the genders of Class I malocclusion

		Independent Samples Test								
		Levene's Test For Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
G-G'	Equal variances assumed	.303	.597*	-1.145	8	.285	-.7167	.6262	-2.1606	.7273
	Equal variances not assumed			-1.114	5.981	.308	-.7167	.6434	2.2922	.8589
A-Sn	Equal variances assumed	3.683	.091*	.214	8	.836	.4833	2.2540	-4.7145	5.6811
	Equal variances not assumed			.257	6.478	.806	.4833	1.8843	-4.0461	5.0128
J-Ls	Equal variances assumed	2.369	.162*	1.296	8	.231	1.0750	.8292	-.8372	2.9872
	Equal variances not assumed			1.153	4.309	.309	1.0750	.9324	-1.4423	3.5923
I-Li	Equal variances assumed	1.183	.308*	.591	8	.571	1.0000	1.6920	-2.9017	4.9017
	Equal variances not assumed			.650	8.000	.534	1.0000	1.5381	-2.5468	4.5468
B-Sm	Equal variances assumed	.295	.602*	-1.353	8	.213	-1.6167	1.1952	-4.3729	1.1395
	Equal variances not assumed			-1.324	6.104	.233	-1.6167	1.2212	-4.5925	1.3592
Pg-Pg'	Equal variances assumed	.175	.687*	-.755	8	.472	-1.2750	1.6880	-5.1675	2.6175
	Equal variances not assumed			-.799	7.680	.448	-1.2750	1.5962	-4.9828	2.4328

*there is no statistical significance between the variables in Class I as the p value is >0.05

Table 5: Independent t test between the genders of Class II malocclusion

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
G-G'	Equal variances assumed	.000	.991*	.790	8	.453	.5250	.6649	-1.0082	2.0582
	Equal variances not assumed			.782	6.374	.462	.5250	.6710	-1.0939	2.1439
A-Sn	Equal variances assumed	.787	.401*	1.779	8	.113	1.8333	1.0307	-.5435	4.2102
	Equal variances not assumed			1.580	4.292	.184	1.8333	1.1604	-1.3038	4.9705
J-Ls	Equal variances assumed	1.886	.207*	1.209	8	.261	2.2333	1.8467	-2.0252	6.4918
	Equal variances not assumed			1.068	4.212	.343	2.2333	2.0902	-3.4566	7.9232
I-Li	Equal variances assumed	3.793	.087*	1.660	8	.136	2.0917	1.2603	-.8146	4.9979
	Equal variances not assumed			1.986	6.462	.091	2.0917	1.0530	-.4410	4.6243
B-Sm	Equal variances assumed	1.603	.241*	2.247	8	.055	4.0250	1.7916	-.1064	8.1564
	Equal variances not assumed			2.107	5.217	.087	4.0250	1.9104	-.8249	8.8749
Pg-Pg'	Equal variances assumed	.488	.505*	-1.617	8	.145	-2.1000	1.2986	-5.0947	.8947
	Equal variances not assumed			1.557	5.755	.172	-2.1000	1.3485	-5.4339	1.2339

*there is no statistical significance between the variables in Class II as the p value is >0.05

Table 6: Independent t test between the genders of Class III malocclusion

		Independent Samples Test								
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
G-G'	Equal variances assumed	.159	.701**	-.189	8	.855	-.1400	.7409	-1.8486	1.5686
	Equal variances not assumed			-.189	7.929	.855	-.1400	.7409	-1.8513	1.5713
A-Sn	Equal variances assumed	.988	.349**	.118	8	.909	.3600	3.0611	-6.6990	7.4190
	Equal variances not assumed			.118	7.397	.910	.3600	3.0611	-6.8005	7.5205
J-Ls	Equal variances assumed	2.769	.135**	.559	8	.592	1.1200	2.0050	-3.5036	5.7436
	Equal variances not assumed			.559	7.005	.594	1.1200	2.0050	-3.6205	5.8605
I-Li	Equal variances assumed	.058	.815**	-.179	8	.863	-.4000	2.2395	-5.5642	4.7642
	Equal variances not assumed			-.179	7.876	.863	-.4000	2.2395	-5.5783	4.7783
B-Sm	Equal variances assumed	1.576	.245**	.428	8	.680	.7400	1.7308	-3.2512	4.7312
	Equal variances not assumed			.428	7.504	.681	.7400	1.7308	-3.2976	4.7776
Pg-Pg'	Equal variances assumed	9.068	.017*	-.058	8	.955	-.1000	1.7346	-4.1001	3.9001
	Equal variances not assumed			-.058	5.973	.956	-.1000	1.7346	-4.3492	4.1492

*there is statistical significance seen only in the chin area of Class III as the p value is <0.05
*there is no statistical significance between the other variables in Class III as the p value is >0.05

reported by Perovic et al., in his research (Perović and Blažej, 2018). When comparing genders, the thickness of gonion and pogonion is more in females compared to males. This is in agreement with the studies conducted in the north Indian population (Saxena *et al.*, 2012). The results, when subjected to One way ANOVA and independent t tests to compare the variables among the other groups and between the gender, yielded statistically insignificant results.

Radiographs can be a valuable aid in the diagnosis of malocclusion. It is easily accessible and can be transferred over the internet. OPGs and CBCT also aid in the ease of implant placements and planning for any sort of implants. They are vital in ruling out individual tooth anomalies as well that might hinder orthodontic tooth movement.

Lateral cephalograms have become a routine in the daily orthodontic practice. Many skeletal discrepancies are precisely diagnosed using lateral cephalometric analysis. The analysis of vertebrae and sella turcica dimensions have also been shown to have diagnostic relevance. Similarly, angular photogrammetric analysis has also been shown to produce reliable results in aiding the diagnosis of soft tissue deviations. This study could also be used as one such adjunct to the growing arsenal of diagnostic aids (Scribante, 2017).

Kamalpreet et al., in his study, has made use of MRI and CBCT to evaluate the soft tissue characteristics of the northeast Indian population (Kaur *et al.*, 2017). Atashi et al. have also reported changes in the thickness of soft tissue characters in males and females (Atashi and Kachooei, 2008). They have cited these differences to be due to differences in their body mass index (BMI). Aggarwal et al., in his study, has recommended the use of the soft tissue characteristics and variations in orthodontic treatment planning as they seemed to have significant clinical implications (Aggarwal and Singla, 2016).

Soft tissue variations can be attributed to a variety of influencing factors, out of which gender is one such cause. The role of hormones such as testosterone in men which facilitates collagen formation, causing thicker soft tissue and estrogen in women, which decreases collagen formation due to the activity of hyaluronic acid, causing a reduction in the soft tissue thickness, is noteworthy (Al-Mashhadany *et al.*, 2017) . Furthermore, improving knowledge on the sexual dimorphism that exists between both the genders in terms of their soft tissue characteristics can aid one to formulate an effective treatment plan, that caters to the patient's optimum requirements and establish a standard protocol of treatment.

CONCLUSION

Within the limits of the study, it was concluded that establishment of a norm for soft tissue characteristics was the need of the hour as it can still provide vital clues in providing quality orthodontic therapy to the patients, by keeping the soft tissue structures ahead of the priority list.

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Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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