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Original Research Article

To Develop Soft Tissue Cephalometric Norms for Skeletal and Dental Relationships in the Adult Population of Middle Gujarat, India

Dishansh Sheth[1], Mosam Thakar[2], Jayesh Nathani[3*]

[1]Assistant Professor, Department of Dentistry, Dr Kiran C Patel Medical College & Research Institute, Bharuch, Gujarat, India

[2]Assistant Professor, Department of Dentistry, GCS Medical College and Hospital, Ahmedabad Gujarat, India

[3]Assistant Professor, Department of Dentistry, Parul Institute of Medical Sciences and Research, Parul University, Vadodara, Gujarat, India

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Corresponding author: Dr. Jayesh Nathani

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Abstract:

Introduction: Soft tissues play an important role of physical appearance and facial esthetics. This study aimed to establish, soft-tissue cephalometric standards in Gujarat, India adults, which can be used in diagnosis, planning of treatment, and stability of orthodontic outcome and orthognathic patients.

Objective: The objectives of this study was to establish Soft Tissue Cephalometric Norms for skeletal and dental relationships amongst the Middle Gujarat adult population.

Methodology: A set of 70 people with proportionate facial profiles and normal occlusion (35 males and 35 females) was chosen. Lateral cephalograms were taken for the complete selected sample. Two operators manually traced each cephalogram using the standard method. Arnett and Bergman's STCA (soft tissue cephalometric analysis) provided the parameters that were used in the investigation. In total, 46 measurements were employed, comprising 40 linear and six angular parameters. Standard deviation and Mean values were calculated by Using a student t-test, the differences between male and female were assessed.

Result: The study's findings showed significant variations in the majority of the characteristics between men and women in the Middle Gujarat community as well as in contrast to norms established by Arnett et al.

Conclusion: We draw the conclusion from our study which is consistent with other studies as well that most soft tissue variables linking Caucasians and our group are significantly different. This implies that for appropriate analysis and planning of treatment, different norms should be established for various ethnic groups, and patients should be treated with this in mind.

Keyword: Lateral Cephalogram, Cephalometric Norms, Conventional Hand Tracing.

Introduction

Facial attractiveness is an imperfectly defined perception, difficult to enumerate and linked to cultural preferences. The facial skeleton and its supporting soft tissue framework play the most important roles in determining structural and other characteristics of the human facial appearance, such as facial harmony, synchronization, and balance or equilibrium.[1] Harmonious facial esthetics and a functional occlusion are two of the main objectives of orthodontic therapy that have long been acknowledged. Cephalometry was first introduced in 1931 by Broadbent[2] and Hofrath[3] from the United States and Germany, respectively. Since then, it has grown to be one of the most dependable and reproducible diagnostic modalities in orthodontic treatment.[4,5]In addition to evaluating the patients' skeletal, dental, and soft tissue patterns related to their ethnic groups, standardized cephalometric analysis is employed to establish realistic guiding principles in orthodontic diagnosis and therapy scheduling.

Analysis of dental and skeletal patterns alone might be insufficient or misleading because of noticeable variations in the soft tissues covering the dento-skeletal framework. Today facial appearance is an important diagnostic criterion to be considered in comprehensive orthodontic treatment of planning. Burstone and Legan developed soft tissue cephalometric investigation for orthognathic surgery (COGS) at the University of Connecticut in the year 1989 and it is most usually used by orthodontists and maxillofacial surgeons. [6,7.8]

Therefore, it is an important to develop norms for various population groups with a standard method. Thus, the present study was conducted with

objectives of to establish soft tissue norms (for Orthognathic surgery) for Middle Gujarat population and to compare the values with that of Caucasian standards.

Materials and Method

A cross-sectional study was conducted at College of Dental Sciences & Research centre, Bopal, Ahmedabad, Gujarat, India from Jan 2017- Dec 2020.The study was conducted on 70 Middle Gujarat Indian individuals comprising of 35 males and 35 females with age ranging from 18 to 30 years who were visiting the outpatient department of the institution.

The subjects included in the study were with class I molar relationship with minimal or no crowding of teeth, straight facial profile and all teeth anterior to second molar being present. The subjects with gross facial asymmetry, history of trauma or previous orthodontic treatment, history of previous maxillofacial or plastic surgery and significant medical history were excluded from the study. All subjects were subjected to Lateral cephalometric radiographic analyses with natural head position; teeth in maximum intercuspation and lip at rest using standardized technique.

The Frankfort horizontal plane was parallel to the floor, the teeth were in centric occlusion, and the patient's lips were relaxed when the cephalograms were taken. Kodak x ray Films were (8″ *10″) exposed at 70 kVp, 40 mA for 1.8 s from a fixed distance of 60 inches. A sharp 4H pencil and a view box with transilluminated light were used to draw the lateral head cephalograms on acetate tracing sheets of 0.003-inch thickness, and any stray light radiations were removed. Cranial registration marks were traced on the acetate tracing sheets after marking them on the cephalogram. The following soft-tissue cephlaometric measurements were taken for establishing soft-tissue norms of west central Indian ethnic population using Holdaway[9] analysis:

By obtaining STCA parameters, all lateral cephalometric films were manually traced on a transparent cellulose acetate sheet of 0.003" thickness. Overall 46 measurements including 5 dentoskeletal, 6 soft tissue structures, 9 Facial lengths, 14 projections to TVL and 12 facial harmony parameters were used in this study. The radiographs were hand traced by two observers. (JS and RMR) who were blinded to the primary aims of the study and standard error was calculated using unpaired t-test. Mean and standard deviation were calculated. The difference between males and females as well as Gujarat population and Arnett et al., [10] norms were evaluated using student t-test. Statistical calculation was done by using online student t test calculator. P value was calculated and p value less than 0.05 was considered as significant.

Result

The measurements' means and standard deviations were computed in order to perform a statistical analysis. Unpaired t-test was used to compare the Middle Gujarat population with that of Arnett et al., whereas paired t-test was utilized to assess the error between observers. The Student t-test was used to determine the norms and significance of the difference between the male and female samples.

Table 1: Association of females and males with respect to different parameters by t test (Facial harmony values)

Main parameter	Parameters	Male		Female		t-value	p-value
		Mean	SD	Mean	SD		
Dentoskeletal factors	Mx occlusal plane	98.60	3.25	98.77	2.76	-0.89	0.39
	Mx occlusal plane to Mxl	53.25	2.10	55.01	3.09	-0.32	0.75
	Overjet	2.60	0.50	2.70	0.45	-1.47	0.13
	Md occlusal plane to Mdl	60.92	2.92	61.50	3.89	0.32	0.61
	Overbite	2.22	0.45	2.45	0.40	-1.80	0.08
Soft tissue structure	Lower lip width	11.80	1.09	10.50	0.88	4.50	0.00*
	Menton'-menton'	5.85	1.05	6.22	1.23	-1.02	0.45
	Nasolabial angle	101.40	1.6942	104.40	5.9	-2.77	0.095*
	Pogonion-Pogonion'	9.77	1.00	9.18	1.21	2.04	0.0459*
	Upper lip width	10.99	0.98	9.68	1.01	5.89	0.0000*

	Nasion'-Menton'	99.50	2.90	95.50	3.20	3.40	0.0015*
	Upper lip angle	11.1167	2.4778	8.6667	1.2888	3.43	0.0011*
	Upper lip length	16.50	1.22	15.80	1.86	2.22	0.035*
Facial length	Inter-labial gap	0.45	0.58	0.58	0.97	-1.05	0.2981
	Length of Lower lip	40.12	2.10	38.50	1.91	4.05	0.0002*
	1/3 of lower face	57.65	2.30	56.12	3.40	5.06	0.0000*
	Overbite	2.30	0.55	2.42	0.50	-1.7	0.092
	Mx1 exposure	1.88	0.90	2.10	0.80	-0.75	0.54
	Height of maxillary	18.59	1.52	19.10	2.04	2.01	0.0580*
	Height of mandibular	38.90	2.33	37.60	1.79	3.45	0.0011*
	Orbital rims	-19.10	1.68	-16.20	1.89	-2.93	0.005*
	Glabella	-5.10	1.42	-4.99	2.10	-0.15	0.99
	Cheek bone	-21.90	1.87	-18.3167	1.94	-5.22	0.000*
Projections to TVL	Sub-nasale	0.00	0.00	0.00	0.00	0.00	1.0000
	Projection of nasal	11.56	1.16	11.01	1.22	0.10	0.9142
	Alar base	-11.12	1.47	-8.50	1.17	-5.32	0.000*
	Sub-pupil	-13.55	1.60	-11.48	1.51	-7.63	0.000*
	A point'	-1.60	0.56	-1.52	0.59	-1.23	0.2226
	Upper-lip anterior	1.37	1.19	1.13	0.89	1.22	0.2238
	Mx l	-10.13	1.27	-8.85	1.54	-3.75	0.0004*
	Md l	-12.65	1.29	-11.50	1.53	-3.14	0.0026*
	Lower-lip anterior	-0.50	1.86	-0.52	1.64	0.07	0.8516
	B-point'	-8.55	2.14	-6.13	1.61	-2.89	0.005*
	Throat length	46.10	2.52	45.20	3.41	-1.09	0.29
	Pogonion'	-7.25	1.88	-6.02	2.15	-2.36	0.021*
	Md1-Pogonion'	6.02	1.68	6.25	2.11	-0.47	0.65
	Lower lip anterior-Pog'	6.60	1.30	5.50	1.59	1.95	0.0548
	B-point'-Pog'	1.58	0.82	1.79	0.96	-1.38	0.1739
	ULA – LLA	2.18	0.85	1.79	1.02	2.06	0.045
Intra-mandibular-facial harmony relations	Subnasale-Pogonion'	7.22	1.54	6.12	2.15	2.36	0.0215*
	A point'- B point'	7.20	1.69	5.70	1.70	2.63	0.0109*
	Orbital rim'-A point'	15.90	1.60	16.20	2.06	3.11	0.0039*
	Orbital rim'-Pogonion'	11.55	1.53	11.48	2.05	1.04	0.29
Inter-jaw relations	Facial-angle	168.73	3.41	169.63	4.83	-0.82	0.42
	Glabella'-A point'	3.70	1.01	3.33	1.74	1.20	0.24
	Glabella'-Pogonion'	2.80	1.20	3.10	2.93	-0.69	0.50
Jaws-orbit	Orbital rim'-Pogonion'	11.78	1.53	11.32	2.15	1.047	0.29
	Orbital rim'-A point'	16.82	1.75	15.14	2.15	3.07	0.04*

Full-facial balance	Glabella'-A point'	3.50	1.11	3.20	1.76	1.3088	0.56
	Glabella'-Pogonion'	2.60	1.10	3.01	2.85	-0.5652	0.30
	Facial angle	165.56	3.53	167.53	4.75	-0.8520	0.51

Men were shown to have thickersoft tissue than women, as well as more acute nasolabial angles (101.40o) than women (104.4000o). (Graph 1)

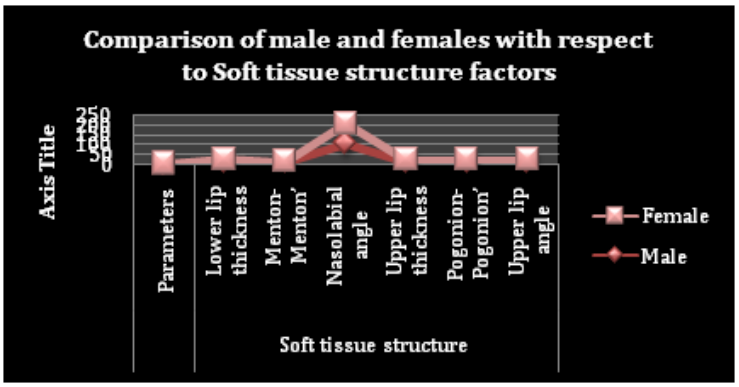

Figure 1: Comparison of male and females with respect to Soft tissue structure factors

In Dento-skeletal factors, there was no statistically difference between the sexes.(Graph 2)

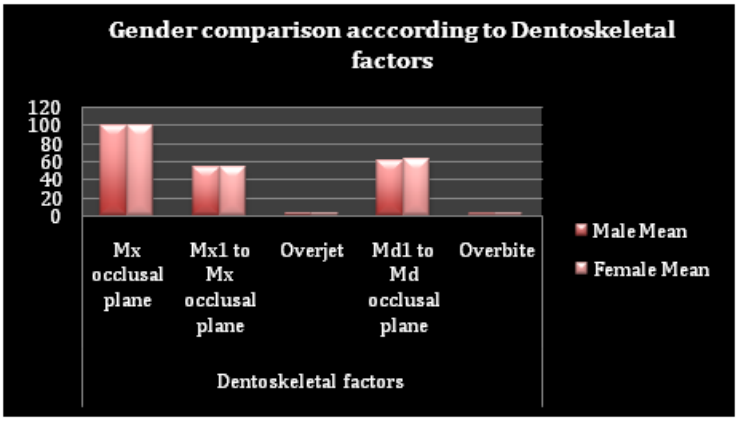

Figure 2: Comparison of Male and female according to Dentoskeletal factors

All measurements of facial length indicated that males had longer faces than females (nasion' to menton', 99.50) did (95.50). (Graph 3)

Inter-labial gap, maxillary incisor exposure and overbite were more in women than the men; all these evaluations were statistically significant.

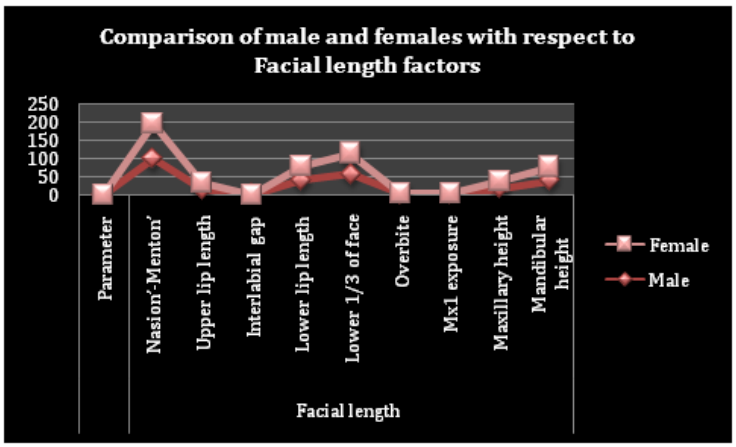

Figure 3: Comparison of male and females with respect to Facial length factors

The Statistically significant alterations, midface and the lower third structures of the face in the projections to TVL were also noted between the genders. In prediction to TVL, orbital rims, cheekbone, sub-pupil, and alar base to TVL were raised in the men. The nasal projection was increased in the men (11.56mm) when associated with the women (11.01 mm) whereas, in the lower third of the face, men were having protrusive lips (upper-lip anterior, 1.37 mm; lower-lip anterior, -0.50 mm)(Graph 4).

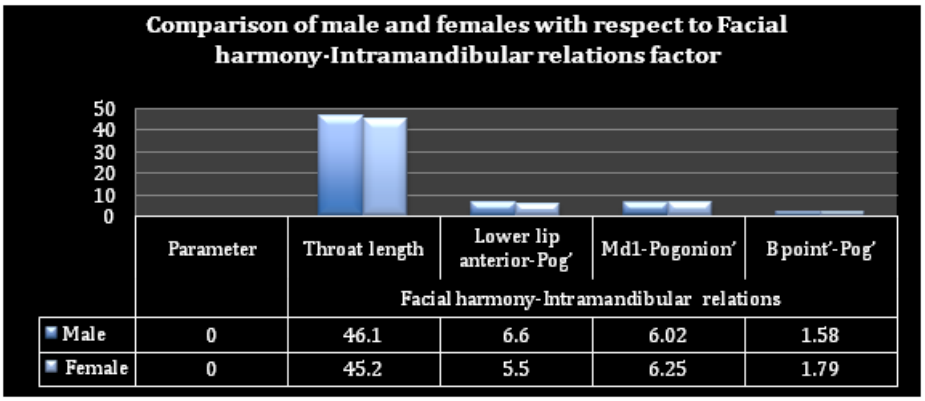

Figure 4: Showing association of male and females with respect to Facial harmony-Intra-mandibular relations factor

Discussion

The sample contained Total of 70 adults (35 Females and 35 males) and the study was based on 46 parameters' of Arnett's Soft tissue cephalometry analysis, which were divided future into five groups. In each group, comparisons were drawn and analyzed between the Female and male samples and the original Soft tissue cephalometry Analysis. [9,10] Among the Dental and Skeletal factors, the Males showed Lower value for Mx OP-TVL angle than Females, indicating steeper occlusal plane in them. This finding are contradictory to the finding of Kalha et al[11] but it was similar to Arnett's4 norms . There is no significant sexual dimorphism found among all the remaining parameters. However, when the mean values of the sample were compared with Arnett's subjects, higher values were noted and the same was observed in Gujarat population, that is indicating flatter occlusal planes in Caucasians. These dental and skeletal factors have a high influence on the facial profile and that is greatly dependent upon the precise treatment from the surgeon and orthodontist.

Lower facial esthetic balance is Controlled Largely by the thickness of soft tissue structures in combination with dentoskeletal factors. Majority of orthodontist are using the nasolabial angle and ULAs in assessing the upper lip and its very important. In our study all the values of soft tissue Parameter measurements demonstrated that Female have lower soft tissue thickens as compared to Male. This result was supported by various other studies. [12,13] Also, upper lip was Less prominent in Females shown by larger ULA and acute nasolabial angle, though the difference found them was not significant as compared to Males. The same Finding were obtained by Kalha et al[11] in their study on south Indian males, showing acute nasolabial angle in males. This was significantly contradictory from the study done by Arnett's, [10] Scheideman et al[14] and Spradley et al[15] conclusions, where females showed fuller and prominent lip regions than males. The soft tissues in the study population's shows that male participants were thinner than those in Arnett's male group, with the exception of the lower lip thickness, which was unremarkably high and the nasolabial angle, which was more acute. This is consistent with the research on South Indians. Contrarily, women exhibit comparable levels of soft tissue thickness to Arnett's group (as noted by Kalha et al. [11]). Women of Caucasian descent had substantially larger ULA and soft tissue chin thickness alone.

In the lower third of the face, males had more protrusive lips as shown by upper-lip and lower-lip anterior to TVL. This can be mainly because of the thicker soft-tissue structures in the males. Females had more proclined maxillary and mandibular anterior teeth as shown by Mx1 and Md1 to TVL. The projection value for the nose was slightly increased in males than females. This might as well contribute to the increased facial convexity in Middle Gujarat males.

Facial length measurements showed that in the present sample, male faces were longer than females, except for the maxillary height. Statistically, longer faces in men were also observed in various other studies. [10,16] Further, the presence and location of vertical abnormalities is indicated by assessing maxillary height, mandibular height, upper incisor exposure and overbite. Women in the present study showed greater ILG, overbite and maxillary incisor exposure though the difference was statistically

insignificant. Thesimilar results in women were also noted by others.[10] All the values of facial lengths were significantly higher for Caucasians according to Arnett[10] than central Indian and South Indian population. [16]

Regarding the comparison of intramandibular harmony values between our study and Arnett's4 indicate that Majority of Values in our group is significantly less as compared to Arnett's sample except LLAPog', indicating recessive chin. Above finding was similar to study by Kalha[11] and Lalitha et al, [17] while Uysal et al[18] did not find any significant difference between Caucasian and Turkish sample.

Interjaw harmony relationships is directly controlling the lower one-third of facial esthetics. These values were significantly higher in central Indians as compared to Arnett's Caucasian sample. Same Finding were found in South Indians1,3 except A'-B', Demonstrating recessive lower faces in Indians in general, while Turkish13 showed values comparable to that of Arnett's group. The orbital rim is an anteroposterior indicator of maxillary position. Deficient orbital rims may correlate positionally with a retruded maxilla because the osseous structures are often deficient as groups, rather than in isolation. The average Values of the relationship between both the jaws and orbit in our study were significantly very less for both females and Males as compared to Arnett's[10] group, While that of others studies [18] does not showing any major Significant differences.

The face angle, which is a component of entire facial equilibrium, revealed a little statistical difference between the sexes. Male in the population is thought to have more convex profiles since the mean facial angle of the men (168.73 º± 3.41) was greater than that of the females (169.63 º±4.83) [Table/Fig-3]. Both the boys and females of the local population had greater convex profiles when compared to conventional STCA standards.

Conclusion

We draw the conclusion from our study which is consistent with other studies as well that most soft tissue variables between Caucasians and our group are significantly different. This implies that for appropriate diagnosis and treatment planning, different norms should be established for various ethnic groups, and patients should be treated with this in mind.

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