Original Article

Comparison Of Arnett's Analysis Parameters Of North Indian Female Population & Caucasian Female Population Using Digital Cephalometric Tracing Method

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Abstract

The idea outlined in Arnett and Bergman's "Facial keys to orthodontic diagnosis and treatment planning, Parts I and II" directly informed the development of this radiography tool. This method's uniqueness, like that of the "Face Keys" articles, is in its focus on soft tissue facial measuring. In this article, different soft tissue structure qualities that contribute to an aesthetically pleasant face and should be taken into account during orthodontic treatment are compared between the North Indian and Caucasian female populations. The purpose of the current study was to demonstrate how North Indaian and Caucasian populations had different norms for soft tissue structure.

Materials and Methods
60 North Indian females between the ages of 18 and 28 years had lateral cephalograms taken at the Himachal Institute of Dental Sciences in Paonta Sahib. Nemoceph software was used to trace the soft tissue profile as well as associated osseous and dental structures. Then, the soft tissue structure attributes of Arnett and North Indian female population was compared.

Results: When compared to Caucasian women, North Indian women have shorter upper and lower lips, pog-pogs, and menton. The posterior height is more in North Indian females as compared to Caucasian females .The values of the projections to TVL are less in North Indian female population as compared to Caucasian population
Because the face skeleton and the soft tissue that covers it vary depending on the population of females, all patients cannot be treated according to the same set of standards.

Keywords: North Indian Females, soft tissue norms, Arnett's analysis, Caucasian population.

INTRODUCTION

An essential objective of orthodontic therapy is the preservation of facial appearance. In order to set goals and foresee challenges that must be overcome, treatment planning involves knowledge of the parameters and normative data. The morphological characteristics of an individual differ from race to race due to a complex interaction of hereditary and environmental factors. Each subgroup had its own norms, even when they belonged to the same race. Therefore, the North Indian female population cannot be expected to adhere to the established norms for other ethnic groups. Thus, it is necessary to examine the applicability of the numerous soft tissue criteria suggested by Bergman in order to enhance treatment planning for the North Indian female population. [1] It has been proposed that certain cephalometric standards relating teeth to cranial or facial bones could assure healthy facial shape if adhered to as a treatment aim since soft tissue norms serve as a guideline in estimating change. [2]With appropriately planned and carried out orthognathic surgery techniques, it is possible to achieve one of the main aims in the treatment of dentofacial abnormalities, which is the acquisition of facial soft-tissue proportionality. [3] Therefore, the goal of this study is to compare the harmony value norms for the female population of Himachal Pradesh with the female population of Caucasians in order to differentiate the soft tissue cephalometric values of various parameters and aid the orthodontist in making a more accurate diagnosis and treatment plan for the North Indian female population dentofacial deformities.

MATERIAL AND METHOD

This research was done at the Himachal Institute of Dental Sciences, Paonta Sahib, in the Department of Orthodontics and Dentofacial Orthopaedics (H.P). For the study, 60 North Indian females between the ages of 18 and 28 were taken into consideration. A panel of professors from the Department of Orthodontics and Dentofacial Orthopaedics inspected each individual, and faces with generally balanced features were chosen. For usage as metallic markers, 2 mm (approximate) diameter silver beads were selected.

With a Carestream X-ray machine with model number CS8100, all cephalograms of patients were taken with their heads in their natural positions (2016). After the pictures were calibrated, all of the radiographs were traced using the (Nemoceph) Dental Studio NX (2006) programme.

Using the software's built-in autozoom capability, all of the landmarks were manually marked, and Nemoceph's software handled the automatic measurement of the data. Additionally, ten radiographs were retraced a week later to evaluate intra-operator reliability. Arnett's STCA (soft tissue cephalometric analysis)[4]was carried out taking into account:

Harmony values:

Intramandibular relations
Mandibular incisor tip (Md1) to Pogonion'(POG')
Lower lip anterior (LLA) to Pogonion' (POG')
'B' point (B') to Pogonion' (POG')
Throat length (NTO to POG')
Interjaw relations
1. Subnasale (Sn') to Pogonion' (POG')
2.'A'point (A') to 'B' point (B')
3. Upper lip anterior (ULA) to lower lip anterior (LLA)
Orbit to jaws
1. Orbital rim (OR') to'A' point (A')
2. Orbital rim (OR') to Pogonion' (POG')
Full Facial balance
1. Facial angle [Glabella'(G') to subnasale (Sn) to Pogonion' (POG')]
2. Glabella' (G') to 'A' point (A')
3. Glabella '(G') to Pogonion' (POG')

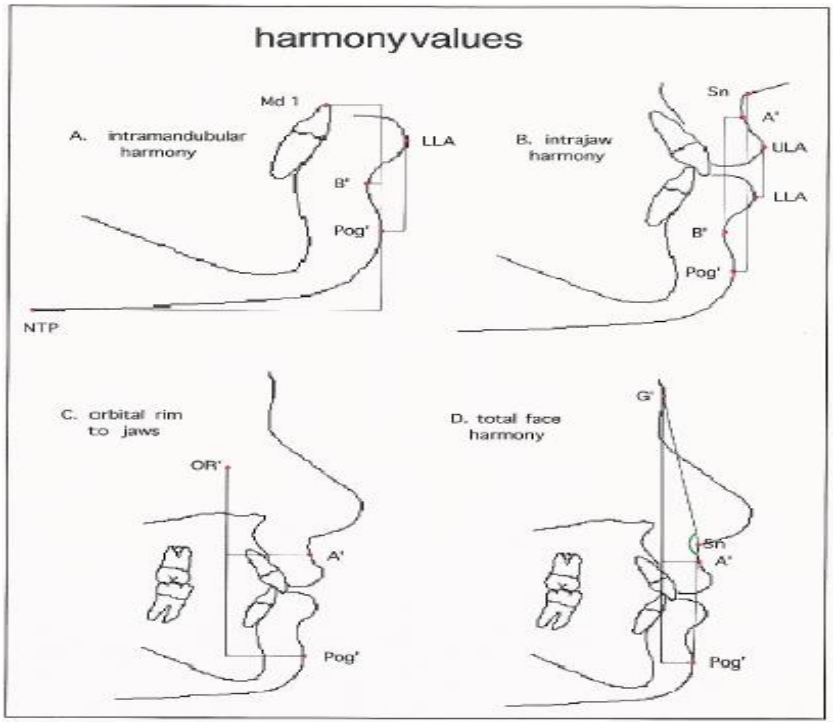

FIG 1- HARMONY VALUES

Facial lengths:

Facial heights (Nasion'[Na] to Menton'[Me'])
Upper lip length (upper lip inferior [ULI] to subnasale[Sn])

Interlabial gap(ILG)
Lower lip length (lower lip superior [LLS] to Menton'[Me])
Lower 1/3 of face (Subnasale[Sn] to Menton'[Me])
Overbite (OB)
Maxillary incisor tip(Mx1) exposure
Maxillary height (Subnasale [Sn]to tip of maxillary incisor tip[Mx1])
Mandibular height (Menton [Me]' to tip of mandibular incisor tip[Md1])

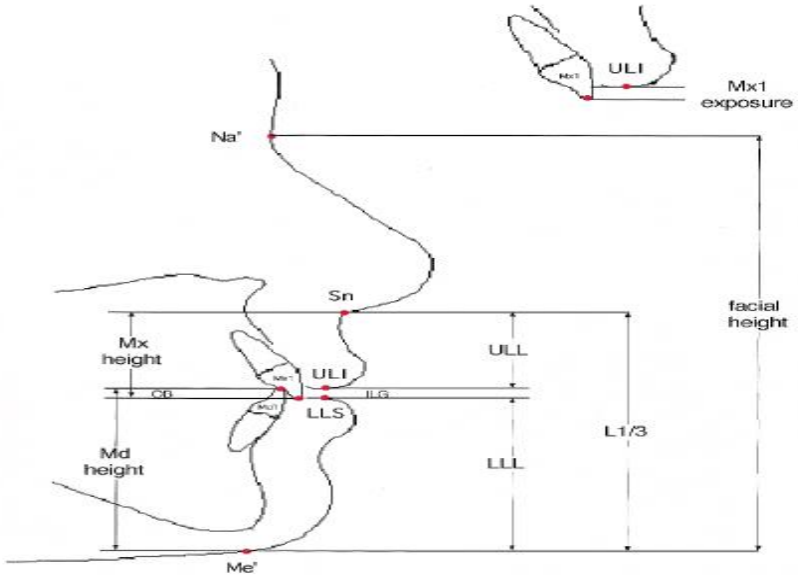

FIG 2- FACIAL LENGTHS

Soft tissue structures:

Upper lip thickness (upper lip anterior[ULA] to upper lip inside[ULI])
Lower lip thickness (lower lip anterior [LLA] to lower lip superior[LLS])
Pogonion –pogonion'(Pog –Pog')
Menton –menton'(Me-Me')
Upper lip angle (subnasale [Sn]- upper lip anterior [ULA]to true vertical line[TVL])
Nasolabial angle (subnasale [Sn]- upper lip anterior [ULA] to subnasale [Sn]-Columella)

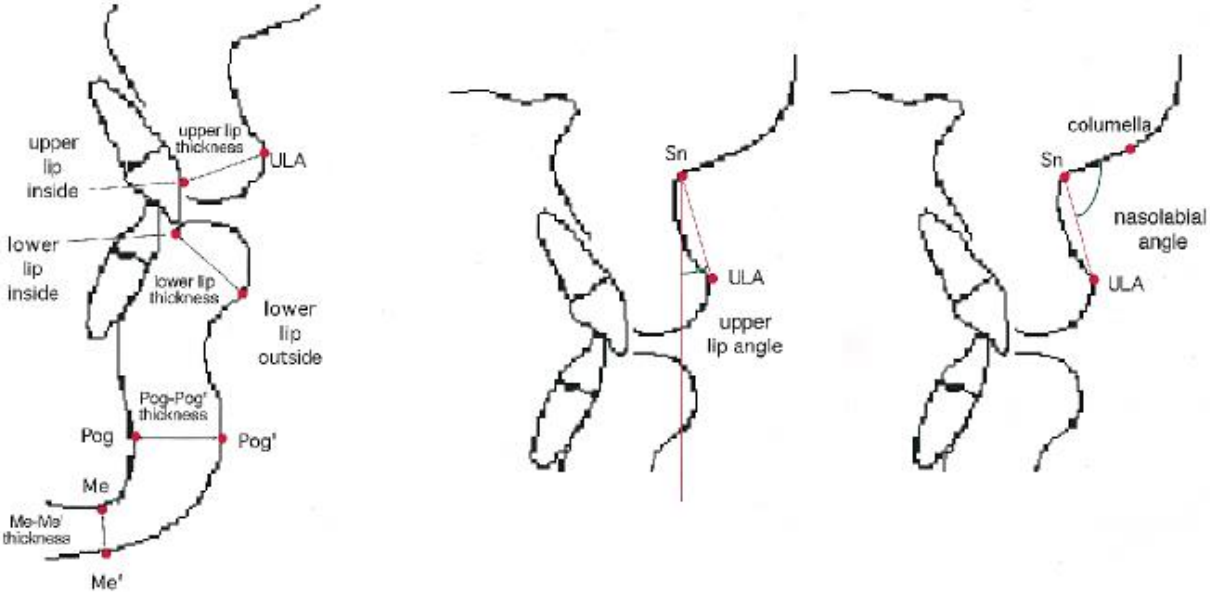

FIG 3 - SOFT TISSUE STRUCTURES

Projections to true vertical line :

Glabella (G')
Orbital rims (OR')

Cheek bone (CB')
Subpupil (SP')
Alar base (AB')
Nasal projections
Subnasale (Sn)
'A' point
Upper lip anterior (ULA)
Maxillary incisor tip (Mx1)
Mandibular incisor tip (Md1)
Lower lip anterior (LLA)
'B'point
Pogonion (POG')

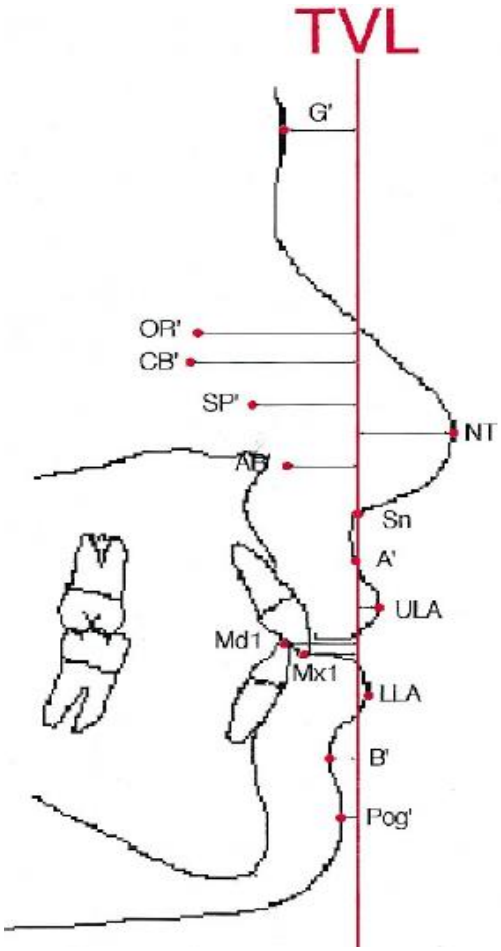

FIG 4 – TRUE VERTICAL LINE

Using Microsoft Excel, the values of all the parameters so collected were arranged in the form of a master chart, statistically analysed, and contrasted with the female Caucasian population.

ASSESSMENTS AND RESULTS

To investigate North Indian ethnic community norms using Arnett's Soft Tissue Cephalometric Analysis study criteria, a study including sixty females was conducted. For purposes of reference during the procedure, normal values were determined as mean ± SD. The Student's t test was used to determine the significance of the differences between the female samples of the two populations. The significance level was set at 5%, and P values were calculated. The results of the statistical analysis revealed that the two populations shared some similar measurements, but not all of them.

In terms of facial harmony, the values for the nasal base to chin, maxillary base to mandibular base, lip to lip, incisor tip to chin, and lower lip to chin for North Indian females were 5.818 ± 4.64 mm, 1.39 ± 6.46 mm, 106.59 ± 6.17 mm, 102.76 ± 9.66 mm, 6.40 ± 4.33 mm, 7.33 ± 2.63 mm, 2.44 ± 1.59 mm and 4.71 ±3.38 mm for North Indian females and 8.4 ± 2.7 mm, 5.9 ±2.3 mm, 18.5 ± 2.3 mm, 16 ± 2.6 mm, 3.2 ± 1.9 mm, 5.2 ± 1.6 mm, 1.8 ± 1.0 mm, and 9.8 ± 2.6 mm for Caucasian females, respectively. The differences in means were statistically significant.

TABLE 1 : Comparison of Cephalometric parameters between North Indian and Caucasian females						
	NORTH INDIAN FEMALES		ARNETT'S VALUE FEMALES		T VALUE	p VALUE
	Mean	S.D.	Mean	S.D.		
Forehead to max	5.818	4.6421	8.4	2.7	3.933	.000***
Forehead to mand	1.398	6.4647	5.9	2.3	4.924	.000***
Max to Orbital rim	106.598	6.1776	18.5	2.3	100.840	.000***
Mand to orbital rim	102.766	9.6659	16	2.6	63.474	.000***
Nasal base to chin	6.406	4.3369	3.2	1.9	5.227	.000***
Mx base- Md base	7.332	2.6366	5.2	1.6	5.718	.000***
Lip to Lip	2.442	1.5957	1.8	1.0	-18.798	.000***
Inc tip to chin	4.716	3.3802	9.8	2.6	30.366	.000***
Low lip to chin	4.892	3.0785	4.5	2.1	.900	.372

Statistically significant value at *p ≤ 0.05, **p ≤ 0.01 and ***p ≤ 0.001

Upper lip, lower lip, upper lip length, interlabial gap, upper incisor exposure to relaxed lip, lower lip length, lower 1/3rd height, total facial height, maxillary height, mandibular height, and posterior height were measured for North Indian females and found to be 10.95 ± 1.48 mm, 9.62 ± 1.27 mm, 19.04 ± 1.83 mm, 1.57 ± 0.75 mm, 3.66 ± 1.45 mm, 42.58± 3.6 mm, 63.21 ± 4.78 mm, 115.95 ± 6.34 mm, 22.71 ± 2.52 mm, 37.12 ± 2.54 mm and 100.31 ± 4.63 mm as compared to Caucasian females with measurements 12.6 ± 1.8 mm, 13.6 ± 1.4 mm, 21 ± 1.9 mm, 3.3 ± 1.3 mm, 4.7 ± 1.6 mm, 46.9 ± 2.3 mm, 71.1 ± 3.5 mm, 124.6 ± 4.7 mm, 25.7 ± 2.1 mm, 48.6 ± 2.4 mm and 95.6 ± 1.8 mm respectively. The differences in means were significant .

TABLE 2 : Comparison of Cephalometric parameters between North Indian and Caucasian females						
	NORTH INDIAN FEMALES		ARNETT'S VALUE FEMALES		T VALUE	p VALUE
	Mean	S.D.	Mean	S.D.		
Post height	100.314	4.6395	95.6	1.8	7.185	.000***
Upper lip length	19.048	1.8388	21	1.9	7.506	.000***
Interlabial gap	1.570	.7576	3.3	1.3	16.147	.000***
Upper incisor exp. Relaxed lip	3.668	1.4575	4.7	1.6	5.007	.000***
Lower lip length	42.58	3.618	46.9	2.3	8.435	.000***
Lower 1/3 height	63.214	4.7853	71.1	3.5	11.653	.000***
Total facial height	115.956	6.3466	124.6	4.7	9.631	.000***
Maxillary height	22.716	2.5239	25.7	2.1	8.360	.000***
Mandibular height	37.122	2.5405	48.6	2.4	31.948	.000***

Statistically significant value at *p ≤ 0.05, **p ≤ 0.01 and ***p ≤ 0.001

The mean thickness of the upper and lower lips among females was 10.95 ± 1.48 mm and 9.62 ± 1.27 mm for North Indian females and 12.6 ± 1.8 mm and 13.6 ± 1.4 mm for Caucasian females, respectively. The differences in mean values were significant for all of these.

TABLE 3 : Comparison of Soft tissue structure parameters between North Indian and Caucasian females						
	NORTH INDIAN FEMALES		ARNETT'S VALUE FEMALES		T VALUE	p VALUE
	Mean	S.D.	Mean	S.D.		
Upper lip	10.956	1.4875	12.6	1.8	-7.815	.000***
Lower lip	9.622	1.2752	13.6	1.4	-22.058	.000***
Pog-Pog'	11.924	2.4381	11.8	1.5	.360	.721
Menton	7.180	1.7707	7.4	1.6	-0.879	.384
Upper lip angle	3.842	8.0772	12.1	5.1	7.229	.000***
Nasolabial angle	103.872	11.4916	103.5	6.8	.229	.820

Statistically significant value at *p ≤ 0.05, **p ≤ 0.01 and ***p ≤ 0.001

The True vertical line measurements of soft tissue orbital rim, cheekbone, subpupil, nasal projection, nasal base, soft tissue point A, upper incisor tip, upper lip ant, upper lip angle, lower incisor tip, lower lip anterior, soft tissue point B, soft tissue Pogonion and facial angle were -108.57 ± 6.27 mm, -19.29 ± 3.45 mm, -12.05 ± 2.48 mm, 12.93 ± 2.04 mm, -8.22 ± 1.63 mm, -1.9 ± 1.2 mm, -11.130 ± 3.01 mm, -.930 ± 1.98 mm, 3.842 ± 8.07 mm, -13.95 ± 4.8 mm, -1.5 ± 2.33 mm, -9.310 ± 3.32 mm, -5.97 ± 4.92 mm and 165.57 ± 6.22 mm respectively for North Indian females and -18.7 ± 2.0 mm, -20.6 ± 2.4 mm, -14.8 ± 2.1 mm, 16 ± 1.4 mm, -12.9 ± 1.1 mm, -0.1 ± 1.0 mm, -9.2 ± 2.2 mm, 3.7 ± 1.2 mm, 12.1 ± 2.2 mm, 1.9 ± 1.4 mm, -5.3 ± 1.5 mm, -2.6 ± 1.9 mm and 169.3 ± 3.4 mm respectively for Caucasian females and the differences in means were statistically significant.

TABLE 4 : Comparison of Cephalometric parameters between North Indian and Caucasian females						
	NORTH INDIAN FEMALES		ARNETT'S VALUE FEMALES		T VALUE	p VALUE
	Mean	S.D.	Mean	S.D.		
Glabella	-7.800	4.6341	-8.5	2.4	1.068	.291
Soft tisue or. Rim	-108.570	6.2762	-18.7	2.0	101.252	.000***
Cheekbone	-19.292	3.4584	-20.6	2.4	2.674	.010*
Subpupil	-12.058	2.4852	-14.8	2.1	7.802	.000***
Nasal projection	12.938	2.0499	16	1.4	10.562	.000***
Nasal base	-8.222	1.6350	-12.9	1.1	20.232	.000***
Soft tissue A	-1.976	1.2009	-0.1	1.0	-5.747	.000***
Upper inc. tip	-11.130	3.0167	-9.2	2.2	-4.524	.000***
Upper lip ant	.930	1.9896	3.7	1.2	-9.845	.000***
Lower incisor tip	-13.958	4.8036	-12.4	2.2	2.293	.026*
Lower lip anterior	-1.508	2.3312	1.9	1.4	10.337	.000***
Soft tissue B	-9.310	3.3260	-5.3	1.5	-8.525	.000***
Soft tissue Pog	-5.976	4.9263	-2.6	1.9	4.846	.000***

Statistically significant value at *p ≤ 0.05, **p ≤ 0.01 and ***p ≤ 0.001

DISCUSSION

Beauty is really hard to define. Various people have different ideas on what is beautiful. There are no set criteria for what makes a face beautiful. The need to comprehend what is and is not beautiful has grown as experts' capacity to transform faces has increased. [5] Occlusal perfection and face harmony have traditionally been two of orthodontics' main objectives. [2] The harmony and balance of the face are determined by the facial bones and the soft tissue that covers it. The impact of the face's appearance is determined by the structure of the soft tissues that lie above and their respective proportions.

Instead of achieving Angle's perfect occlusion, the main goal of treatment is to achieve soft tissue harmony and balance. This objective is consistent with Angle's ideal occlusion and it understands that optimal occlusion cannot always be the main emphasis of a treatment strategy in order to assist the patient to the fullest extent possible. [6] The Soft Tissue Cephalometric Analysis is a radiographic tool that exemplifies the theory outlined in "Facial Keys to Orthodontic Diagnosis and Treatment Planning" on a clinical level. Similar to previous prior articles, this cephalometric soft tissue analysis directs soft tissue evaluation, but with more benefits. Profile soft tissue landmarks are easily recognised, identified, and assessed cephalometrically because the STCA is a cephalometric study.

Importantly, for the first time, the midface metallic markers make it simple to see, mark, and measure key soft tissues such the alar base, cheekbone, and orbital rim. [4] The STCA is composed of five unique yet complementary components:

- The system first evaluates significant dentoskeletal elements under the surgeon's and orthodontist's control (Mx1 to MxOP, Md1 to MdOP) (MxOP to TVL). For a pleasing face profile and aesthetics, dentoskeletal variables must be adjusted using orthodontic and surgical means.
- Second, it assesses important soft tissue components that influence facial appearance.
- Third, it measures crucial vertical soft tissue lengths and the connections between soft and hard tissues.
- Fourth, it calculates the absolute projection values for each point by comparing soft tissue points to the TVL.
- Fifth, to verify face harmony, the absolute values are then compared to one another. Harmony numbers, which are crucially independent of the true vertical anteroposterior location, offer a test of facial balance inside the individual's face. 15

The Himachal Institute of Dental Sciences in Paonta Sahib's Department of Orthodontics and Dentofacial Orthopaedics conducted the current study (H.P). For the study, a sample of 60 females between the ages of 18 and 28 who were inhabitants of North India were taken into consideration. The individuals were first clinically evaluated with their lips at rest, their heads in their natural positions, and their condyles seated. Then, facial examination (frontal/profile), as reported by Arnett and Bergman[7], was used with a focus on midface features that are not visible on conventional cephalometric analysis. The maxilla's anteroposterior location was revealed by the features of the orbital rim, subpupil, and alar base in particular. According to Arnett et al [4] in 1999, small diameter silver beads with a dimension of 2 mm (approximately) were chosen for the use as metallic markers due to their excellent radio-opaque properties even in small dimensions and the ease with which they could be applied on the face at the precise location with the aid of paper tape. The right side of the face was then marked with metallic markers in the shape of tiny silver beads to identify important midface structures in preparation for the cephalometric radiograph.ed with a focus on midface features that are not visible on conventional cephalometric analysis. The next step in preparing for a cephalometric radiograph was to identify important midface structures on the right side of the face using metallic markers in the shape of tiny silver beads.
The midface structures were noted, and the Natural Head Position was taken. They were instructed to inhale and bite into focal occlusion. A cephalogram was taken with the patients' heads in their natural positions, sitting on the condyle, and their lips relaxed. The subject tilted his or her head forward and backward with decreasing amplitude until a comfortable posture of natural balance was reached. This procedure, which Cooke and Wei introduced in 1988, was used to record the subject's natural head position.

The individual was then instructed to use the mirror to stare into the reflection of their eyes in a mirror that was 200 cm in front of them. When inserting the ear posts, extra care was taken to prevent the head from moving.
Then, with the aid of the (Nemotec) Dental Studio 2006 software, the acquired digital cephalograms were traced. Dentoskeletal, soft tissue, vertical, projection, and facial harmony norms and SDs were determined following the measurement of cephalometric landmarks in 50 facially balanced Himachali subjects. The values were acquired, and Student's t test was used for statistical analysis.
The STCA integrates soft tissue balance and occlusal correction.
The STCA is not intended to replace other cephalometric analyses. Its purpose is to offer clinically useful soft tissue information with checks and balances in conjunction with cephalometric treatment planning and clinical face assessment (between cephalometric and clinical facial findings). [4]

This study emphasises the contrasts between the facial shapes of female Caucasian and North Indian female populations. The thickness of upper lip, lower lip and upper lip angle are less in North Indian female population as compared to Caucasian population so this should be taken care of while retracting the incisors.
In the projections to True vertical line, the measurement of soft tissue orbital rim, cheekbone, subpupil, nasal projection, nasal base, soft tissue point A, upper incisor tip, upper lip ant, upper lip angle, lower incisor tip, lower lip anterior, soft tissue point B, soft tissue Pogonion and facial angle were lesser for North indian females as compared to Caucasian females and the differences in means were statistically significant

CONCLUSION

The face skeleton and its underlying soft tissue vary for different populations of females, so all patients cannot be treated according to the same set of standards. Therefore, it is crucial to preserve the face harmony and balance of a specific population while caring for a patient from that particular population.

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