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Research Article

Comparison of Arnett's Soft Tissue Norms of Himachali Male Population with Caucasian Male Population Using Digital Tracing Method: A Cephalometric Study

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Abstract: **Background:** This analysis was developed directly from the philosophy expressed in Arnett and Bergman "Facial keys to orthodontic diagnosis and treatment planning, Parts I and II". The novelty of this approach, as with the "Facial Keys" articles, is an emphasis on soft tissue facial measurement. This article describes comparison of various soft tissue traits between Himachali male population and Caucasian male population that contribute to an aesthetically pleasing face which should be considered during orthodontic treatment. The aim of the present study was to highlight the differences in soft tissue norms between Himachali males and Caucasian males. **Materials and Methods:** Lateral cephalograms of 50 Himachali males of age group 18-25 years were taken in Department of Orthodontics, Himachal Institute of Dental Sciences, Paonta Sahib and tracing of soft tissue profile as well as related osseous and dental structures were made using Nemoceph software. Then Arnett's soft tissue traits were compared with Himachali traits. **Results:** The present study showed that, a horizontal growth tendency in Himachali is acceptable esthetically. A fuller upper lip is considered balanced and esthetic. Increase in lip incompetency is considered unaesthetic. **Conclusion:** An increased posterior height resulting in horizontal growth tendency is acceptable esthetically. Individual norms are necessary for a population in order to plan and deliver quality treatment.

Keywords: Himachali males, soft tissue traits, treatment planning.

INTRODUCTION

Preservation of facial attractiveness is an important goal of orthodontic treatment. Treatment planning requires knowledge of the parameters and normative data that helps to establish goals and predict the obstacles that need to be negotiated. Due to a complicated interaction of genetic and environmental factors the morphological features of an individual vary from race to race. Even within the same race, each subgroup had its own standards. Hence, the established norms for other ethnic group can not apply to the population of Himachal Pradesh. Therefore, the applicability of various soft tissue parameters proposed by Bergman, should be analyzed which will improve treatment planning for male population of Himachal Pradesh (Burstone, C. J. 1967). As Soft tissue norms serve as a guideline in calculating change it has been suggested that certain cephalometric standards relating teeth to cranial or facial bones could ensure good facial form if adhered to as a treatment goal (Spyropoulos, M. N., & Halazonetis, D. J. 2001). The attainment of facial soft-tissue proportionality is one of the principal goals in the treatment of dentofacial deformities and can be achieved with properly planned and executed orthognathic surgery techniques (Proffit, W. R. *et al.*, 2013). Therefore the aim of this study is to compare the norms for the male population of Himachal Pradesh with the Caucasian male population so that the soft

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tissue cephalometric values of various parameters could be differentiated so as to guide the orthodontist towards a better diagnosis and treatment planning of dentofacial deformities for the population of Himachal Pradesh.

MATERIALS AND METHODS

This study was carried out in the Department of Orthodontics and Dentofacial Orthopaedics of Himachal Institute of Dental Sciences, Paonta Sahib (H.P). 50 Males in the age group of 18-25 years who were residents of Himachal Pradesh were considered for the study. All subjects were examined by a panel of the faculty members of the Department of Orthodontics and Dentofacial Orthopaedics and reasonably balanced faces were selected. Small diameters silver beads of dimension 2 mm (approx.) were chosen for the use as metallic markers.

All the cephalograms of patients were taken in natural head position with Carestream X-ray machine with model no CS8100 (2016). All the radiographs were traced using (Nemoceph) Dental Studio NX (2006) software after the calibration of the images.

All the landmarks were marked manually using inbuilt autozoom feature of the software and the measurement of the values and was done automatically by the Nemoceph software. Ten radiographs were also retraced after one week to check the intra-operator reliability. The Arnett's soft tissue cephalometric analysis (STCA) (Park, Y. C., & Burstone, C. J. 1986) was performed considering:

Dentoskeletal Factors:

- Maxillary occlusal plane (Mx OP) to true vertical line (TVL)
- Maxillary central incisor tip (Mx1) to maxillary occlusal plane (Mx OP)
- Mandibular incisor tip (Md1) to mandibular occlusal plane (Ms OP)
- Overjet(OJ)
- Overbite(OB)

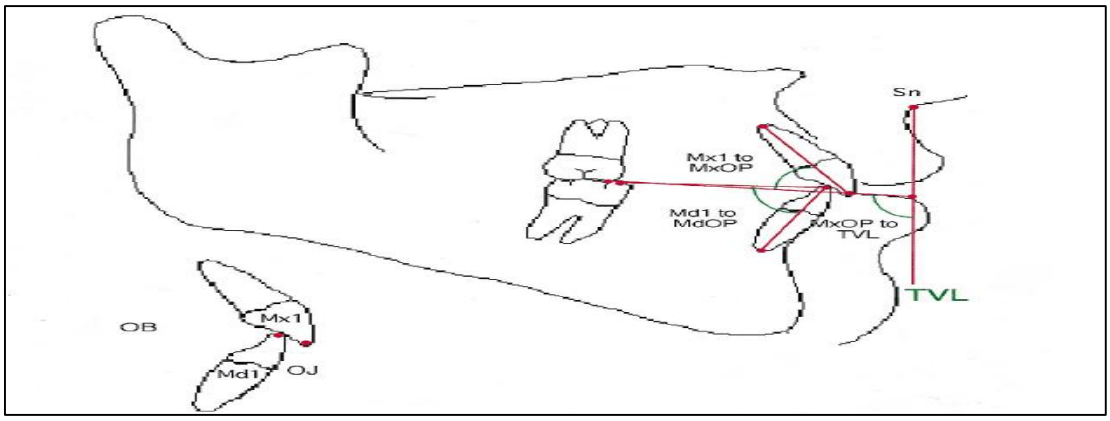

Fig1. Dentoskeletal factors

Soft Tissue Structures:

- Upper lip thickness (upper lip anterior[ULA] to upper lip inside[ULI])
- Lip 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)

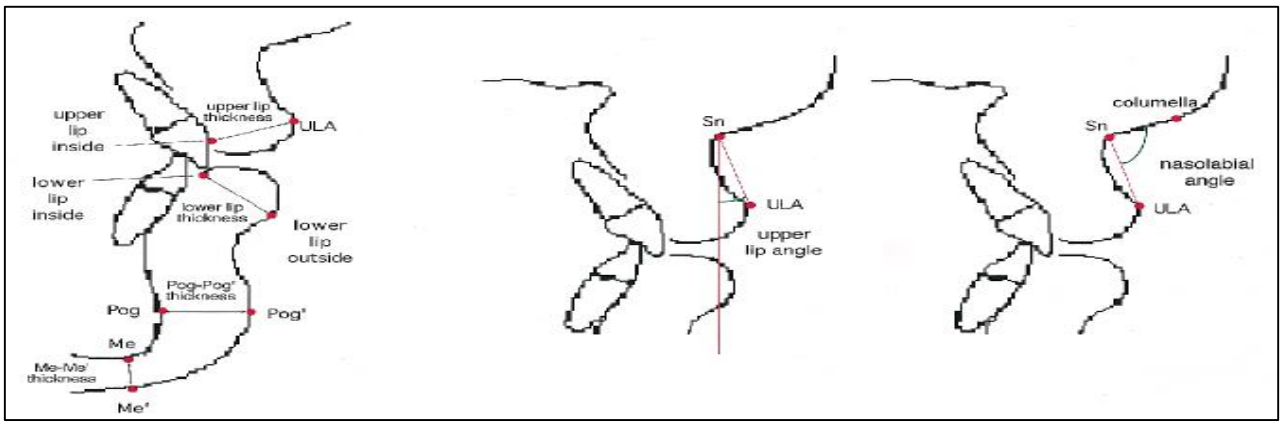

Fig2. Soft tissue structures

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])

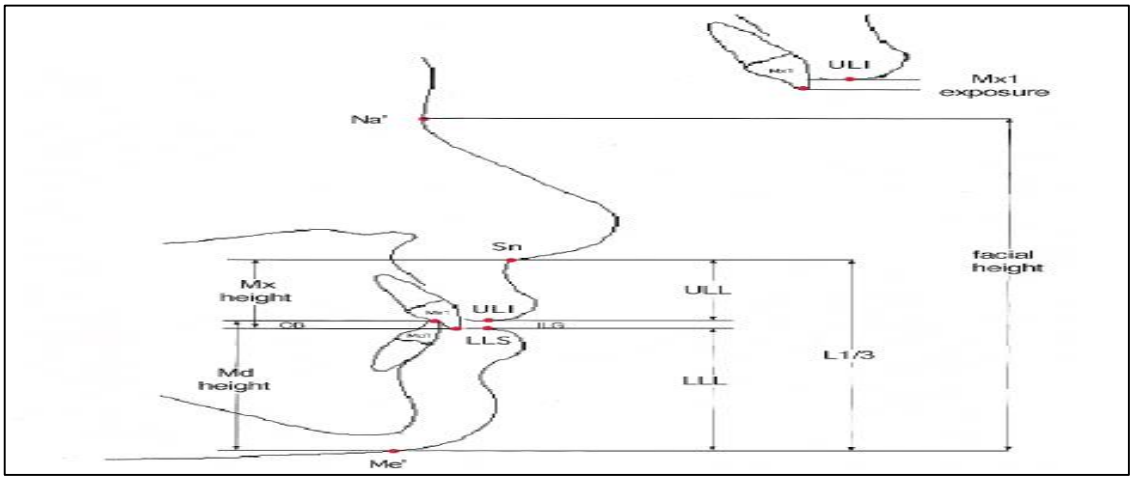

Fig3. Facial heights / lengths

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')

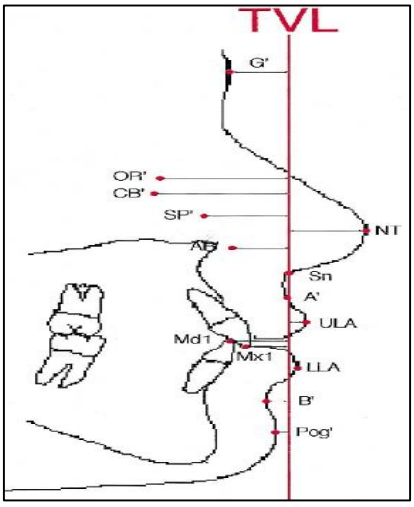

Fig4. True Vertical Line Measurements

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
- Subnasale (Sn') to Pogonion' (POG')
- 2.'A'point (A') to 'B' point (B')
- Upper lip anterior (ULA) to lower lip anterior (LLA)

Orbit to Jaws
- Orbital rim (OR') to'A' point (A')
- Orbital rim (OR') to Pogonion' (POG')

Full Facial Balance
- Facial angle [Glabella' (G') to subnasale (Sn) to Pogonion' (POG')]
- Glabella' (G') to 'A' point (A')
- Glabella '(G') to Pogonion' (POG')

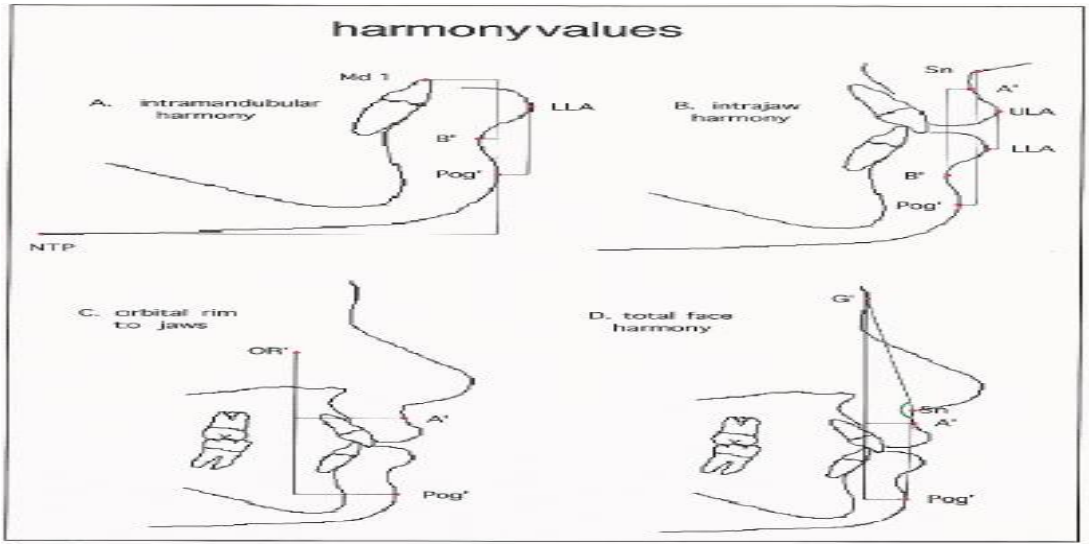

Fig5. Harmony Values

Values of all parameters thus obtained were organized in the form of a master chart using Microsoft Excel and were statistically analyzed and compared with Caucasian male population.

OBSERVATIONS AND RESULTS

A study consisting of fifty males was undertaken to study norms of the Himachali ethnic male population based on Arnett's Soft Tissue Cephalometric Analysis study parameters. Normal values were calculated as mean ± 2SD for reference in the procedure. Significance of the difference between the male samples of both populations were tested with the Student't' test. A level of significance of 5% was assigned and P values were determined. Statistical analysis showed that the two male populations were similar in some but not in all measurement.

In dentoskeletal factors among male population, only the mean value of Mx1-MxOP, Overjet and Posterior height which was (55.14 ± 5.30 mm, 3.83 ± 0.91mm and 97.06 ±4.24 mm respectively) in Himachali males and (57.8 ± 3.0 mm, 3.2 ± 0.6 mm and 95.6 ± 1.8 mm respectively) in Caucasian males showed a significant difference with p value of 0.001, 0.000 and 0.001 respectively. The mean values of Md1-Md OP and overbite were insignificant (TABLE-I).

Among the soft–tissue measurements among male population, the mean values of thickness of upperlip, lower lip, Pog-Pog' and soft tissue menton were (11.53 ± 1.39 mm, 10.63 ± 1.58 mm, 12.78 ± 2.18 mm and 8.81 ± 1.87 mm respectively) for Himachali males and 14.8 ± 1.4 mm, 15.1 ± 1.2 mm, 13.5 ± 2.3 mm and 8.8 ±1.3 mm respectively for Caucasian males and the differences in mean value were significant for all of these with p value of 0.000, 0.000, 0.024 and 0.024 respectively (TABLE-I).

Among Facial height/length measurement values, 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 20.73 ±2.52 mm, 1.42 ±0.82 mm, 3.00 ±1.39 mm, 47.03 ±3.46 mm, 69.20 ± 5.11 mm, 124.28 ± 7.9 mm, 23.74 ±2.57 mm, 40.29 ±3.72 mm and 97.06 ±4.24 mm respectively for Himachali males and 24.4 ± 2.50 mm, 2.4 ±1.1 mm, 3.9 ± 1.2 mm, 54.3 ± 2.4 mm, 81.1 ± 4.7 mm, 137.7 ±6.5 mm, 28.4 ±3.2 mm, 56 ± 3.0 and 95.6 ±1.8 respectively for Caucasian males and the differences in means were significant with p values of 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000 and 0.001 respectively (TABLE-I).

In the projections to True vertical line, the measurement of glabella, soft tissue orbital rim, subpupil, nasal projection, nasal base, soft tissue point A, upper lip ant, nasolabial angle, lower lip anterior, soft tissue point B, soft tissue Pogonion, throat length and facial angle were -9.84 ± 4.2 mm, -116.19 ± 9.23 mm and -16.17 ± 3.46 mm, 13.86 ± 2.40 mm, -9.79 ± 2.08, -1.79 ± 1.28 mm, 2.02 ± 1.96 mm, 109.76 ± 11.06 mm, -0.37 ± 2.73 mm, -9.6 ± 3.36 mm, -6.19 ± 4.05 mm, 58.61 ± 7.86 mm and 164.48 ± 4.95mm respectively for Himachali males and -8 ± 2.5 mm, -22.4 ± 2.7 mm, -18.4 ± 1.9 mm, 17.4 ± 1.7 mm, -15 ± 1.7 mm, -0.3 ± 1.0 mm, 3.3 ± 1.7 mm, 106.4 ± 7.7 mm, 1 ± 2.2 mm, -7.1 ± 1.6 mm, -3.5 ± 1.8 mm, 61.4 ± 7.4 mm and 169.4 ± 3.2 mm respectively for Caucasian males and the differences in means were statistically significant with p value of .003, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.037, 0.001, 0.000, 0.000, 0.016 and 0.000 respectively. The differences in means of the values for cheekbone, upper incisor tip, upper lip angle and lower incisor tip were not found to be significant (TABLE-I).

Among the facial harmony values the values for maxilla to orbital rim, mandible to orbital rim, nasal base to chin, maxillary base to mandibular base, lip to lip, incisor tip to chin and lower lip to chin were 113.62 ± 7.19 mm, 109.20 ± 7.67 mm, 6.19 ± 4.05 mm, 7.83 ± 2.91 mm, 2.41 ± 1.88 mm, 5.57 ± 3.96 mm and 5.996 ± 3.16 mm respectively for Himachali males and 22.1 ± 3 mm, 18.9 ± 2.8 mm, 4 ± 1.7 mm, 6.8 ± 1.5 mm, 2.3 ± 1.2 mm, 11.9 ± 2.8mm and 4.4 ± 2.5 mm respectively for Caucasian males and the differences in means were statistically significant with p values of 0.000, 0.000, 0.000, 0.015, 0.000, 0.000 and 0.001 respectively (TABLE-I).

Table I: Comparison of Cephalometric Parameters between Himachali and Caucasian Males

	HIMACHALI MALES		ARNETT'S VALUE MALES		T VALUE	p VALUE
	Mean	S.D.	Mean	S.D.		
Mx1-MxOP	55.14	5.305	57.8	3.0	-3.551	.001**
Overjet	3.836	.9194	3.2	0.6	4.892	.000***
Md1-Md OP	62.878	7.0245	64.60	4.0	-1.733	.089
Overbite	2.782	1.6834	3.2	0.6	-1.756	.085
Post height	97.062	4.2434	95.6	1.8	3.436	.001**
Upper lip	11.530	1.3987	14.8	1.4	-16.5321	.000***
Lower lip	10.636	1.5869	15.1	1.2	-19.891	.000***
Pog-Pog'	12.782	2.1842	13.5	2.3	-2.324	.024*
Menton	8.182	1.8709	8.8	1.3	-2.336	.024*
Upper lip length	20.738	2.5248	24.4	2.5	10.256	.000***
Interlabial gap	1.426	.8236	2.4	1.1	8.363	.000***
Upper incisor exp. Relaxed lip	3.006	1.39777	3.9	1.2	4.523	.000***
Lower lip length	47.03	3.469	54.3	2.4	14.819	.000***
Lower 1/3 height	69.200	5.1138	81.1	4.7	16.454	.000***
Total facial height	124.286	7.9040	137.7	6.5	12.000	.000***
Maxillary height	23.744	2.5729	28.4	3.2	12.796	.000***
Mandibular height	40.29	3.7279	56	3.0	29.783	.000***
Post height	97.062	4.2434	95.6	1.8	3.436	.001**
Glabella	-9.846	4.2029	-8	2.5	-3.106	.003**
Soft tisue or. Rim	-116.198	9.2315	-22.4	2.7	71.847	.000***
Cheekbone	-24.212	4.1245	-25.2	4.0	1.694	. 097
Subpupil	-16.170	3.4693	-18.4	1.9	4.545	.000***
Nasal projection	13.836	2.4094	17.4	1.7	91.671	.000***
Nasal base	-9.790	2.0877	-15	1.7	17.646	.000***
Soft tissue A	-1.790	1.2802	-0.3	1.0	-8.230	.000***
Upper inc. tip	-11.766	3.1342	-12.1	1.8	.754	.455
Upper lip ant	2.026	1.9625	3.3	1.7	-4.590	.000***
Upper lip angle	7.436	7.2937	8.3	5.4	-.838	.406
Nasolabial angle	109.762	11.0614	106.4	7.7	2.149	.037*
Lower incisor tip	-15.3	3.1616	-15.4	1.9	.022	.982
Lower lip anterior	-.376	2.7341	1	2.2	3.559	.001**

Soft tissue B	-9.6	3.3654	-7.1	1.6	-5.291	.000***
Soft tissue Pog	-6.190	4.0576	-3.5	1.8	4.688	.000***
Throat length	58.61	7.867	61.4	7.4	-2.508	.016*
Facial angle	164.480	4.9521	169.4	3.2	-7.025	.000***
Forehead to max	8.066	4.5162	7.8	2.8	.416	.679
Forehead to mand	3.660	5.9200	4.6	2.2	-1.123	.267
Max to Orbital rim	113.622	7.1985	22.1	3	89.902	.000***
Mand to orbital rim	109.206	7.6757	18.9	2.8	83.193	.000***
Nasal base to chin	6.190	4.0576	4	1.7	3.816	.000***
Mx base- Md base	7.838	2.9115	6.8	1.5	2.521	.015*
Lip to Lip	2.412	1.8806	2.3	1.2	-17.717	.000***
Inc tip to chin	5.578	3.9695	11.9	2.8	31.135	.000***
Low lip to chin	5.996	3.1668	4.4	2.5	3.564	.001**

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

DISCUSSION

Defining beauty is quite difficult. The perception of beauty is different for different people. There are no rules governing why a face is beautiful. As professionals have increased their ability to change faces, the necessity to understand what is and is not beautiful has increased (Scheideman, G. B. *et al.*, 1980). Orthodontics has always included facial harmony as one of its important goals along with occlusal excellence. Angle suggested that if teeth were placed in optimal occlusion, good facial harmony would result (Spyropoulos, M. N., & Halazonetis, D. J. 2001). The facial skeleton and its overlying soft tissue determine facial harmony and balance. It is the structure of the overlying soft tissues and their relative proportions that provide the visual impact of the face (Burstone, C. J. 1967).

The primary goal of treatment becomes soft tissue harmony and balance, not Angle's ideal occlusion. This broader goal is totally compatible with Angle's ideal occlusion and it acknowledges that to provide maximum benefit to the patient, ideal occlusion cannot always be the major focus of a treatment plan. Keeping this in mind while planning treatment is very important (Charles, J. B. 1958).

The Soft Tissue Cephalometric Analysis is a radiographic instrument that represents the clinical extension of the philosophy detailed in "Facial keys to orthodontic diagnosis and treatment planning." This cephalometric soft tissue analysis guides soft tissue examination, as do these earlier articles, but with added advantages. Because the STCA is a cephalometric analysis, profile soft tissue landmarks are easily seen, marked, and measured cephalometrically. Importantly, the midface metallic markers, for the first time, allow important soft tissues (orbital rim, cheekbone, subpupil, and alar base) to be easily seen, marked, and measured (Park, Y. C., & Burstone, C. J. 1986).

The STCA has five distinct but cross-contributory elements:

- First, the system analyzes key dentoskeletal structures controlled by the orthodontist (Mx1 to MxOP, Md1 to MdOP) and surgeon (MxOP to TVL). Orthodontic and surgical manipulation of the dentoskeletal factors is key to facial profile and esthetics.
- Second, it measures key soft tissue structures that affect facial appearance.
- Third, it measures important vertical soft tissue lengths and soft tissue to hard tissue relationships.
- Fourth, it measures soft tissue points relative to the TVL, thus producing absolute projection values for each point.
- Fifth, the absolute values are then related to one another to test facial harmony. Harmony numbers provide a test of facial balance within the individual's face and, importantly, are independent of the true vertical anteroposterior placement (Arnett, G. W. *et al.*, 1999).

The present study was carried out in the Department of Orthodontics and Dentofacial Orthopaedics of Himachal Institute of Dental Sciences, Paonta Sahib (H.P). A sample of 50 Males who were residents of Himachal Pradesh in the age group of 18-25 years were considered for the study. The subjects were first assessed clinically, in natural head position, seated condyles, and with lips at rest. Then, facial examination (frontal/profile) was used as described by Arnett and Bergman (Scheideman, G. B. *et al.*, 1980) with particular emphasis on midface structures that do not show on standard cephalometric analysis. In particular, orbital rim, subpupil and alar base contours were noted to indicate anteroposterior position of the maxilla.

Small diameters silver beads of dimension 2 mm (approx.) were chosen for the use as metallic markers on the basis of their excellent radio – opaque properties even in small dimensions and since they are light weight they could easily applied on the face to the precise location with the help of paper tape according to Arnett *et al.*, in 1999. Next in the preparation for cephalometric radiograph, metallic markers in the form of small beads of silver were placed on the right side of the face to mark key mid face structures.

With the midface structures marked, the Natural Head Position was recorded. The subjects were asked to swallow and bite into centric occlusion. A cephalogram was obtained with subjects positioned in natural head position, seated condyle, and with lips at rest. The natural head position was recorded based on the method proposed by Cooke and Wei in the year 1988 according to which the subject tilted the head forward and backward with decreasing amplitude until a comfortable position of natural balance was achieved.

With the mirror, the subject was then requested to look into the reflection of their eyes in a mirror located 200 cm ahead. Special care was taken to ensure that the head was not moved when the ear posts were carefully inserted.

The digital cephalograms obtained were then traced with the help of (Nemotec) Dental Studio 2006 software. After the cephalometric soft and hard tissue landmarks were measured on 50 facially balanced males of Himachali origin, dentoskeletal, soft tissue, vertical, projection and facial harmony norms and SDs were established. The values were obtained and statistical analysis was done with Student's t test.

The STCA integrates occlusal correction and soft tissue balance. Of all the STCA (Park, Y. C., & Burstone, C. J. 1986) measurements, only five relate hard tissue to hard tissue points: maxillary occlusal plane, maxillary incisor to maxillary occlusal plane, mandibular incisor to mandibular occlusal plane, overbite, and overjet. These hard tissue relationships are measured because to a large extent they control the esthetic outcome of occlusal treatment (Park, Y. C., & Burstone, C. J. 1986).

The remaining measurements of the STCA emphasize soft tissue dimensions (ie, upper lip length) or soft tissue to hard tissue dimensions (ie, upper incisor to upper lip exposure). The STCA is not meant as a stand-alone cephalometric analysis. It is meant to be used in combination with clinical facial examination and cephalometric treatment planning, to provide clinically relevant soft tissue information with checks and balances (between cephalometric and clinical facial findings) (Park, Y. C., & Burstone, C. J. 1986).

This study highlights the differences in facial structures of Himachali and Caucasian male population (Kalha, A. S. *et al.*, 2008) Himachali males and Caucasian males show significant differences in certain parameters like there is increased overjet and posterior facial height in Himachali males as compared to Caucasian males.

The length of upper lip, lower lip, pog-pog' and menton are less in Himachali male population as compared to Caucasian population so this should be taken care of while retracting the incisors.

These findings show that group specific norms are an essential prerequisite for accurate evaluation of orthodontic patients. The attainment of facial soft-tissue proportionality is one of the principal goals in the treatment of dentofacial deformities and can be achieved with properly planned and executed orthognathic surgery techniques. It would also help to evaluate the progress of treatment in various stages.

CONCLUSION

All male patients cannot be treated to one set of norms as the facial skeleton and its overlying soft tissue is different for different population in males. So, it is very important to maintain the facial harmony and balance of a particular population while treating a patient of that particular population which reinforces the concept of the STCA so pertinently conceived by Arnett *et al.,*.

REFERENCES

1. Burstone, C. J. (1967). Lip posture and its significance in treatment planning. *American journal of orthodontics*, *53*(4), 262-284.
2. Spyropoulos, M. N., & Halazonetis, D. J. (2001). Significance of the soft tissue profile on facial esthetics. *American Journal of Orthodontics and Dentofacial Orthopedics*, *119*(5), 464-471.
3. Proffit, W. R., Fields Jr, H. W., & Sarver, D. M. (2013). Contemporary Orthodontics, Pg: 4.
4. Park, Y. C., & Burstone, C. J. (1986). Soft-tissue profile-fallacies of hard-tissue standards in treatment planning. American Journal of Orthodontics and Dentofacial Orthopedics, 90(1), 52-62.
5. Scheideman, G. B., Bell, W. H., Legan, H. L., Finn, R. A., & Reisch, J. S. (1980). Cephalometric analysis of dentofacial normals. *American journal of orthodontics*, *78*(4), 404-420.
6. Charles, J. B. (1958). The Integumental profile. Am Journal of Orthodontics; 44(1), 1-25.
7. Arnett, G. W., & Bergman, R. T. (1993). Facial keys to orthodontic diagnosis and treatment planning. Part I. *American journal of orthodontics and dentofacial orthopedics*, *103*(4), 299-312.
8. Robert, M. R. (1968). Esthetics, Environment, and the law of lip relation. The Angle Orthodontist, 54(4), 272-289.
9. Kamak, H., & Celikoglu, M. (2012). Facial soft tissue thickness among skeletal malocclusions: is there a difference?. *The Korean Journal of Orthodontics*, *42*(1), 23-31.
10. Kalha, A. S., Latif, A., & Govardhan, S. N. (2008). Soft-tissue cephalometric norms in a South Indian ethnic population. *American journal of*

orthodontics and dentofacial orthopedics, *133*(6), 876-881.

11. Reed, A. H. (1983). A soft tissue cephalometric analysis and its use in orthodontic treatment planning. Part-I. Am J Orthod Dentofac Orthop, 84(1), 1-28.
12. Reed, A. H. (1984). A soft tissue cephalometric analysis and its use in orthodontic treatment planning. Part-II. Am J Orthod Dentofac Orthop, 85(4), 279-293.
13. Raghav, S., Baheti, K., Hansraj, V., Rishad, M., Kanungo, H., & Bejoy, P. U. (2014). Soft Tissue Cephalometric Norms for Central India (Malwa) Female Population. *Journal of international oral health: JIOH*, *6*(5), 51.
14. Cecil, C. S. (1959). Cephalometrics in clinical practice. The Angle Orthodontist, 29(1), 8-29.
15. Arnett, G. W., Jelic, J. S., Kim, J., Cummings, D. R., Beress, A., Worley Jr, C. M., ... & Bergman, R. (1999). Soft tissue cephalometric analysis: diagnosis and treatment planning of dentofacial deformity. *American Journal of Orthodontics and Dentofacial Orthopedics*, *116*(3), 239-253.