



ORIGINAL ARTICLE

ESTABLISHMENT OF SOFT TISSUE CEPHALOMETRIC NORMS USING PROFILE ANGLE AND ESTHETIC ANALYSIS IN HIMACHALI POPULATION

*¹Dr. Tushar Abrol, ²Dr. Anil Singla, ³Dr. Vivek Mahajan, ⁴Dr. Harupinder Singh Jaj, ⁵Dr. Indu Dhiman and ⁶Dr. Shikha Thakur

¹Reader, Bhojia Dental College, Hospital Baddi; Hospital; ²Head of Department, Himachal Dental College, Sundernagar; ³Professor, Himachal Dental College, Sundernagar; ⁴Professor, Himachal Dental College, Sundernagar; ⁵Reader, Himachal Dental College, Sundernagar; ⁶Senior Lecturer, Himachal Dental College, Sundernagar

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*Corresponding author:

Dr Tushar Abrol

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ABSTRACT

Background: Canines are considered to be the key teeth for personal identification as it exhibits greatest sexual dimorphism. The morphometric assessment provides the evidence of sex determination due to dimorphic nature of canine. **Objectives:** To evaluate the reliability of canine morphometric analysis in prediction of sexual dimorphism in Himachali population. **Methods:** Total 70 subjects (35 males and 35 females) were randomly selected and study models were fabricated. The intercanine width and mesiodistal width of canine was measured using digital vernier caliper on the study models of both maxilla and mandible. Sexual dimorphism, Standard and observed canine index was calculated. All the measurements were statistically analysed using student t test. **Results:** On comparison the mean values were found to be larger in males than females and was statistically significant ($p < 0.05$). **Conclusion:** The left canine was more dimorphic than the right canine in both maxilla and mandible and mandibular canine index was found to be more reliable than maxillary canine index in prediction of sexual dimorphism. The value of the standard canine index was found to be 0.25 in maxilla and 0.28 in mandible in Himachali Population.

INTRODUCTION

Facial esthetics has changed the orthodontic concept from a simple tooth movement to a more comprehensive approach.¹ The key to success of an orthodontic treatment is frequently related to the improvement gained in the patient's facial appearance. Though the cephalometrics have assisted the orthodontist in making important decisions regarding treatment approach but the conventional measurements in cephalometrics do not provide all the answers to the esthetic considerations of the face and dentition, particularly in relation to the soft tissue². During the analysis of facial profile in lateral cephalograms, various intra-cranial reference lines were used but these reference lines are very variable. This variability can be overcome by extra-cranial reference lines which provide more accuracy in analyzing the facial profile. The most common extracranial reference lines used are Natural Head Posture³ and Natural Head Position⁴. However both these lines are technique sensitive and not particularly easy in the clinical environment. To overcome all the mentioned difficulties, the Aesthetic Horizontal reference line was proposed, which is related to the Aesthetic or photographic position of the facial profile which is familiar to all orthodontists.

The conventional method of obtaining this position requires the co-operation of trained staff or the clinician's own time as all cephalometric radiographs were taken with the wire in position to avoid duplication of exposure⁵. To avoid this problem, another method has been developed which allows the Aesthetic Horizontal line to be placed at any time after a radiograph has been processed. The Esthetic Position (or photographic position of the head) is effectively a corrected Natural Head Position with the adjustment made by the clinician rather than the radiographer, subsequent to the radiograph being taken. This method has proved to be more precise, accurate, reliable and easy in the clinical environment. The soft tissue paradigm places greater emphasis on function and esthetics of soft tissue which requires thorough knowledge for assessment of facial profile clinically. This analysis evaluates the soft tissue profile in a clinically meaningful way and provides new way to evaluate the correct position of the upper incisors within the face. The position of the upper incisors and the relationship to the lips is the key to the smile and always the central focus of the diagnosis and treatment plan to achieve the optimum smile and is of major significance to the patient also. So the aims and objectives of the present study were to establish the soft tissue cephalometric norms using profile angle and esthetic analysis in Himachal Population and to compare them with the other ethnic groups.

MATERIALS AND METHODS

Lateral cephalometric radiographs of 150 subjects (75 males and 75 females), aged 18 to 25 years who visited the department to seek orthodontic treatment were taken on the basis of following inclusion criteria such as Class I molar, canine and incisor relations, pleasant and balanced facial profile, Competent lips, Normal overjet and overbite and subject should be the resident of Himachal Pradesh from the past generations. Exclusion criteria was presence of any craniofacial deformity and history of previous orthodontic treatment.

METHODOLOGY

For the measurement of profile angle, an inexpensive student's protractor forms the basis of the simple measuring device. A small hole was drilled at the centre and suspended from this position by means of a hook formed at one end. A small weight was attached to the other end, to form a plumb bob.⁵ After making the protractor with a suspended plumb bob, the patient's head was placed in the aesthetic position like a profile photograph was taken. This orientation was reproduced with an error of less than 1.5 degrees, more than sufficient accuracy for all clinical purposes. The straight edge of the protractor was be placed in light contact with the tip of the nose and the chin and the plumb bob is allowed to settle. Then, the angle between the vertical and the line joining the nose tip to chin (E-plane) was measured which is known as Profile Angle⁵ as shown in figure IV. Then the measured angle was transferred to the lateral cephalogram in figure VI. Further for the transfer of profile angle on the lateral cephalogram, the tracing was done and E-plane was drawn on the radiograph from tip of nose to the soft tissue pogonion. The measured profile angle was then transferred to the E-plane which was reproduced as vertical line on the lateral cephalogram¹² (i.e the line of the plumb bob). Then a perpendicular was drawn to this vertical line which represents the Aesthetic Horizontal plane.

The subnasale and A point was then marked on the radiograph tracing and a point half the distance of these two points was marked. This represents the point V. Then the two vertical lines were drawn passing through the point subnasale and other passing through the point V perpendicular to the esthetic horizontal line and the following linear measurements (in mm) were taken (Figure VII).



Figure I. Lateral Cephalogram machine



Figure II. Cassette used for radiograph.

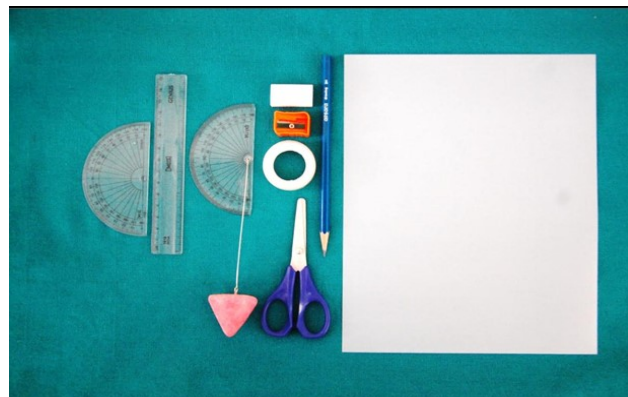
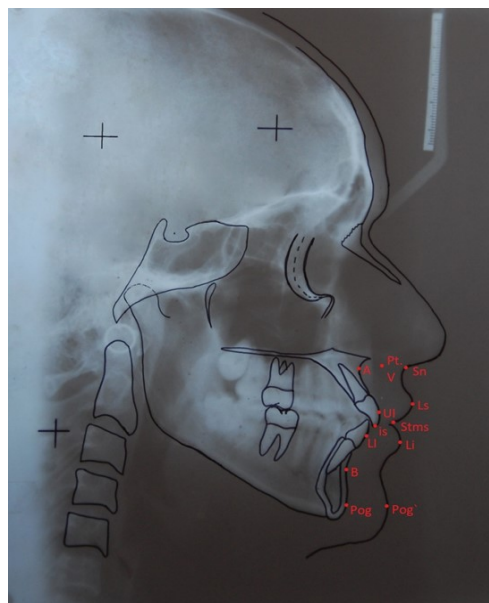


Figure III. Armamentarium used for tracing



Figure IV. Measurement of Profile angle



- | | |
|--------------|-------------------|
| Point A | Labrale superius |
| Sella-nasion | Labraleinferius |
| Point B | Stomion |
| Pog:Pogonion | Incision superius |

Figure V. Reference points used in the study

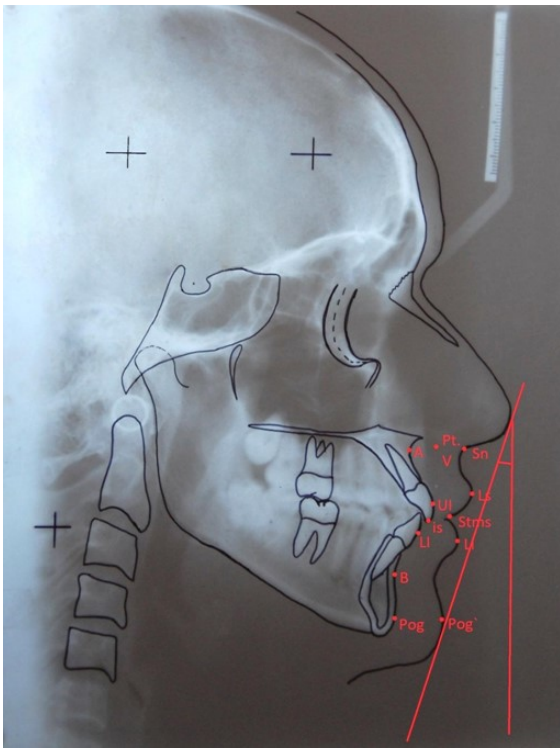
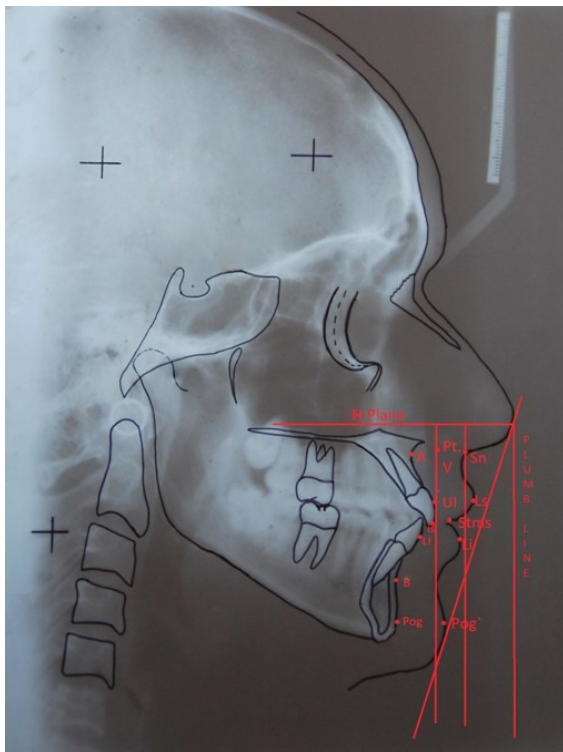


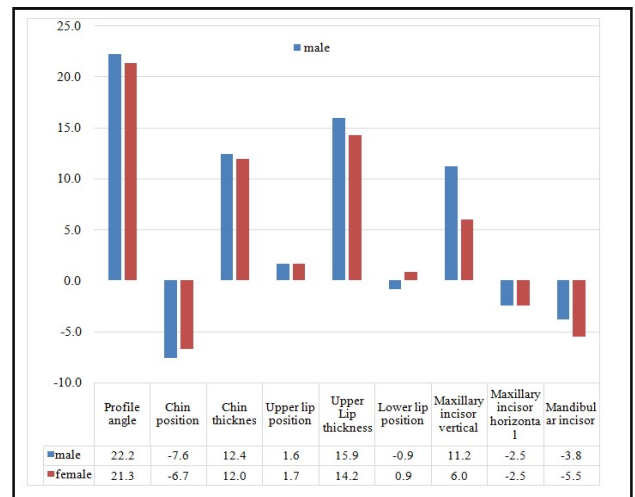
Figure VI. Transfer of Profile Angle on lateral cephalogram



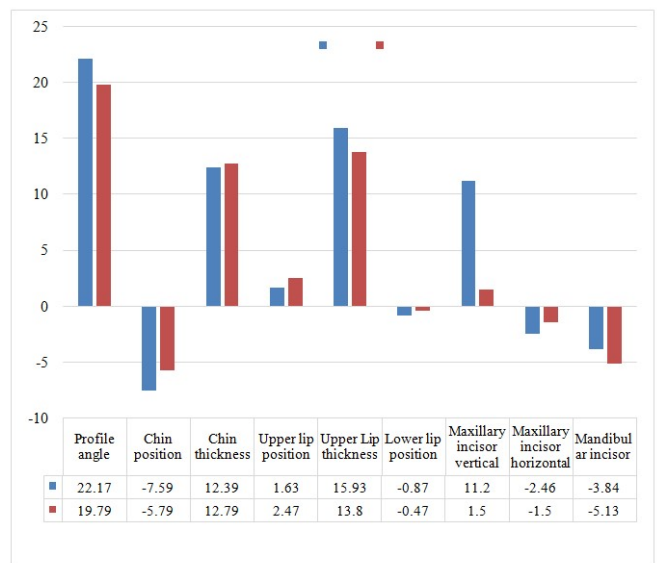
- Pog – SN
- Pog – pog
- Ls – Sn
- Li – Sn
- Uli – UI
- Ui – Pt.V
- Li – Pt.V
- Is -Stms

Figure VII. Linear measurements used in the study

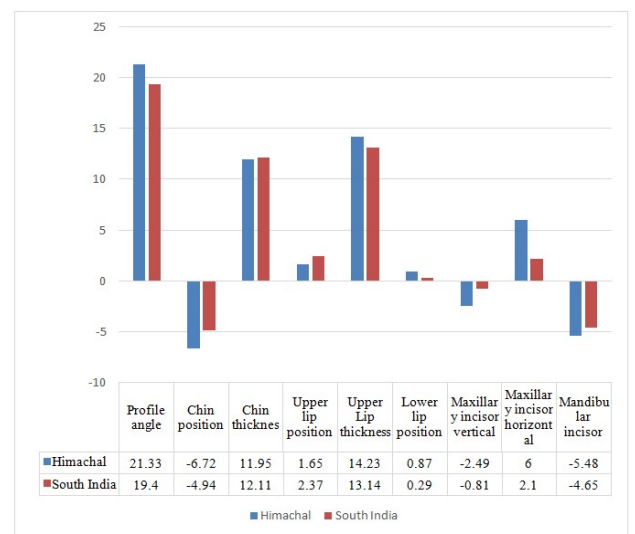
All the measurements on the lateral cephalogram were made twice by the same examiner to minimize the error of measurements. Assessment of intra-examiner reliability analysis was performed using kappa statistics. The intra examiner reliability was found to be kappa = 0.80 – 1.00 (p<0.001) which shows the perfect agreement according to Landis and Koch (1977).66 The data obtained was statically analyzed using SPSS (statistically package for the social sciences) software (version 16).The variables were calculated as Descriptive statistics through mean and standard deviation.



Graph I. Graphical representation of mean values of soft tissue parameters in Himachali Males (n =75) and Himachali Females (n =75)



Graph II. Graphical representation of mean values of soft tissue parameters in Himachali Males (n = 75) and South Indian Males (n = 38)



Graph III. Graphical representation of mean values of soft tissue parameters in Himachali Females (75) and South Indian Females (n =52)

The independent “t” test was used to compare the different parameters of the present study between males and females and also used to compare the parameters between Himachali and south Indian male and female population. Statistical significance was set at $p < 0.01$ and $p < 0.05$.

RESULTS

The results were statistically analyzed to establish norms for the local population as well as to compare them with the findings of other studies..

The descriptive statistics for soft tissue data for males and females variables used in this study was shown in Table I& II and Graph I. Table III showed the comparison of different parameters of present study between male and females using independent “t” test. Table IV showed the comparison of the parameters used in the study between the males of Himachali population and South Indian population. Table V showed the comparison of the parameters used in the study between the females of Himachali population and South Indian population.

Table I. Descriptive statistics for soft tissue data for males (n = 75)

Parameters	Mean	SD	95 % CI			
			Lower	Upper	Min	Max
Profile angle	22.17	2.82	21.5	22.8	15	28
Chin position	-7.59	9.20	-9.7	-5.5	-22	22
Chin thickness	12.39	4.02	11.5	13.3	-11	20
Upper lip position	1.63	3.72	0.8	2.5	-4	22
Upper Lip thickness	15.93	3.88	15	16.8	0	23
Lower lip position	-0.87	3.93	-1.8	0.03	-8.0	6.0
Maxillary incisor horizontal position	-2.46	5.73	-3.8	-1.2	-11	18
Maxillary incisor vertical position	11.2	1.63	10	12.4	8	13.4
Mandibular incisor position	-3.84	9.19	-5.9	-1.7	-18	12

Table II. Descriptive statistics for soft tissue data for females (n = 75)

Parameters	Mean	SD	95 % CI			
			Lower	Upper	Min	Max
Profile angle	21.33	3.47	20.5	22.1	10	35
Chin position	-6.72	8.49	-8.6	-4.7	-18	21
Chin thickness	11.95	4.65	10.9	13.0	-11	18
Upper lip position	1.7	2.58	1.1	2.3	-11	13
Upper Lip thickness	14.23	1.54	13.9	14.6	11	18
Lower lip position	0.87	5.72	-0.5	2.2	-6	44
Maxillary incisor horizontal position	-2.49	3.13	-3.2	-1.7	-10	8
Maxillary incisor vertical position	6.0	1.68	4.78	7.19	3.5	8
Mandibular incisor position	-5.48	7.16	-7.1	-3.7	-19	13

Table III. Comparison of different parameters of present study between male and females Results of independent sample t test of male (n = 75) and female (n = 75) subjects

Parameters	T	Sig. (2-tailed)	Mean Difference
Profile angle	1.63	0.11	0.84
Chin position	-0.61	0.55	-0.87
Chin thickness	0.63	0.53	0.45
Upper lip position	-0.04	0.97	-0.02
Upper Lip thickness**	3.55	0.00	1.71
Lower lip position*	-2.17	0.03	-1.74
Maxillary incisor horizontal position*	19.23	0.001	0.270
Maxillary incisor vertical position**	3.02	0.003	0.326
Mandibular incisor position	1.22	0.22	1.64

** Highly significant at $p < 0.01$ *Significant at $p < 0.05$

Table IV: Comparison of parameters between Himachali and South Indian Male population

Parameters	Himachali male population- present study (n = 76)		South Indian male population- previous study (n = 38)		df	t	P
	Mean	SD	Mean	SD			
Profile angle*	22.17	2.82	19.79	2.46	112	4.430	0.0001*
Chin position	-7.59	9.20	-5.79	2.33	112	1.185	0.2386
Chin thickness	12.39	4.02	12.79	1.68	112	0.588	0.5576
Upper lip position	1.63	3.72	2.47	1.61	112	1.329	0.1866
Upper Lip thickness*	15.93	3.88	13.80	1.85	112	3.202	0.0018*
Lower lip position	-0.87	3.93	-0.47	2.14	112	0.585	0.5599
Maxillary incisor horizontal position*	-2.46	5.73	-1.5	1.72	112	2.84	0.005*
Maxillary incisor vertical position *	11.2	1.63	1.5	1.45	112	20.9	0.0001*
Mandibular incisor position	-3.84	9.19	-5.13	2.17	112	0.852	0.3962

** Highly significant at $p < 0.01$ *Significant at $p < 0.05$

Table V. Comparison of parameters between Himachali and South Indian Female population.

Parameters	Himachali female population- present study (n = 75)		South Indian female population- previous study (n = 52)		df	T	P
	Mean	SD	Mean	SD			
Profile angle*	21.33	3.47	19.40	3.23	125	3.170	0.0020*
Chin position	-6.72	8.49	-4.94	2.68	125	1.461	0.1466
Chin thickness	11.95	4.65	12.11	1.61	125	0.238	0.8121
Upper lip position	1.65	2.58	2.37	1.78	125	1.744	0.0836
Upper Lip thickness*	14.23	1.54	13.14	1.34	125	4.132	0.0001
Lower lip position	0.87	5.72	0.29	1.81	125	0.706	0.4813
Maxillary incisor horizontal position*	6.0	1.68	2.096	1.287	125	14.62	0.0001*

** Highly significant at $p < 0.01$ *Significant at $p < 0.05$

DISCUSSION

The soft tissues covering the teeth and bones can vary so greatly that the dentoskeletal pattern may be an inadequate guide in evaluating facial harmony. Relying on cephalometric dentoskeletal analysis for treatment planning can occasionally lead to esthetic problems⁶ especially when the orthodontist tries to predict soft tissue outcome using only normal hard tissue values. So, it is necessary to study the soft tissue contour to adequately assess facial harmony. In the present study, we have used the esthetic analysis and profile angle to establish soft tissue cephalometric norms in the Himachali population. In the present study, the mean value of profile angle was found to be slightly more in males as compared to females as shown in Table I, II and Graph 1. These results were in accordance with the study conducted by Kotak VB⁷ and Bhat M⁸. When the intercomparison of the profile angle was done between Himachali males and females, the statistically significant difference was found as shown in Table III. On comparison of profile angle between males and females of Himachali population and south Indian population, it was found to be highest in Himachali males and females as shown in Table IV, V & Graph II, III. This suggested that the Himachali males and females have more convex profile as compared to south Indian males and females. In the present study the mean value of chin position in males was found to be more negative as compared to females as shown in Table I, II & Graph I. The negative value was an indication that the chin was behind the vertical line. This was in accordance with the study conducted by Biradar et al² who found that the chin lies posterior to the vertical line passing through the sub nasale. On intercomparison of the chin position between Himachali males and females, no statistically significant difference was found as shown in Table III. When the comparison of mean values of chin position was done between males and females of Himachali population and south Indian population, it was found to be highest in Himachali males and females as shown in Table IV, V and Graph II, III.

On comparison of mean values of the chin thickness in males and females, it was found to be higher in males as compared to females. These results were in accordance with the study conducted by Biradar et al². When the intercomparison of the chin thickness was done between Himachali males and females, no statistically significant difference was found as shown in Table III. When the comparison of chin thickness was done between males and females of Himachali population and south Indian population, it was found to be highest in Himachali males and less in Himachali females as shown in Table IV, V and Graph 2,3. In the present study, the lower lip was found to be slightly more prominent in females relative to the males. This was in accordance with the study conducted by Scheideman et al⁹ who found that the more prominent lips and shallow labiomental fold de-emphasize the female chin prominence, creating the appearance of a more recessive chin. When the intercomparison of the lower lip position was done between Himachali males and females, no statistically significant difference was found as shown in Table III. When the comparison of lower lip position was done between Himachali population and south Indian population, it was found to be highest in Himachali males and less in Himachali females but no statistically significant difference was found as shown in Table IV, V

& Graph 2,3. In the present study, the upper lip position in females was found to be slightly more as compared to males as shown in Table I & II, Graph 1. This was in accordance with the study conducted by Kotak VB et al⁷, Grewal H et al¹⁰, Frederick et al¹¹. When the intercomparison of the upper lip position was done between Himachali males and females, no statistically significant difference was found as shown in Table III. When the comparison of upper lip position was done between males and females of Himachali population and south Indian population, it was found to be less in Himachali males and females but no statistically significant difference as shown in Table IV, V & Graph 2,3.

In the present study the upper lip thickness was found to be more in males as compared to females as shown in Table I, II and Graph 1. Since the lips are supported directly by the anterior teeth, any dental changes that may occur during orthodontic therapy will have a direct impact on their position. This was in accordance with the study conducted by Mamandras AH.¹² When the intercomparison of the upper lip thickness was done between Himachali males and females, a statistically significant difference was found as shown in Table III. When the comparison of upper lip thickness was done between males and females in Himachali population and south Indian population, it was found to be more in Himachali males and females as shown in Table IV, V & Graph 2,3.

The mean values of maxillary incisor position was found to be slightly more in males as compared to females as shown in Table I, II & Graph 1. This suggested that they are slightly proclined and give an appearance of more fullness to the upper lip. This ensures that the teeth are well displayed during expression, without appearing to be too proclined or retroclined. This also places the roots at the correct angulations. This is in accordance with the study conducted by Moorrees CFA⁴ and Bass M.¹ When the intercomparison of the maxillary incisor horizontal position was done between Himachali males and females, statistically significant difference was found as shown in Table III. When the comparison of maxillary incisor horizontal position was done between males and females in Himachali population and south Indian population, it was found to be less in Himachali males and females as shown in Table IV, V & Graph 2,3.

The mean values of maxillary incisor vertical position was found to be more in females as compared to males as shown in Table I, II & Graph 1. The incisors are below the level of the stomion in both males and females and incisor display is more in females than males. This was in accordance with the study conducted by Moorrees CFA⁴. When the intercomparison of the maxillary incisor vertical position was done between Himachali males and females, statistically significant difference was found as shown in Table III. When the comparison of maxillary incisor vertical position was done between males and females in Himachali population and south Indian population, it was found to be less in males and more in females of Himachali population as shown in Table IV, V and Graph 2,3.

The mean values of mandibular incisor position was found to be less negative in males as compared to females as shown in Table I & II, Graph 1. The negative sign indicates that the mandibular incisors are behind the vertical line.

This was in accordance with the study conducted by Nanda R.²³ When the intercomparison of the mandibular incisor position was done between Himachali males and females, no statistically significant difference was found as shown in Table II. When the comparison of mandibular incisor position was done between males and females of Himachali population and south Indian population, it was found to be more in males and less in females of Himachali population as shown in Table IV, V and Graph 2, 3. Unauthentic bony landmarks are avoided by the use of the Aesthetic Horizontal line which is easily reproducible with a low method error. It also provides the determinants for the horizontal positions of the soft tissue chin, upper lip, lower lip, upper incisors, and lower incisors in relation to the profile. This allows the Aesthetic Analysis to be rapidly carried out, as an addition to the clinicians usual cephalometric analysis.

CONCLUSION

The following conclusions drawn from the study were as follows:

- The females had slightly smaller profile angle than the males which suggests that mild convex profile is associated with esthetic and balanced occlusion in the Himachali population.
- Chin position, chin thickness, upper lip thickness and Mandibular incisor position was found to be highest in Himachali males as compared to Himachali females.
- Lower lip position, Upper lip position and Maxillary incisor position was found to be highest in Himachali females as compared to Himachali males.
- Statistical significant difference was found between profile angle, upper lip thickness and maxillary incisor position when Himachali population was compared with the South Indian population. This suggested that Himachali male and female were found to have more convex profile as compared to south Indian population.

REFERENCES

1. Bass NM. 1991. The aesthetic analysis of the face. *European Journal of Orthodontics* 13; 343-350.
2. Biradar AK, Madanagowda SB. 2010. Establishment of south Indian soft tissue, cephalometric norms using profile angles and esthetic analysis. *World Journal of Orthodontics* Vol.11; 104-113
3. Cooke M.S. 1988. A Summary five-factor cephalometric on natural head posture and the true analysis based horizontal. *Am, J Orthod.*, Vol.93;3.
4. Moorrees CFA. 1994. Natural head position – A revival. *Am J Orthod Dentofacial Orthop* 1994;105;512-513.
5. Bass N.M. 2003. Measurement of the profile angle and the aesthetic analysis of the facial profile. *Journal of Orthodontics*, Vol. 30; 3–9.
6. Park Y.C, Burstone CJ. 1986. Soft-tissue profile Fallacies of hard-tissue standards in treatment planning. *Am. J. Orthod. Dentofac. Orthop.* July Vol.90;1.
7. Kotak V B. 1964. Cephalometric evaluation of Indian girls with neutral occlusion. *J Indian Dent Assoc.* 36;183-197.
8. M. Bhat, P. Sudha, S. 2001. Tandon and Manipal. Cephalometric norms for Bunt and Brahmin children of Dakshina Kannada based on McNamara's analysis. *J Indlansoc.* June.
9. GB Scheideman, Bell WH. 1980. Cephalometric analysis of dentofacial norms. *Am J Orthod.*, Oct;78(4):404-20.
10. Grewal H, Sidhu SS, Kharbanda OP. 1994. A cephalometric appraisal of dento-facial and soft tissue pattern in Indo-Aryans. *J Pierre Fauchard Acad. Sep*;8(3):87-96.
11. Frederick L. Spradley, Joe D. Jacobs, David P. 1981. Crowe. Assessment of the anteroposterior soft-tissue contour of the lower facial third in the ideal young adult. *Am J Orthod.* Vol. Vol. 79, Issue 3, 316–325.
12. Mamandras AH. 1988. Linear changes of the maxillary and mandibular lips. *Am. J Orthod. Dentofac. Orthod.* November 94:405-10
