

Soft Tissue Cephalometric Evaluation in Adult Kodava Population

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ABSTRACT

Aim: To determine the soft tissue cephalometric norms as per Holdaway's analysis for male and female subjects of Kodava population and to compare these cephalometric norms with Holdaway's norms for Caucasian population.

Materials and methods: Frontal and Profile photographs of 100 subjects with normal occlusion and pleasing profile were rated by a panel of judges, from which 30 male and 30 female subjects were selected and lateral cephelograms were taken for the present study. The head films were traced on acetate matt paper using 3H pencil. The tracings were analyzed using linear and angular measurements according to Holdaway's soft tissue analysis to identify the soft tissue pattern. The angular measurements were done to an accuracy of 0.5 degrees and linear measurements were done to an accuracy of 1mm. All essential landmarks were identified and traced twice and the average of two values was considered. The above measurements have been enumerated to describe the soft tissue profile of the ethnic kodava population. The results were statically determined using Students unpaired t test and Mann-Whitney test. These values were also compared among males and females of Kodava population.

Results: The following parameters like nose prominence, upper lip curl, upper lip curvature, upper lip thickness and chin thickness were found to be different from the Caucasian population. The superior sulcus depth, soft tissue subnasale to H line, upper lip thickness, upper lip strain, inferior sulcus to H line and soft tissue chin thickness differences were seen between males and females.

Conclusion: Statistically significant differences in certain parameters were found between Kodava population and Caucasian population and also between males and females of Kodava population.

Keywords: Cephalometric Evaluation, Orthodontics, Kodava Population.

INTRODUCTION

For centuries, facial esthetics has been a subject of interest to people of all cultures. The world is full of evidence of human achievements since antiquity to make themselves more graceful and attractive. As far as orthodontics is concerned, harmonious facial aesthetics and functional occlusion have long been recognized as the two important goals of orthodontic treatment.^{1,2} Angle wrote about facial harmony and the importance of soft tissue and used the term balance, harmony,

beauty and ugliness. He noted that "the study of orthodontia is indissolubly connected with that of art as related to the human face. The mouth is a potent factor in making or marring the beauty and character of the face". Although his concept of ideal profile is based on the classical Greek profile of Apollo Belvedere, a review of art from Egyptian times, through the days of the Greek and Roman Empires, and in to the periods influenced by the renaissance shows clearly that the concept of profile beauty has changed over the centuries.

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Pioneers in Orthodontics who have paved way for racial studies, have elicited demons trouble in cephalometric norms within race and ethnic groups.^{10,11,12} Similar studies have also been carried out by many Indian authors on different racial and ethnic population found in the Indian subcontinent.^{18,19,20} The Kodavas are a community of 100,000 inhabiting the district of Coorg with a population of 500,000 in Karnataka. Coorg was reduced from statehood to a status of district in 1956. Kodavas are of unknown origin, are ethnically distinct and have unique facial and physical characteristics, with distinct language (kodava), dress, unique life style and culture of their own. As clinicians in this part of the country, there is a need to setup soft tissue cephalometric norms for the Coorg population in order to facilitate proper treatment planning to serve the esthetic needs of the community.

MATERIALS AND METHODS

The present study was carried out at the department of Orthodontics and DentofacialOrthopedics, Coorg Institute of Dental Sciences, Virajpet. For the present study 30 males and 30 females were selected from ethnic Kodava population between the ages 18 to 26 on the following basis. -

- 1 Subjects who had normal growth pattern.
- 2 Subjects who had no history of Orthodontic or prosthodontic treatment.
- 3 Subjects who had full compliment of teeth (except third molars) with class 1 molar and canine relationship with good interdigitation of posterior teeth.
- 4 Subjects who had overjet and overbite relationship within the range of 2-4mm with crowding less than 3mm.
- 5 Subjects who had Orthognathic profile (class 1 skeletal pattern).

After examining each subject for his/her dental occlusion facial, intraoral photographs and lateral cephalograms were taken. The lateral cephalometric radiographs were taken with a GendexOrthoralix 9200 cephalostat on 8"X 10" Kodak film. The subjects were positioned with their spines erect and FH plane parallel to the floor. The head was immobilized in the cephalostat using ear rods and the Nasion holder. The subject was

requested to look in to the reflection of their eyes in a mirror located 200cm ahead. A metal thread plumb line in front of the subject was used to bisect the facial reflection and to minimize lateral head rotations. The object source distance was 5 feet. A voltage of 80 kVp and a current of 10 mA was used to obtain the lateral head film. The exposure time was 1 second. A filter was used to clear soft tissue image. The head films were traced on acetate matt paper using 3H pencil. The tracings were analyzed using linear and angular measurements according to Holdaway's soft tissue analysis to identify the soft tissue pattern. The angular measurements were done to an accuracy of 0.5 degrees and linear measurements were done to an accuracy of 1mm. All essential landmarks were identified and traced twice and the average of two values was considered.

The above measurements have been enumerated to describe the soft tissue profile of the ethnic kodava population. The results were statically determined using Students unpaired t test and Mann- Whitney test.

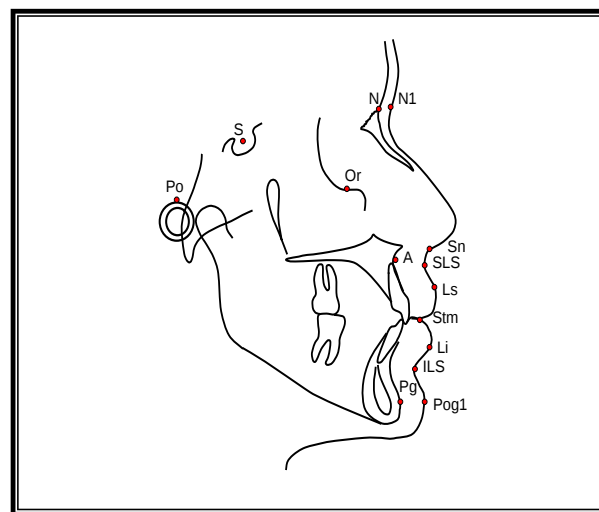


Fig 1: Points used in the study

Glossary of landmarks used in this study

Points

Nasion (N): The most anterior point on the frontonasal suture in the midsagittal plane.

Soft tissue nasion (N1): The point was a line drawn from sella to nasion crosses the soft tissue profile.

Sella (S): Geometric center of the pituitary fossa located by visual inspection.

Orbitale (Or): The lowest point on the inferior rim of the orbit.

Porion (Po): The most superior positioned point of the external auditory meatus located by using the ear rods of the cephalostat.

Point A: The most posterior midline point in the concavity between the anterior nasal spine and prosthion.

Subnasale (Sn): The point at which the nasal septum between the nostrils merges with the upper cutaneous lip in the midsagittal plane.

Superior labial sulcus (SLS): The point of greatest concavity in the midline of upper lip between subnasale and labralesuperius.

Labralesuperius (Ls): The median point in the upper margin of the upper membranous lips.

Stomion (Sto): Embrasure between upper and lower lip.

LabraleInferius (Li): The median point in the lower margin of the lower membranous lips.

Inferior labial sulcus (ILS): The point of greatest concavity in the midline of the lower lip between labraleinferius and soft tissue pogonion.

Pogonion (Pg): The most anterior point on the chin.

Soft tissue pogonion (Pog1): The point on the soft tissue chin overlying the hard tissue and soft tissue facial planes at the level of Ricketts supra pogonion.

1. Frankfort horizontal plane
2. Facial plane
3. H line
4. Facial angle
5. H angle

Planes

Frankfort Horizontal plane (FH): This plane is represented by a line passing through the machine porion to orbitale.

Facial plane: Line extending from soft tissue nasion to soft tissue pogonion.

H line: It is a line drawn tangent drawn from the tip of the chin point to the upper lip.

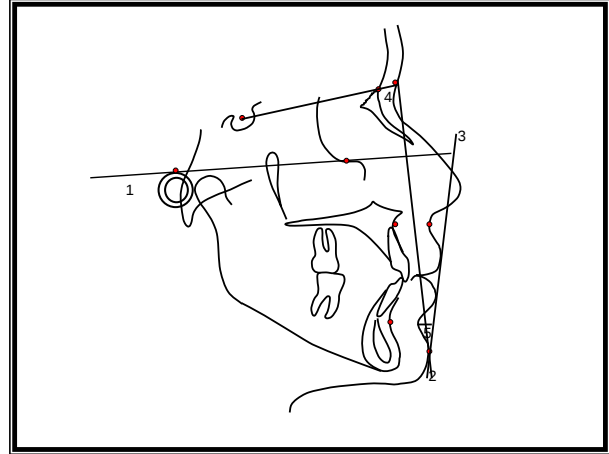


Fig 2: planes and angles used in this study

Angles

Facial angle: Facial angle is formed from the downward and inner angle formed at a point where the sella- nasion line crosses the soft tissue, and a line combining the suprapogonion with the Frankfort horizontal plane.

H line angle: The H-line angle is the angle formed between the soft tissue facial plane line and the H line.

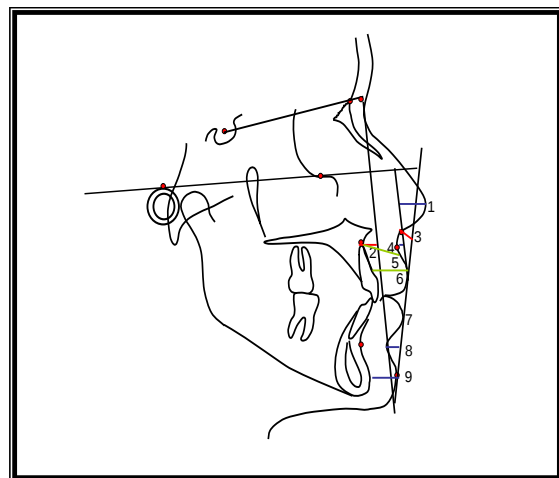


Fig 3: linear measurements used in this study.

1. Nose prominence
2. skeletal profile convexity
3. soft tissue subnasale to H line
4. upper sulcus depth
5. Upper lip thickness
6. Upper lip strain
7. Lower lip to H line
8. Inferior sulcus to H line
9. soft tissue chin thickness

Linear measurements

Upper lip sulcus depth: A perpendicular is dropped from Frankfort horizontal tangent to the tip of the upper lip and from this line the depth of the upper lip sulcus is measured.

Skeletal convexity: It is measured from point A to the facial plane line (skeletal).

Nose prominence: The dimension between the tip of the nose and a perpendicular line drawn from the vermilion to the Frankfort plane

Soft tissue subnasale to H line: Measurement from subnasale to H line.

Upper lip thickness: It is measured horizontally from the point on the outer alveolar plate 2mm

below point A to the outer boarder of the upper lip. At this point, nasal structures will not influence the drape of the lip.

Upper lip strain measurement: It extends horizontally from the vermilion boarder of the upper lip to the labial surface of the maxillary central incisor. This measurement should be approximately the same as the upper lip thickness (within 1mm). If this measurement is less than the upper lip thickness the lips can be considered to be strained.

Lower lip- H line: It is measured from the most prominent outline of the lower lip to the H line. A negative reading indicates that the lips are behind the H line and positive reading indicates that the lips are ahead of the H line.

Lower sulcus depth: This is measured at the point of deepest curvature between the lower lip and the soft tissue chin.

Soft tissue chin thickness: This is recorded as a horizontal measurement and is the distance between the two vertical lines representing the hard tissue and soft tissue facial planes at the level of Ricketts suprapogonion.

Table 1: Measurements used in this study.

SL.NO	MEASUREMENT	NORMS
1	Soft tissue facial angle	91+/- 7 degrees
2	Nose prominence	14 to 24 mm
3	Superior sulcus depth	1 to 4mm
4	Soft tissue subnasale to H-line	3 to 7mm
5	Skeletal profile convexity	-2 to +2mm
6	Upper lip thickness	13 to 14mm
7	Upper lip strain	No norms
8	H angle	7 to 14 degrees
9	Lower lip to H-line	1 to 4mm
10	Inferior sulcus to H-line	No norms
11	Soft tissue chin thickness	10 to 12 mm

Table 2: Mean and std. deviation of cephalometric measurements for adult Kodava population.

	N	Minimum	Maximum	Mean	Std. Deviation
Soft tissue facial angle	60	84.00	96.00	89.3500	3.13442
Nose prominence	60	7.00	18.00	13.5000	2.37572
Superior sulcus depth	60	.00	6.00	2.9667	1.27514
Soft tissue subnasale to H-line	60	2.00	10.00	6.1833	1.87302
Skeletal profile convexity	60	-4.00	5.00	.4000	1.99321
Upper lip thickness	60	13.00	21.00	16.4167	1.81605
Upper lip strain	60	12.00	20.00	15.4500	1.74108
H angle	60	8.00	25.00	17.0333	3.32921
Lower lip to H-line	60	-2.00	4.00	1.0500	1.14129
Inferior sulcus to H-line	60	1.00	10.00	5.0833	1.99399
Soft tissue chin thickness	60	9.00	16.00	12.0167	1.72216

Table 3: Comparison of Kodava norms with the Holdaway's norms.

Measurement	Caucasian norms	Kodava norms	mean	Test of significance
Soft tissue facial angle	91+/-7 degrees	89.3500	3.13442	P=0.0983 NS
Nose prominence	14 to 24 mm	13.5000	2.37572	P<0.0001 VHS
Superior sulcus depth	1 to 4mm	2.9667	1.27514	P=0.034 SIG
Soft tissue subnasale to H line	3 to 7mm	6.1833	1.87302	P=0.002 HS
Skeletal profile convexity	-2 to +2mm	.4000	1.99321	P=0.125 NS
Upper lip thickness	13 to 14mm	16.4167	1.81605	P<0.0001 VHS
Upper lip strain	No norms	15.4500	1.74108	
H-angle	7 to 14 degrees	17.0333	3.32921	P<0.0001 VHS
Lower lip to H-line	1 to 4mm	1.0500	1.14129	P=0.245 NS
Inferior sulcus to H-line	No norms	5.0833	1.99399	
Soft tissue chin thickness	10 to 12 mm	12.0167	1.72216	P<0.0001 VHS

The results of the Coorg population were compared with the standards norms as established by Holdaway in Caucasian population and it was found that both the population were facially similar in some measurements but different in others.. The nose prominence in Kodava population was found to be less prominent statistically when compared to Caucasian population. The upper lip curl (superior sulcus depth) showed more prominence statistically

In Kodava population when compared to Caucasian population. The soft tissue sub nasal to H line showed more upper lip curvature statistically when compared to Caucasian population. There was no statistical difference between skeletal profile

convexities for Kodava population when compared to Caucasian population. The soft tissue upper lip thickness in Kodava population was found to be more prominent statistically when compared to Caucasian population. The soft tissue H line angle in Kodava population was found to be more prominent statistically when compared to Caucasian population. There was no statistical difference between lower lip to H line for Kodava population when compared to Caucasian population. The soft tissue chin thickness in Kodava population was found to be more prominent statistically when compared to Caucasian population.

DISCUSSION

One of the most important components of orthodontic diagnosis and treatment planning is the evaluation of patient's soft tissue profile. Investigators have developed numerous methods of analysis to interpret the diagnostic information that the lateral cephalogram provides. In orthodontic practice a diagnosis is determined, in part, comparing patient's cephalometric measurements to standard values. Lateral cephalometric norms, however, may be specific to an ethnic group and cannot always be applied to other ethnic types. In spite of possible ethnic differences, most classical cephalometric standards are based on sample population of people with European American ancestries.

For these reasons, attempts have been made to investigate the differences of the human face among various ethnic groups including American blacks, Africans, Chinese, Japanese, Koreans, Indians, Saudi Arabians Turkish Mexican Americans, Brazilians and Puerto Ricans. In most of the comparative studies greater ethnic differences in soft tissue relationships was seen than skeletal and dental relationship.

This study provides Holdaway's cephalometric norms for adult Kodava population from a selected sample of adult Kodava. The cephalometric measurements obtained from this study will be of value in the development of proportionate templates for the Kodava population. This would provide a baseline aid for the diagnosis, treatment planning and prognosis for orthodontic cases. These analyses included the following linear and angular measurements – nose prominence, superior sulcus depth, soft tissue subnasale to H line, skeletal convexity, upper lip thickness, upper lip strain, lower lip to H line, inferior sulcus to H line and soft tissue chin thickness. Angular measurements were soft tissue facial angle and H line angle. Very small sex differences and modest signs of sexual dimorphism are obtained in Kodava male and female. When linear and angular measurements are compared with Caucasian adults, some ethnic differences in the skeletal and soft tissue component are noted.

COMPARISON OF CEPHALOMETRIC NORMS BETWEEN KODAVA MALE AND FEMALE SUBJECTS

Some researchers have studied the problem without regard to the sex of the patient; others have investigated males and females separately. Although some researchers did not find any significant difference between sexes, others established considerably important differences. When comparisons were made between the sexes in Kodava population, some significant differences between men and woman were noticed. They are the superior sulcus depth, soft tissue subnasale to H line, upper lip thickness, upper lip strain, inferior sulcus to H line and soft tissue chin thickness.

In photographic studies of American black adults soft tissue subnasale to H line were found to be of mean 6.2mm and standard deviation 2.0mm in woman and mean 7.8mm and standard deviation 2.8 mm in men. In our study this measurement was found to be of mean 6.8mm and standard deviation 1.8mm in men and mean 5.5mm and standard deviation 1.69mm in woman. Kodava adult's soft tissue subnasale to H line measurements were more similar to American black adults with thicker upper lip.

Superior sulcus depth in ideal Caucasian population and male Kodava population norms are same. The mean value for the males was 3.33mm with a standard deviation of 1.42mm and the mean value for the females was 2.60mm with a standard deviation of 1.003 mm, this shows that female upper lip are less curled when compared to males. In cephalometric studies of Turkish adult's superior sulcus depth were found to be of mean 2.19mm and standard deviation of 0.3mm in woman and mean 2.28 and standard deviation of 0.6 mm in men.

The difference between sexes in upper lip thickness and upper lip strain was statistically significant. Upper lip thickness and upper lip strain was more in males than females in relation to Holdaway's H line for the Kodava population. In our study the upper lip thickness measurement was found to be a mean of 17.30mm with standard deviation of 1.84mm in men, and a mean of 15.53mm and standard deviation of 1.30mm in woman. For upper lip strain the mean is 16.23mm and with a standard deviation of 1.71mm in men and a mean of 14.66mm with a standard deviation of 1.39mm in woman respectively. In cephalometric studies of Turkish adults⁵⁸ these measurements

were also found to be a mean of 17.56mm with standard deviation of 0.58mm and a mean of 15.24mm with standard deviation of 0.58mm in men. The upper lip thickness and upper lip strain had a mean of 14.61mm and a standard deviation of 0.5mm and a mean of 11.54mm with a standard deviation of 0.62 mm in woman for upper lip thickness and upper lip strain. In Chinese population, also males and females had longer upper lip when compared to whites⁴³.

In cephalometric studies of Turkish adult's inferior sulcus to H line were found to be of mean 7.11mm and standard deviation of 2.3mm in men and mean 5.29mm and standard deviation of 2.26 mm in women. In our study this measurement was found to be of mean 5.66mm and standard deviation of 2.27mm in men and mean 4.50mm and standard deviation 1.47mm in woman. This shows that males are having higher lip curvature when compared to females.

The soft tissue chin thickness of men and women were also significantly different in the present study. The mean for the males is 12.50mm with a standard deviation of 1.79mm. The females showed a mean of 11.53mm with a standard deviation of 1.52mm. This shows that kodava males are having higher soft tissue chin thickness when compared to kodava females. The mean of Turkish males is 13.99mm with a standard deviation of 2.02mm. The females showed a mean of 12.25mm with a standard deviation of 1.83mm. The soft tissue chin for men and women are less protrusive than African men and women and more protrusive than that in Chinese.

COMPARISON OF KODAVA POPULATION NORMS WITH THE ESTABLISHED HOLDAWAYS NORMS FOR THE CAUCASIAN POPULATION

Studies have shown that significant differences exist between average Caucasian and other population. With recent advances in Orthodontic, Orthognathic, plastic and reconstructive technique and their expanding application to patients from diverse racial and ethnic origin, it is important to define facial parameters from each patient's racial and ethnic background. Most of the analysis has been given to assess the facial harmony and balance as for the Caucasian population. To understand the soft tissue

facial harmony and balance in kodava group of population, selected parameters were compared with the Caucasian standard.

In this study 30 males and 30 females of population were studied, the mean values were established for the kodava population and compared with the Caucasian norms. In this comparison most of the values showed highly significant variations. The soft tissue profile of these subjects was found to be more protrusive when compared to the Caucasian subjects, as indicated by the highly significant increase in the H line angle.

Although the Holdaway's analysis contributes towards successful treatment planning in Caucasian population, studies of other races have indicated that these standards are different enough to warrant closer evaluation. Indian profile has considerable variability and should not be treated with an Orthognathic profile in mind. Studies by many Indian pioneers in Orthodontics have shown that North Indian population and south Indian population has considerable variability.

The mean of soft tissue facial angle established for the Kodava population is 91degrees and standard deviation of 7degrees. The mean value for Kodava population is similar to the Caucasian and Turkish Holdaway's norms (mean 91degrees and standard deviation 7degrees). The Chinese population norms had more chin prominence when compared to Caucasian, Turkish and Kodava population with a mean value of 92.5degrees and standard deviation of 7degrees.

The mean of nose prominence established for Kodava population is 13.5mm and a standard deviation of 2.37mm. According to Holdaway for nose prominence he has given a range of 14mm to 24mm as mean value, less than 14mm is considered to be small and above 24mm is large or prominent range. Studies have shown that the nose prominence measurement to be much smaller among Chinese (mean 6mm and standard deviation 2mm) than among Turkish adults (mean 18mm and standard deviation 3mm)⁴³. In kodava population, nose prominence is found to be smaller when compared to Caucasian samples and higher than Chinese samples.

The mean of upper lip sulcus and soft tissue subnasale to H line is 2.96mm and standard deviation of 1.27mm and mean of 6.18mm with standard deviation of 1.87mm for Kodava population. According to Holdaway, upper lip sulcus depth has an acceptable range of +1 to +4 mm, with +3mm as ideal. The measurement of soft tissue subnasale to H line has an acceptable range of +3 to +7mm, with +5 mm being ideal. Studies have shown that the upper lip sulcus and soft tissue subnasale to H line measurement to be much larger among Chinese (mean 5.5mm and standard deviation 1.5mm and mean 9mm and standard deviation 1.5mm) than among Turkish (mean 3mm and standard deviation 1.5mm and mean 5mm and standard deviation 3mm)⁵⁸. In kodava population, upper lip sulcus and soft tissue subnasale to H line is found to be smaller when compared to Chinese samples and same as Caucasian samples.

The mean of lower lip to H line and inferior sulcus to H line for Kodava population is 1.05mm with standard deviation of 1.41mm and a mean of 5.08mm and standard deviation of 1.99mm. According to Holdaway the distance between the lower lip and the H line has an acceptable range between -2mm to +2mm, with the ideal between 0 and +0.5mm. Holdaway also specified that the contour in the inferior sulcus area should fall in to harmonious lines with the superior sulcus form. So a range of +3 to +7mm will also be accepted as normal for inferior sulcus to H line. According to the given values above lower lip to H line and inferior sulcus to H line was found to be same as Kerala population (mean 1.5mm and standard deviation 2mm) and higher than Chinese population (mean 0.5mm and standard deviation 1.5mm and mean 4mm and standard deviation 1.5mm)⁴³. This indicates that the kodava upper lip is not in balance with the H line.

Table 4: Comparison of Holdaway's standards between Caucasian, Chinese, Turkish and kodava population.

Parameter	Caucasian	Chinese	Turkish	Kodava (present study)
Soft tissue facial angle(degrees)	91 +/- 7	92.5+/-7	91+/-7	89.35+/-3.13
Nose prominence(mm)	14 to 24	6+/-2	18+/-3	13.5+/-2.3
Superior sulcus depth(mm)	1 to 4	5.5+/-1.5	3+/-1.5	2.96+/-1.27
Soft tissue subnasale to H line(mm)	3 to 7	9+/-1.5	5+/-3	6.18+/-1.87
Skeletal profile convexity(mm)	-2 to +2	1.5+/-1.5	0+/-2	0.4+/-1.99
Upper lip thickness(mm)	13 to 14	15+/-1.5	17+/-2.5	16.41+/-1.81

The mean of upper lip thickness in Kodava population is 16.41mm with a standard deviation of 1.81mm. The differences in basic upper lip thickness between kodava population and Caucasian population (13 to 14mm) showed very high statistical significance. In Kodava population the upper lip thickness is found to be more protrusive like Chinese (mean 17mm and standard deviation 2.5mm)⁴³.

The mean of H angle in Kodava population is 17.03 and standard deviation is 3.32 degrees. Holdaway said that the ideal face has an H angle of 7 to 15 degrees, which is dictated by the patient's skeletal convexity. He suggested that, with a normal ANB angle of 1 to 3 degrees, his soft tissue angle should be 7 to 9 degrees. The larger the ANB angle, the larger the Holdaway's soft tissue angle. But even though the ANB angle is normal, this study showed higher H angle which is suggestive of a protrusive profile, which is same as Chinese population (mean 16 degrees and standard deviation 1.5 degrees)⁴³.

The mean of soft tissue chin thickness is 12.01 and standard deviation is 1.72mm. The soft tissue chin in Kodava adults is more protrusive than Chinese⁴³ (mean 9mm and standard deviation 1mm) and same as Caucasian norms (mean 13mm and standard deviation 2mm).

The kodava population has a protrusive profile when compared to Caucasian population as indicated by an increase in the values of H angle and upper lip thickness. However balanced and harmonious arrangement between the size of the nose, lips and chin contribute to a balanced facial appearance that is pleasing to the eye.

Upper lip strain(mm)	No norms	1.5+/-0.5	16.6+/-2.4	15.45+/-1.74
H-angle(degrees)	7to 14	16+/-1.5	13+/-3	17.03+/-3.3
Lower lip to H-line(mm)	1 to 4mm	0.5+/-1	0+/-2	1.05+/-1.14
Inferior sulcus to H-line(mm)	No norms	4+/-1.5	0.03+/-1.9	5.08+/-1.99
Soft tissue chin thickness(mm)	10 to 12	9+/-1	13+/-2	12.01+/-1.72

CEPHELOMETRIC NORMS FOR THE KODAVA POPULATION

The Kodava population norms had significant difference than that of the Caucasian norms. This provided the rationale to make cephalometric norms for the adult Kodava population, as the norms for other ethnic groups can't be used for this population. In discussing any given profile, we need to be able to state in a specific way just how prominent, reseeded or orthognathic is the soft tissue profile.

The mean of soft tissue facial angle established for the Kodava population is 89.35degrees with a standard deviation of 3.13degrees. This suggests that the Kodava population has normal chin. The mean of nose prominence established for the Kodava population is 13.50mm with standard deviation of 2.37mm. As the nasal form should be judged on an individual basis, this population should have a lesser nose prominence for an esthetic profile.

The mean of superior sulcus depth and soft tissue subnasale to H-line established for the Kodava population are 2.96mm with standard deviation of 1.27mm and 6.18mm with standard deviation of 1.87mm. This measurement is especially useful in cases found to have an extreme facial convexity where a measurement to the H line is misleading because of the change in the cant of these lines in high convex or concave cases. This is a simple way to quantitate the actual curl of upper lip.

The norm established for the Kodava population for skeletal convexity at point A is 0.40mm with a standard deviation of 1.99mm. This is not really a soft tissue measurement, but the convexity is directly interrelated to the harmonious lip positions and therefore has a bearing on the dental relationships needed to produce harmony of the features of the human face.

The norms established for the upper lip thickness and upper lip strain of the Kodava

population are 16.41 mm with a standard deviation of 1.81mm and 15.45 mm with a standard deviation of 1.74mm. This measurement is useful in comparing the lip thickness overlying the incisor crowns at the level of the vermilion border in determining the amount of lip strain. Though the upper lip thickness and upper lip strain was higher in this population the subjects had an esthetic profile.

The norms established for the Kodava population for H angle was 17.03 degrees with a standard deviation of 3.32degrees. Ideally as the skeletal convexity increases, the H angle must also increase if a harmonious drape of soft tissues is to be realized in varying degrees of profile convexity. But in this population even though the skeletal profile is normal the H angle is high indicating a protrusive profile which is normal to this population.

The norms established for the Kodava population for lower lip to H line and inferior sulcus to H line are 1.05 mm with a standard deviation of 1.14mm and 5.08mm with a standard deviation of 1.99mm. These measurements suggest the lower lip position, the axial inclination of the lower incisors and actual curl of lower lip. The Kodava population shows a higher lower lip curl which is normal to this population.

The norms established for the Kodava population for the linear measurement of soft tissue chin thickness showed a mean value 12.01mm with a standard deviation of 1.72mm. This measurement suggests that the kodava population has normal soft tissue chin thickness. The Kodava population has a protrusive profile as indicated by an increase in the values of H angle and upper lip thickness.

Altamus found that facial balance and harmony are often a compromise or compensation in the relationship between skeletal, dental and soft tissue components of the face³⁰. He also argued against the concept that the orthognathic face is necessarily more beautiful and healthy. However

balanced and harmonious arrangement between the nose, lips and chin contribute to a balanced facial appearance that is pleasing to the eye. Sushner discovered that black adults are more protrusive in soft tissue profile than white adults. Studies by Indian orthodontic pioneers have shown that Indians have a protrusive profile^{18,19,20}. As a result we can say that the beauty of the face encompasses all of its segments in harmony however, racial and interracial characteristics differ in harmonious relationships.

CONCLUSION

From the present study following conclusions were made:

1. There was no statistical difference between soft tissue facial angle for Kodava population when compared to Caucasian population.
2. The nose prominence in Kodava population was found to be less prominent statistically when compared to Caucasian population.
3. The upper lip curl (superior sulcus depth) showed more prominence statistically in Kodava population when compared to Caucasian population.
4. The soft tissue subnasale to H line showed more upper lip curvature statistically when compared to Caucasian population.
5. There was no statistical difference between skeletal profile convexity for Kodava population when compared to Caucasian population.
6. The soft tissue upper lip thickness in Kodava population was found to be more prominent statistically when compared to Caucasian population.
7. The soft tissue H line angle in Kodava population was found to be more prominent statistically when compared to Caucasian population.
8. There was no statistical difference between lower lip to H line for Kodava population when compared to Caucasian population.
9. The soft tissue chin thickness in Kodava population was found to be more prominent

statistically when compared to Caucasian population.

The difference found in the present study as compared to the standard Caucasian population may be due to racial variations. These differences should be considered when formulating an Orthodontic diagnosis and treatment plan for patients of varying ethnic backgrounds.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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