

# Photographic Analysis of Aesthetically Pleasant Facial Profile in Aryan Group of Nepalese Population

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## ABSTRACT

**Background:** Facial aesthetics has been considered as the most significant factor for individual. The aim of the study was to identify the standard linear and angular measurement of facial profile in Aryan group of Nepalese population so as to set up aesthetic treatment goal.

**Methods:** A cross-sectional observational study was done in fifty-seven subjects (27: females and 30: males, from 17-30 years). The landmarks were marked and two most commonly used lines were taken as reference lines E-line and S-line and seven facial angles were measured: Total Facial Convexity Angle (G-Prn-Pog), Facial Convexity Angle (G-Sn-Pog), Nasofacial Angle (G-Pog-N-Prn), Nasolabial Angle (Ls-Sn-Cm), Mentolabial Angle (Pog-B-Li), Nasofrontal Angle (G-N-Nd) and Nose tip Angle (N-Prn-Cm). Data was analyzed using Statistical Package for the Social Sciences (SPSS) 21. To assess anterior-posterior relationship of upper and lower lips judged by E-line and S-line were determined using correlation coefficient (r). Likewise, to compare the angular measurement between males and females were determined using Mann-Whitney U test.

**Result:** The anterior-posterior position of upper lip and lower lip judged by E-line were  $-3.78 \pm 0.67$  mm and  $-1.92 \pm 0.61$  mm respectively whereas upper and lower lips judged by S-line were  $0.18 \pm 0.58$  mm and  $0.06 \pm 0.44$  mm respectively. Statistically significant ( $p < 0.001$ ) strong correlation (r) was found between upper lip to E-line and S-line (0.999) and between lower lip to E-line and S-line. Out of seven angular parameters, four parameters showed gender dimorphism which means statistically significant difference ( $p < 0.001$ ) were seen in Nasofrontal Angle.

**Conclusion:** Either one of the reference line can be used for evaluation of facial profile at the time of diagnosis. The parameters calculated by photographic analysis serve as a comparing guide for setting up aesthetic treatment plan and can be used both before and after orthodontic treatment.

**Keywords:** aesthetically, facial profile, photographic analysis, pleasant

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## INTRODUCTION

The face has been considered as the most essential part of the human body and almost all the individual since from their childhood has the innate desire to look beautiful. There are various ways that express the beauty of the face which is mainly dependent on different shapes and sizes of individual characteristics of soft tissue facial profile and also by different facial lines and angles.<sup>1</sup>

Even though there is a saying that “beauty lies in the eye of the beholder” but each and every individual have an innate desire to see oneself being esthetically sound both facially and dentally. People do believe especially the adults, if they do not have good teeth and good facial profile, it's a shame to be in a society. They do have very low self confidence. Hence, the facial aesthetics has been considered as the most important factor with regard to society and as well as it plays a very crucial role in the development of one's personality and social acceptance.<sup>2</sup>

To look good and beautiful is the human nature of each individual since the childhood. People believe that having a good facial esthetics is one of the most important factors that influence individual's relationship with society, thus by increasing their self-esteem. Almost every adult patient or the child patient's parents who visit orthodontists, to seek the good facial aesthetics rather than structural balance and functional efficiency.<sup>2</sup>

Hence, it's the prime duty of we orthodontist to keep in mind that once the treatment is over, every patients should have esthetically pleasing facial profile along with an ideal occlusion while setting up the treatment goal and treatment plan. Since the pleasing facial profile is what the adult patient and the parent's of the children patient desire, along with the Cephalometric analysis, orthodontic diagnosis and treatment planning has been shifted towards photographic facial analysis. Gender and ethnicity of each individual plays an important role in determining the attractiveness of the face.<sup>3</sup>

<sup>4</sup> There are various methods to determine the attractiveness of the face, one of which is by means of photographs since it reproduces soft tissue more accurately.<sup>2</sup> Moreover, photographic analysis is simple to perform, non-invasive and is cost effective. A good photograph helps in determining the relationship between extra-oral craniofacial structure and the soft tissue facial characteristics. Through the photometric analysis, the linear and angular measurement thus obtained will be the key

point for pleasant or balanced facial profile. A facial profile is said to be balanced when there is good nose-lip-chin balance.<sup>3, 5, 6</sup>

The aim of the present study was to evaluate which linear and angular measures influence aesthetically pleasant facial profile that can be useful for setting up the aesthetic treatment goal, to assess the anterior-posterior position of lip judged by E-line and S-line and to find the correlation between lip prominence judged by E-line and S-line and to compare the soft tissue facial profile of males and females through angular measurement.

## MATERIALS AND METHODS

A cross-sectional observational study was done in fifty-seven subjects, Sample sizes were taken by convenient sample size, twenty-seven of them were females and thirty of them were males. The study was done in patients and students of Nepalgunj Medical College and Teaching Hospital, Kohalapur, Nepal in 2015-2017. The inclusion criteria of the study were both males and females aged from 17-30 years with Angle's Class I molar relationship, orthognathic facial profile with normal overbite and overjet no previous history of orthodontic treatment done and all the teeth except third molar had to be present on the oral cavity and they should be Aryan Nepalese population (Brahmins and Chettris) which were determined by asking the subjects personal history including their family history. Informed consent was obtained from all the patients and students included in the study. Profile photographs were taken in Natural head position (NHP) with digital camera. A vertical mirror was adjusted 90 cm away from the floor and approximately 150 cm away from the subjects. The profile photographs were taken in relax position with their eyes looking straight forward in the mirror. Photographs were taken in centric occlusion with lips in light contact. All the profile photographs were taken from the right side with forehead, nose, ear and neck clearly visible and the subjects were asked to remove the spectacles and ear ornaments if they had worn before the photographs were taken.

The points with abbreviations that were traced for analysis in the present study were illustrated in the table 1 and the reference lines and reference angles were illustrated in figure 1, 2 respectively.

After collecting the photographs, all the pictures were printed and all the landmarks needed for the image analysis were traced with pencil and

the reference lines: E-line and S-line were drawn and measured with ruler. E-line was drawn from tip of the nose to the tip of the chin and S-line was drawn from midpoint between subnasale (Sn) and pronasale (Prn) to soft tissue pogonion (Pog). Likewise, the landmarks were joined to measure the reference angles: Total facial convexity angle (G-Prn-Pog), Facial convexity angle (G-Sn-Pog), Nasofacial angle (G-Pog-N-Prn), Nasofrontal angle (G-N-Nd), Nasolabial angle (Ls-Sn-Cm), Mentolabial angle (Pog-B-Li), Lower third angle (Sn-Me-C) and Nose tip angle (N-Prn-Cm) and the angular measurements were done with the help of protractor. All the measurements were done by the single investigator and all the parameters were measured twice at the interval of 2 weeks so as to minimize the errors. The method errors were calculated using Dahlberg formula as illustrated in table 5.

**Table1: Abbreviations and landmark**

Abbreviations	Landmarks/ Reference points
G	Glabella
N	Nasion
Nd	Nasal dorsum
Prn	Pronasale
Sn	Subnasale
A	A point
Cm	Columella
Ls	Labralesuperius
Li	Labraleinferius
B	B point
Pog	Pogonion
Me	Menton



Figure 1. Reference Lines: A: E-line; B: S-line

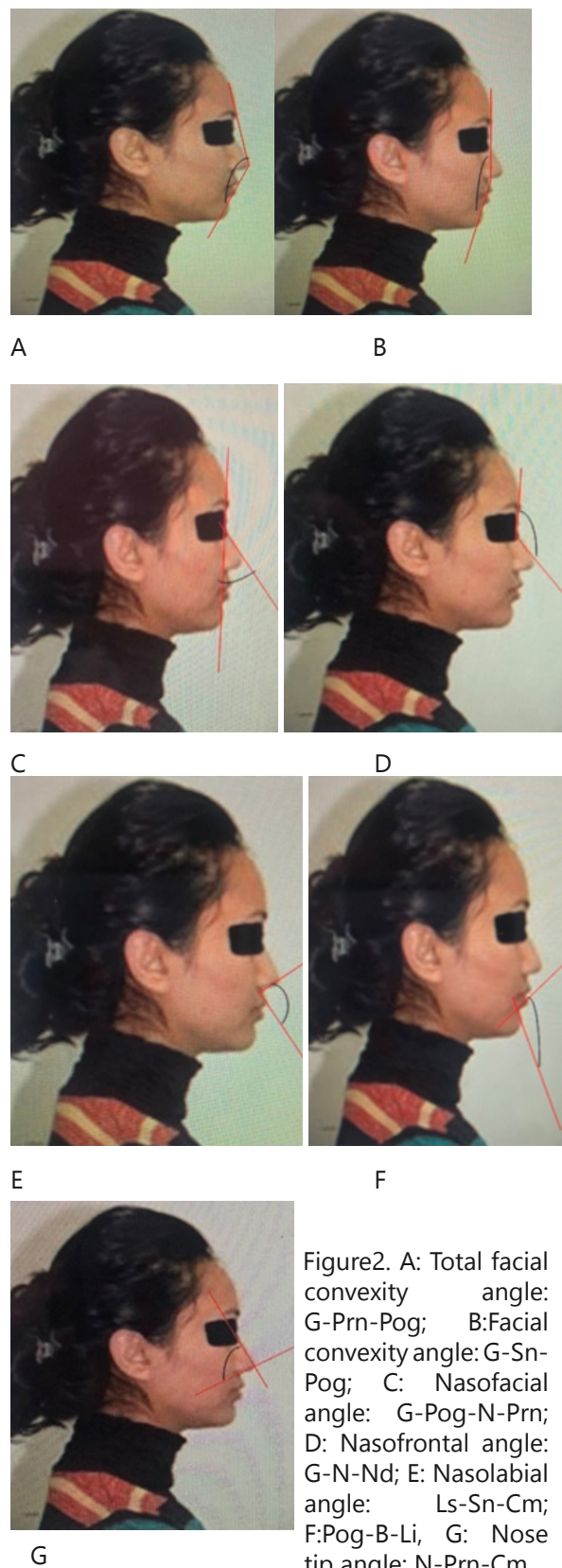


Figure2. A: Total facial convexity angle: G-Prn-Pog; B: Facial convexity angle: G-Sn-Pog; C: Nasofacial angle: G-Pog-N-Prn; D: Nasofrontal angle: G-N-Nd; E: Nasolabial angle: Ls-Sn-Cm; F: Pog-B-Li, G: Nose tip angle: N-Prn-Cm

SPSS 21 was used for statistical analysis. Mean, standard deviations, range, maximum and minimum were calculated for each variable for each subject. To assess anterior-posterior relationship of upper and lower lips judged by E-line and S-line were determined using correlation co-efficient (r). Likewise, to compare the angular measurement between males and females were determined using Mann-Whitney U test. Bar diagrams were drawn using Microsoft excel 2007.

## RESULTS

The study was conducted on 57 subjects (27 females and 30 males) with age ranges

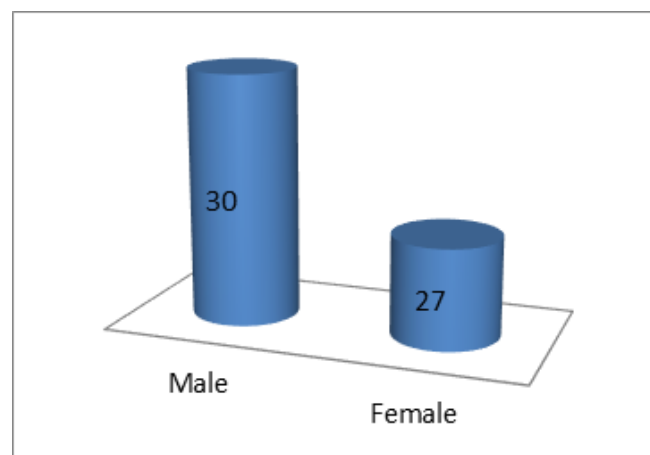


Figure 3: Gender Distribution

**Table 2: Anterior-posterior lip position judged by E-line and S-line**

Characteristics	Range	Minimum	Maximum	Mean	SD
E-line to upper lip	4.00	-6.00	-2.00	-3.78	0.67
E-line to lower lip	4.00	-4.00	.00	-1.92	0.61
S-line to upper lip	3.50	-2.00	1.50	.184	0.58
S-line to lower lip	3.00	-1.50	1.50	.061	0.44

**Table 3: Correlation of parameters that determine the position of upper and lower lip**

Variables	E-line to Lower lip	S-line to Upper lip	S-line to Lower lip
E-line to Upper lip	0.823**	0.999**	0.823**
E-line to Lower lip		0.830**	0.993**
S-line to Upper lip			0.830**

**Table 4: Descriptive statistics and comparison of male and female parameters**

Parameters	Gender	Mean	SD	z-value	p-value
Total Facial Convexity Angle	Male	139.50	1.10	-0.190	0.849
	Female	139.44	1.12		
Facial Convexity Angle	Male	170.93	1.66	-0.295	0.768
	Female	171.03	1.78		
Nasofacial Angle	Male	32.28	1.68	-0.609	0.543
	Female	32.09	1.40		
Nasofrontal Angle	Male	133.16	2.87	-6.406	<0.001
	Female	140.66	1.24		
Nasolabial Angle	Male	104.33	0.98	-6.534	<0.001
	Female	110.01	1.49		
Mentolabial Angle	Male	129.32	1.10	-6.528	<0.001
	Female	134.11	1.27		
Nose tip Angle	Male	105.48	0.75	-6.570	<0.001
	Female	110.50	1.50		

from 17-30 years. Gender distributions of the samples were shown in figure 3.

**Table 5: Method errors of linear and angular measurements done using Dahlberg formula**

Parameters	M.E.
E-line to upper lip	0.25
E-line to lower lip	0.28
S-line to upper lip	0.5
S-line to lower lip	0.25
Total facial convexity angle	1
Facial convexity angle	0.77
Nasofacial angle	1.18
Nasofrontal angle	0.85
Nasolabial angle	1.5
Mentolabial angle	0.78
Nose tip angle	0.85

Mean value for anterior-posterior relationship of upper and lower lip judged by E-line were  $-3.78 \pm 0.67$  mm and  $-1.92 \pm 0.61$  mm respectively whereas upper and lower lip judged by S-line were  $0.18 \pm 0.58$  mm and  $0.06 \pm 0.44$  mm respectively which are tabulated in the table 2. Since the data were not normally distributed according to Shapiro Wilk, Spearman's correlation was done to compare the two parameters that describe position of upper

and lower lip. Statistically significant ( $p < 0.01$ ) strong correlation was found between upper lip to E-line and S-line ( $r = 0.999$ ) and between lower lip to E-line and S-line ( $r = 0.993$ ) which are tabulated in table 3.

Regarding angular measurement, out of 7 angular measurements, four parameters show gender differences which means statistically significant ( $p < 0.001$ ) difference were seen in Nasofrontal angle (M:  $133.16^\circ \pm 2.87^\circ$ ; F:  $140.66^\circ \pm 1.24^\circ$ ), Nasolabial angle (M:  $104.33^\circ \pm 0.98^\circ$ ; F:  $110.01^\circ \pm 1.49^\circ$ ), Mentolabial angle (M:  $129.32^\circ \pm 1.10^\circ$ ; F:  $134^\circ \pm 1.27^\circ$ ) and Nose tip angle (M:  $105.48^\circ \pm 0.75^\circ$ ; F:  $110.50^\circ \pm 1.50^\circ$ ) were larger in females. Since the data were not normally distributed, Mann-Whitney U test was done to compare these angles which are tabulated in table 4 and figure 1.

## DISCUSSION

Despite the good occlusion and stable results, the patients and parents of children's patients are found to give more priority to aesthetics, therefore facial profile analysis should also be performed during the time of treatment planning. Previously, lateral cephalogram were used for facial analysis but nowadays, it has been shifted towards photometric analysis which has become more popular to analyze the soft tissue facial profile as the photograph reproduces the soft tissues more accurately and there is no need for subject's exposure to radiation

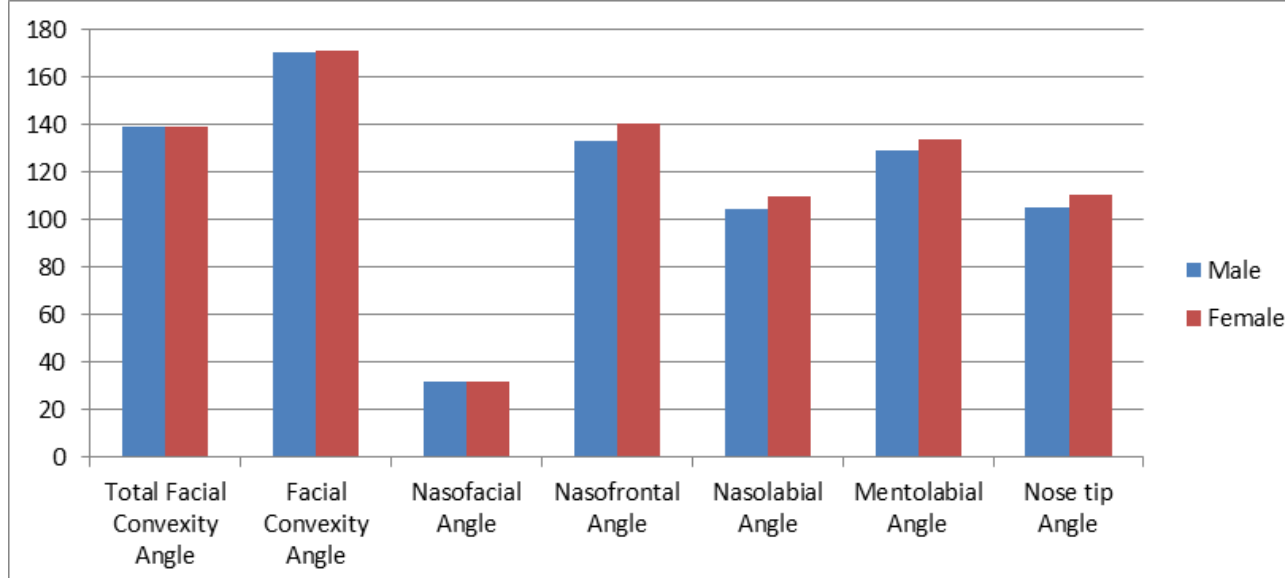


Figure 4: Comparison of the angular parameters between male and female

as compared to cephalograms.<sup>2</sup> There are various reference lines that assess the anterior-posterior relationship of upper and lower lips. Since E-line and

S-line being the most commonly used reference lines,<sup>5</sup> these two lines were taken as a reference line for determining the anterior-posterior position of the lip in this study.

In present study, the anterior-posterior position of upper lip and lower lip judged by E-line were  $-3.78 \pm 0.67$  mm and  $-1.92 \pm 0.61$  mm respectively whereas upper and lower lips judged by S-line were  $0.18 \pm 0.58$  mm and  $0.06 \pm 0.44$  mm respectively which is similar to the norms suggested by Ricketts and Steiner<sup>5, 7-10</sup> and was also similar to the study done by various authors as seen in different literatures. And statistically significant correlation was found between upper lip judged by E-line And S-line and between lower lip judged by E-line and S-line which means there is only small difference in position of upper and lower lip assessed by both the reference lines. However, lip prominence is dependent upon the position of nose and chin.<sup>11-13</sup>

Similarly, seven reference angles had been used in the study that defines the facial characteristics. Total facial convexity angle plays an important role to assess how the nose influences the convexity of the facial profile. In the present study there is no significant gender difference in this angle (M:  $139.50^\circ \pm 1.10^\circ$ , F:  $139.44^\circ \pm 1.12^\circ$ ) like the study done by Fortes et al which was found to be  $141.60^\circ \pm 5.30^\circ$  for male and  $143.73^\circ \pm 3.95^\circ$  for female.<sup>2</sup>

Facial Convexity angle helps in determining the convexity of the face without involvement of the nose. Pattanaik et al in their study found the mean value of Facial convexity angle was  $168.16^\circ \pm 3.7^\circ$  in male and  $166.96^\circ \pm 4.73^\circ$  in female indicating no significant gender difference.<sup>14</sup> Similarly, Milosevic et al in their study on Croatian (Caucasian) sample found no significant gender difference in Facial Convexity angle (M:  $130.5^\circ \pm 3.7^\circ$ , F:  $130.2^\circ \pm 3.5^\circ$ ).<sup>15</sup> In present study, there is no significant gender difference in Facial convexity angle (M:  $170.93^\circ \pm 1.78^\circ$ , F:  $171.03^\circ \pm 1.78^\circ$ ) like Pattanaik et al and Milsoevic et al but unlike Maneula et al who found statistically significant gender difference (M:  $168.84^\circ \pm 0.70^\circ$ , F:  $170.31^\circ \pm 2.09^\circ$ ).<sup>3</sup>

Nasofacial angle showed no significant gender difference (M:  $32.28^\circ \pm 1.68^\circ$ , F:  $32.09^\circ \pm 1.40^\circ$ ) in present study like the study conducted by Ferdousi et al in Bangladeshi Garo. They found  $38.67^\circ \pm 4.05^\circ$  in male and  $40.27^\circ \pm 4.54^\circ$  in female.<sup>1</sup> In the present study, the value for Nasofacial angle is smaller as compared to Ferdousi et al. Higher the angle higher will be the nasal projection.<sup>16</sup> But

the study done by Ezeuko and Eboigbe in Bini ethnicity showed significant sexual difference (M:  $35.5^\circ \pm 0.3^\circ$ , F:  $34.3^\circ \pm 0.2^\circ$ ).<sup>4</sup>

Nasofrontal angle showed significant gender difference (M:  $133.16^\circ \pm 2.87^\circ$ , F:  $140.66^\circ \pm 1.24^\circ$ ) in this study which was similar to the study conducted by Milosevic et al who had found significant gender difference with mean value of  $136.38^\circ \pm 6.7^\circ$  in male and  $139.11^\circ \pm 6.35^\circ$  in female.<sup>15</sup> Similarly, significant gender difference was found in the study conducted on Coastal Andhra population by Pattanaik et al (M:  $130.64^\circ \pm 6.27^\circ$ , F:  $140.33^\circ \pm 6.85^\circ$ ).<sup>14</sup> Manuela et al also got the significant gender difference in Central Romania population (M:  $135.78^\circ \pm 1.21^\circ$ , F:  $137.10^\circ \pm 1.52^\circ$ ).<sup>3</sup>

Nasolabial angle plays an important role in assessing the position of upper lip and also give an idea about whether to deal the particular case by extraction or non-extraction method. Manuela et al found the significant gender difference (M:  $102.19^\circ \pm 1.55^\circ$ , F:  $105.3^\circ \pm 2.71^\circ$ )<sup>3</sup>. The present study showed significant gender difference (M:  $104.33^\circ \pm 0.98^\circ$ , F:  $110.01^\circ \pm 1.49^\circ$ ) which is in accordance with the study conducted by Manuela et al and Milosevic et al (M:  $105.42^\circ \pm 9.52^\circ$ , F:  $109.39^\circ \pm 7.84^\circ$ )<sup>15</sup> but in variance with the study conducted by Pattanaik et al who did not find the gender difference (M:  $98.56^\circ \pm 5.6^\circ$ , F:  $99.69^\circ \pm 7.0^\circ$ ).<sup>14</sup>

Mentolabial angle plays a key role in assessing the position of lower lip in relation to soft tissue pogonion hence determining the aesthetics of the chin. This angle also shows significant gender difference (M:  $129.32^\circ \pm 1.107^\circ$ , F:  $134.11^\circ \pm 1.27^\circ$ ) in the present study which is similar to the study conducted by Maneula et al (M:  $118.27^\circ \pm 7.73^\circ$ , F:  $126.07^\circ \pm 3^\circ$ )<sup>3</sup>, study conducted by Pattanaik et al (M:  $124.82^\circ \pm 6.57^\circ$ , F:  $127.38^\circ \pm 5.35^\circ$ )<sup>14</sup> and the study conducted by Milosoveic et al (M:  $129.26^\circ \pm 9.55^\circ$ , F:  $134.50^\circ \pm 9.08^\circ$ ).<sup>15</sup>

Nose tip angle helps in determining the nose prominency. The present study showed the significant gender difference (M:  $105.48^\circ \pm 0.75^\circ$ , F:  $110.50^\circ \pm 1.50^\circ$ ) which is in accordance with the study conducted by Milosevic et al in which mean value for male was  $105.42^\circ \pm 9.52^\circ$  and for female was  $109.39^\circ \pm 7.84^\circ$ <sup>15</sup> but in variance with the study conducted by Pattanaik et al (M:  $77.71^\circ \pm 11.63^\circ$ , F:  $80.31^\circ \pm 3.52^\circ$ ).<sup>14</sup>

Limitation: Sample size was small due to limited time factor and inclusion criteria of the study. Hence, for future recommendation more sample size can be taken for more accurate result.

## CONCLUSION

The upper and lower lips are in retruded position in relation to E-line and almost touch the S-line in aesthetically pleasant facial profile in Aryan group of Nepalese population and statistically significant strong correlation was found between upper lip judged by E-line and S-line and lower lip judged by E-line and S-line which means either one of the line can be used as reference for evaluation of aesthetically pleasant facial profile during the time of diagnosis. There is gender dimorphism in soft tissue facial profile which is larger in females especially in nose, lip and chin area suggesting that males have more pronounced facial profile than females in aesthetically pleasant facial profile. Therefore, these parameters serve as a comparing guide for setting up aesthetic treatment plan and can be used both before and after orthodontic treatment.

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