

# Measurement of proportion of lower facial height and its significance in different age, sex and ethnicity

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## ABSTRACT

**Background:** The lower facial third is divided into upper one third from base of the nose to commissural line and lower two third from commissural line to lower border of the chin. This proportion may not be true for all population of different age, sex and ethnicity.

**Purpose:** To determine the proportion of lower facial height and to correlate its significance in different age, sex and ethnicity.

**Material and methods:** Convenient sampling was done among different age group of both sexes above 18 years. The 111 subjects (40 Male and 71 Female) were separated into three age groups. It consist of 58 Aryan and 53 Mongolian ethnics group. Vertical distance from the base of the nose to commissural line (upper one third of the lower facial height) and vertical distance from the commissural line to the lower border of the chin (lower two third of the lower facial height) was measured by vernier calliper respectively.

**Results.** Proportion of upper one third to lower two third of the lower facial height was found more in 71.17 % , less in 19.83 % and equal in 9% of the total sample.

**Conclusions:** It was found that proportion of upper one third to the lower two third of the lower facial height was greater in our study population. Proportion of lower facial height was not statically significant with age, sex and ethnicity.

**Keywords:** facial proportion, lower face height, upper lip length.

## INTRODUCTION

Current concepts in diagnosis and treatment planning of dento-facial rehabilitation focus on the balance and harmony of various facial features.<sup>1</sup> Measurements of the human face as part of the body had been performed since the Greek era. The artists in Egypt and Greece formulated standards for human body proportion.<sup>2</sup> The Greeks tried to formulate beauty as an exact mathematical concept. They believed that beauty could be quantified and represented in a mathematical formula and led Pythagoras to conceive the "Golden Proportion".<sup>3,4</sup> Leonardo da Vinci in 1490 defined proportion as the ratio between the respective

parts and the whole. The figure of Vitruvian man, shows the importance of proportions in the human form. The distance from the hairline to the inferior aspect of the chin is one-tenth of a man's height.<sup>5</sup> Proportion of facial height are evident where hairline to eyebrows, eyebrows to base of nose, base of nose to below chin are equal. Further lower facial height is again divided into upper third (upper lip) and lower two-thirds.<sup>5-8</sup>

In Caucasians, the middle third is less than the upper third, middle and upper thirds are less than the lower third.<sup>9</sup> In East Asians, the middle third is greater than the upper third and equal to the lower third.<sup>10</sup>

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In Indian population lower third of face is greater than middle third having proportion of 55.37% and 44.63%.<sup>11</sup>

The lower one third of the face has a major impact on the perception of facial aesthetics.<sup>12</sup> Various research shows conflicting result hence this present study is designed to determine the lower facial height proportion and to correlate its significance in different age, sex and ethnicity.

## MATERIALS AND METHODS

### Research setting

Approval for the study was obtained from Institutional Review Board, Institute of Medicine, Tribhuvan University. The subjects were under-graduate, post-graduate dental students, dental surgeons, staff and faculty at People's Dental College and Hospital. It was properly explained to potential subjects that purpose of this study was to determine proportion of lower facial and its significance in different age, sex and ethnicity. This study was cross sectional observational study.

### Sample size and technique

Convenient sampling was done among different age group of both sexes above 18 years. The 111 subjects were separated into three groups with the following age ranges:

Group A: 18 - 29 years old

Group B: 30 - 39 years old

Group C: 40 - 49 years old

Total sample, according to sex comprises of 40 Male and 71 Female and according to ethnicity was 58 Aryan and 53 Mongolian respectively.

### Inclusion criteria

1. All samples are over 18 years of age
2. Normognathic facial profile with symmetric face
3. Presence of natural dentition in appearance zone
4. Acceptable alignment of teeth in appearance zone
5. Ability to accept their voluntary involvement in the study

### Exclusion criteria

1. Missing tooth in appearance zone
2. Developmental defects and neurological

disorder of oro-facial region

3. Subjects with history of Orthodontic, Prosthodontic, Periodontal and Surgical intervention.

4. Cosmetic treatment of oro-facial region

### Measurement design

For clinical measurement of proportion of lower facial height, upper one third was determined with the reference of base of the nose to commissural line and lower two third was determined with the reference of commissural line to lower border of the chin. Measurement were done with the help of a vernier caliper. (Fig. 1)

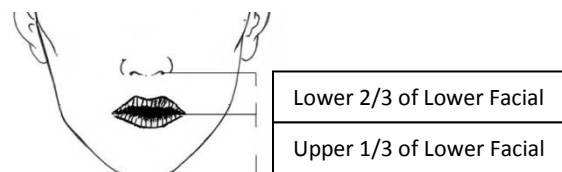


Figure 1. Lower Facial Height Proportion

### Data collection

Written consent was obtained from the subjects who agreed to voluntarily participate in the study. They were asked to fill the personal information section of the Performa with name, age, sex and ethnicity. These data were used to divide the sample groups.

Landmarks like base of the nose, commissural line and lower border of the chin were identified (Fig. 2). Vertical distance from the base of the nose to commissural (Fig. 3) and commissural line to the lower border of the chin (Fig. 4) were measured respectively.



Fig 2. Landmarks for Lower Facial Height Measurement



Fig 3. Measurement of Upper One Third of the Lower Facial Height



**Fig 4. Measurement of Lower Two Third of the Lower Facial Height**

**Data and Statistical Analysis**

Values were entered in the SPSS ver 20 and data were analyzed for significance. Descriptive

and inferential statistics were used to interpret the data.

**OBSERVATIONS AND RESULTS**

Proportion of lower facial height among different age groups are equal in 10 samples, less in 22 samples and more in 79 samples. Proportion of lower facial height in samples of Group A (18-29yrs) consist of 8 equal, 22 less and 65 more. Similarly, proportion of lower facial height in Group B (30-39yrs) consist of 2 equal, 0 less and 10 more; and in Group C (40-49yrs) consist of 0 equal, 0 less and 4 more respectively (Table 1). Proportion of lower facial height was not statically significant ( $p\text{-value}=0.223$ ) with different age groups.

**Table 1 Correlation of Lower Facial Height Proportion and Age Group**

Age Group	Lower Facial Height Proportion			Total
	Equal <sup>+</sup>	Less <sup>++</sup>	More <sup>+++</sup>	
Group A (18-29 yrs)	8	22	65	95
Group B (30-39 yrs)	2	0	10	12
Group C (40-49 yrs)	0	0	4	4
<b>Total</b>	<b>10</b>	<b>22</b>	<b>79</b>	<b>111</b>

<sup>+</sup> = Upper 1/3 and Lowe 2/3 are in proportion ( $p\text{-value}=0.223$ )

<sup>++</sup> = Upper 1/3 are in lesser proportion

<sup>+++</sup> = Upper 1/3 are in greater proportion

Proportion of lower facial height among different sex reveals following results: Male samples consist 6 equal, 5 less and 29 more; Female samples consists 4 equal, 17 less and 50

more. (Table 2). Proportion of lower facial height was not statically significant ( $p\text{-value}=0.123$ ) in male and female.

**Table 2 Correlation of Lower Facial Height Proportion and Sex**

Sex	Lower Facial Height Proportion			Total
	Equal <sup>+</sup>	Less <sup>++</sup>	More <sup>+++</sup>	
Male	6	5	29	40
Female	4	17	50	71
<b>Total</b>	<b>10</b>	<b>22</b>	<b>79</b>	<b>111</b>

<sup>+</sup> = Upper 1/3 and Lowe 2/3 are in proportion ( $p\text{-value}=0.123$ )

<sup>++</sup> = Upper 1/3 are in lesser proportion

<sup>+++</sup> = Upper 1/3 are in greater proportion

Proportion of lower facial height among different ethnic groups reveal following results: Aryan samples comprise 7 equal, 15 less and 36 more; Mongolian samples comprise 3 equal, 7

less and 43 more. (Table 3) Proportion of lower facial height was not statically significant ( $p\text{-value}=0.086$ ) in different Ethnicity

**Table 3 Correlation of Lower Facial Height Proportion and Ethnicity**

Ethnicity	Lower Facial Height Proportion			Total
	Equal <sup>+</sup>	Less <sup>++</sup>	More <sup>+++</sup>	
Aryan	7	15	36	58
Mongolian	3	7	43	53
<b>Total</b>	<b>10</b>	<b>22</b>	<b>79</b>	<b>111</b>

<sup>+</sup> = Upper 1/3 and Lower 2/3 are in proportion (*p-value=0.086*)

<sup>++</sup> = Upper 1/3 are in lesser proportion

<sup>+++</sup> = Upper 1/3 are in greater proportion

## DISCUSSION

Human being had always been aware of facial esthetics and function. Early human had to concentrate more on function and had little time to contemplate natural beauty.<sup>1</sup> Later, Ancient Greeks were preoccupied with seeking methods by which beauty could be quantified and predictably reproduced by artisans and artists. Their goal was to discover arithmetic simplicity, which could signify beauty and harmony.

However, this was more of an artistic representation of body proportion and not a scientific data. Scientific approach to anthropometry was laid down by Johan Friedrich Blumenbach (1752-1840). Paul Broca, Flower and Turner did specific studies and evolved the study of craniology.<sup>13</sup> Leon William in 1914 had classified face and gave the concept of law of proportion.<sup>14, 15</sup> Lombardi in 1973, was the first to emphasize the importance of order proportion.<sup>4</sup>

Nani F B et al in 2008 also divide the lower facial third into the upper lip forming the upper third and the lower lip and chin forming the lower two-thirds.<sup>16</sup> According to Reyneke in 2012, in the well-balanced lower third of the face, the upper lip makes up one-third, whereas the lower lip and chin comprises the lower two-thirds.<sup>17</sup>

Nepal is a relatively small country but conglomeration of different religious, linguistic and ethnic groups. All these groups look different in terms of their physical characteristics but there is no recorded data in the literature that provides evidence of their physical differences.<sup>18</sup> All above researches are done in different parts of the world.

Baral P et al in 2010, had done study to examine the differences in facial height proportions and facial growth patterns, belonging to the Brahmin, Chhetri, Rai and Limbu communities in the Sunsari district of Nepal. Among 857 subjects (429 male and 428 female) aged between 3- 18. The data analysis revealed that the upper facial height proportion increased and the lower facial height proportion decreased initially from 3–15 years of age, after which the upper facial height proportion decreased and the lower facial height proportion increased from 15–18 years of age. The adult proportions were found to be similar to those observed in the 3–5 year age group with no significant difference of facial height proportions between the male and female subjects.<sup>18</sup>

The present study is design to determine the proportion of lower facial height and to correlate its significance in different age, sex and ethnicity. In our study, proportion of upper lip consisting one third and lower two third was found in only 9%. The proportion of upper one third to the lower two third was found to be more in 71.17%. This result is in favor of study done by Mizumoto in 2009 in which it was found that proportions that deviated from the ideal were in lower anterior facial height.<sup>19</sup> Our study shows no statically significant difference between lower facial proportion with age groups, sex and ethnicity.

## CONCLUSION

One hundred and eleven subjects of various age, sex and ethnicity were selected. It was found that proportion of upper one third (upper lip

length) to the lower two third of the lower anterior facial height was greater in our study population. This study also shows no statically significant difference of lower facial proportion with age groups, sex and ethnicity.

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