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Evaluation of Facial Divine Proportion in Dogra population in Jammu Region – A Cross-Sectional Study

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Abstract

Background: The purpose of the study is to evaluate Facial Divine Proportion and to assess its relationship to the facial attractiveness in the Dogra population of Jammu region. **Subjects and Methods:** The sample consists of 344 adults with pleasing profile who have not undergone any kind of orthodontic treatment. Standardized frontal facial photographs of all the subjects were obtained. The subjects were selected on the basis of facial attractiveness which led to the reduction of sample to 100 which were, then, divided into 2 groups – Group I (Female subjects) and Group II (Male subjects). The Divine Proportion was determined using Ricketts RM (1982) Divine Proportion Analysis on frontal facial photographs. **Results:** Transverse and Vertical facial proportion in males were higher than females. Group I showed that five of seven vertical facial proportions were close to divine proportion (1.618) whereas only two vertical facial proportions in Group II were close to divine proportions. Transverse facial proportions in both the groups deviated more from divine proportion (1.618). **Conclusion:** There was difference between males and females for the vertical and transverse facial proportions with values being larger in males. This should be considered as an accessory guideline in planning orthodontic or orthognathic treatment.

Keywords: Facial Proportion, Transverse Proportion, Vertical Proportion, Facial Width, Facial Height.

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Introduction

Facial beauty of an individual has almost always been a reason for favorable reaction in social interaction. Many factors influence the perception of beauty, including makeup, clothing, and facial expressions. However, it is the relational proportion of our physical features which is the primary factor in determining the perception, conscious, or subconscious, of beauty.[1] The ancient Egyptians were possibly among the first to deal with harmonious (attractive) proportions of the face and body.[2]

Leonardo Da Vinci pointed out the affinity between proportion and harmony when he talked of 'proportional beauties of an angelic face'.[3] Various norms and standards have been proposed to describe the attractiveness of face, out of which, one of the most famous axiom is facial golden proportion. Divine proportion, golden proportion, and phi (φ) are the synonymous terms and geometrically it was found to be equal to 1:1.618.[4]

This golden proportion has been considered as the ratio most attractive to the human eye and mind.[5] Ricketts found that the divine proportion existed in a large number of lateral and frontal cephalograms and photographs that he considered ideal.[6] Therefore, Ricketts advocated the use of these divine proportion ratios as guides for planning orthognathic surgery. Furthermore, Marquardt developed a beauty mask based on the divine proportion,[7] and he suggested that any face that conforms to beauty mask is likely to be beautiful irrespective of age and race.

Facial proportions are of great interest in the field of Orthodontics and Dentofacial Orthopedics. Previously, no such study has been conducted in Dogra population. Hence, there was a need to evaluate the relationship between facial esthetics and the divine proportions. Hence, the aim of this

study was to evaluate various facial divine proportions and to evaluate its relationship with facial attractiveness in Dogra population.

Subjects and Methods

The study was conducted in the Department of Orthodontics & Dentofacial Orthopedics, Indira Gandhi Government Dental College & Hospital, Jammu. A sample of 344 subjects was taken randomly from the patients reporting to the department. The ethical clearance was taken from the ethical committee of the institute. The frontal facial photographs were taken by the same person using DSLR Camera in a photographic room with the same photographic background. The digital camera was set on a tripod stand at a fixed distance from the subject.

The inclusion criteria for the subjects included

- Adults withing range of 18-30 years
- Pleasing profiles
- No history of previous orthodontic treatment
- No history of facial trauma

Subjects were seated on an adjustable stool and instructed to hold the head in natural head position by looking straight into a mirror hung on the wall at eye level. The photographs were taken without any spectacles or sunglasses and hair covered with the surgical head cap from the hairline above. The photographs thus taken were cropped and converted into black and white images using Adobe Photoshop computer software to avoid the influence of facial complexion over the attractiveness. These black and white images were presented as slides of powerpoint presentation in front of a panel of judges for rating the facial attractiveness of each subject. The panel of judges consisted of two clinician (both orthodontist) and two non-clinicians (a beautician, a lay person) for rating the facial attractiveness of each subject. Rating scale was a 10 point scale, with 10 as "most attractive" and 0 as "least attractive face." Thus, each subject received a total score of attractiveness ranging from 0 to 40. Individuals with total score 28 or more were considered as attractive faces and considered for further analysis in the study and rest all were excluded from the study.

After an exercise for selecting the subjects based on attractiveness, we were left with the sample of 100 adults which were taken up further in the study. These subjects were divided into 2 groups – Group I included 50 female subjects and Group II included 50 male subjects.

Nine vertical and four transverse linear measurements of the face were taken as depicted in [Figures 1]. Seven measurements of vertical facial proportion and three measurements of transverse facial proportion were taken based on previous studies.[2]

Vertical facial proportions were

TR ME: LC ME; TR LC: LC ME; LN ME: TR LN; LC LN: LN ME; CH ME: LC CH; LN CH: LC LN; and LN CH: CH ME.

Transverse facial proportions were: LN (right) r–(left) l: CHr–l; LCr–l: CHr–l; and TSr–l:

LCr–l.

Mean measurements were converted to percentages, assuming that the divine proportion 1.618 was 100%.

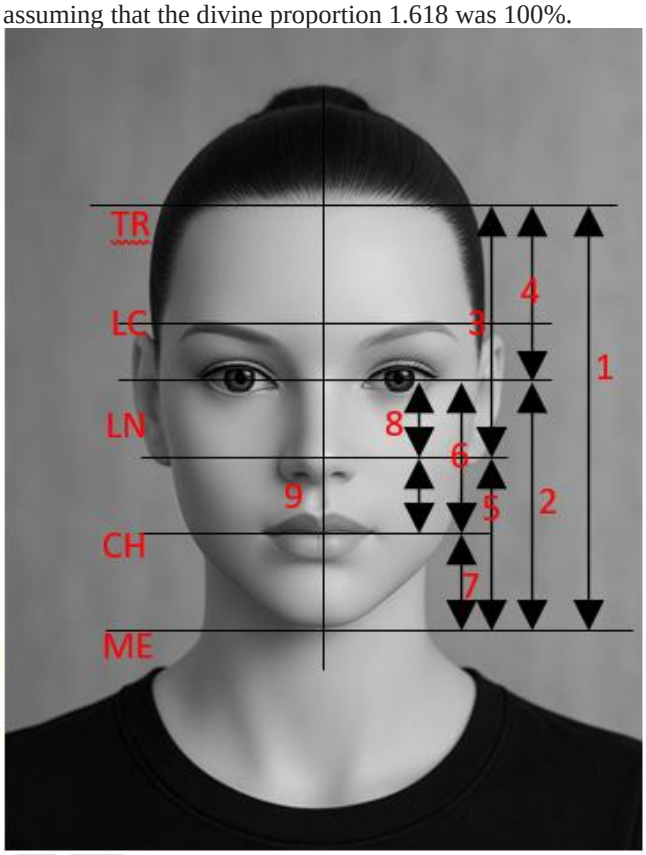

Figure 1: Photographic points and vertical linear measurements (for reference purpose only). used in the study. 1: TR ME (trichion to soft tissue menton); 2: LC ME (lateral canthus of eye to soft tissue menton); 3: TR LN (trichion to ala of nose); 4: TR LC (trichion to lateral canthus of eye); 5: LN ME (ala of nose to soft tissue menton); 6: LC CH (lateral canthus of eye to corner of mouth); 7: CH ME (corner of mouth to soft tissue menton); 8: LC LN (lateral canthus of eye to ala of nose); 9: LN CH (ala of nose to corner of mouth)

The data so obtained were subjected to statistical analysis. Results were expressed as the mean (standard error of mean). Data were summarized as mean ± standard deviation. Groups were compared by unpaired Student's t test. A two tailed $P < 0.05$ was considered statistically significant. Analyses were performed on SPSS software.

Results

[Table 1] shows the various facial proportions in both groups. In Group I (attractive females) subjects five vertical proportions TR ME: LC ME, LC ME: TR LC, LC CH: CH ME, LC LN: LN CH, CH ME: LN CH were very close to divine proportion with their percentage values of 99.51, 103.21, 99.5, and 101.97 with respect to divine proportion whereas TR LN: LN ME and LN ME: LC LN were 85.29% and 133.49% deviated from divine proportion.

In Group II (attractive males), only two vertical proportions TR ME: LC ME and LC ME: TR LC were 98.74% and 98.35%, similar to the divine proportion.

In contrast to vertical facial proportions, transverse proportions CH (r–l): LN (r–l), LC (r–l):CH (r–l), and TS (r–l):LC (r–l) deviated more from divine proportion in both groups.

In Group I values were 1.96 (79.55%), 2.08 (121.36%), and1.35 (80%) and in Group II these were 1.22 (71.72%), 1.89 (127.41%), and 1.40 (86.13%), respectively.

Table 1: Comparison of various facial proportions between the groups

Facial Proportion	Group I(Females)		Group II(Males)		p
	Mean±SD	%value (1.618=100%)	Mean±SD	%value (1.618=100%)	
Vertical proportions					
TR-ME: LC-ME	1.59±0.06	99.51	1.61±0.12	98.74	0.27
LC-ME: TR-LC	1.69±0.22	103.21	1.63±0.23	98.35	0.52
TR-LN: LN-ME	1.88±0.13	85.29	1.24±0.15	82.81	0.12
LN-ME: LC-LN	2.18±0.55	133.49	2.36±0.56	146.47	0.02*
LC-CH: CH-ME	1.63±0.22	99.5	1.16±0.24	77.87	0.0001***
LC-LN: LN-CH	1.66±0.51	101.97	1.23±0.35	79.11	0.0001***
CH-ME: LN-CH	1.67±0.54	104.45	1.88±0.40	115.57	0.02*
Transverse proportions					
CH (r-l):LN (r-l)	1.96±0.15	79.55	1.22±0.11	71.72	0.0001***
LC (r-l):CH (r-l)	2.08±0.10	121.36	1.89±0.11	127.41	0.002**
TS (r-l):LC (r-l)	1.35±0.06	80.22	1.40±0.06	86.13	0.0001***

Discussion

Ricketts[4,6] was the first orthodontist to apply divine proportion to the composition of facial hard and soft tissues. He showed that the proportions in a face generally perceived as being beautiful are intimately related to the golden ratio.

There exists a relationship between Fibonacci series/ the divine proportion and the beautiful art in nature; like the intersecting spirals in sunflower or pine cones, the beautiful bands on the wings of a butterfly, the symmetrical veins of a tree leaf, the exhilarating color proportions of a peacock feather or the logarithmic spirals of a snails (Nautilus).[8]

Throughout the ages, painters and sculptors have attempted to establish ideal proportions for the human facial form. However, possibly the most famous of all axioms about ideal proportions is best described with golden proportions.

Values of measured proportion in beautiful faces are likely to approximate divine proportion or Golden proportion and is considered as an important factor in facial esthetics. It is also named as 'Golden Proportion' or 'Golden ratio' and denoted by symbol as 'Phi' ratio. This ratio can be expressed mathematically as 1.618:1 or 1:0.618.[9]

The results in our study shows that Transverse and Vertical facial proportion in males were higher than females. Group I showed that five of seven vertical facial proportions were close to divine proportion (1.618) whereas only two vertical facial proportions in Group II were close to divine proportions. Group II shows more deviation from the Mizumoto et al,[10] observed almost similar result in their study in Japanese women. Kawakami et al,[11] also reported that deviations from divine proportion were more in males as compared to female subjects. Omotoso et al,[12] also showed that there was bisexual variation in upper and lower face height.

As opposed to the vertical proportions, transverse proportions showed greater deviation from Golden Proportion in both the groups. The findings of the present study partially agree with previous studies,[4,6] who believed that the facial beauty is directly related to the divine proportion however the results of our investigation showed that a relationship exists between the divine proportion and the perception of beauty. This shows that attractive faces exhibit greater concordance with the divine proportions than with common faces.

Shortcomings of the Study: A study with a bigger sample size is warranted.

Conclusion

There was difference between males and females for the vertical and transverse facial proportions with values being larger in males. This should be considered as an accessory guideline in planning orthodontic or orthognathic treatment.

Hence we conclude that certain faces are attractive although they do not fit into the set of measurements of ideal proportions and is a guide for evolution in aesthetic and reconstructive procedures.

If divine proportions need to be employed in orthodontic or orthognathic surgical planning, should be used only as a guideline working together with other already established methods like facial assessment, facial symmetry, averageness, sexual dimorphism and cephalometrics.

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