Assessment of Facial Golden Proportions among North Maharashtrian Population

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ABSTRACT

Background: Divine Proportion in Orthodontics and Prosthodontics has always been intriguing. This was applied to the North Maharashtrian population to evaluate the relationship between facial esthetics and the golden proportions.

Materials & Methods: Facial proportions were assessed by examining photographs of sum total of 300 subjects of North Maharashtrian population. Young adults with a skeletal and dental Class 1 occlusion, competent lips, and balanced facial proportion were selected. Photographic prints were taken and manually parameters were plotted and analysis was done.

Results: The measurements of anterior facial height showed proportionality with the total facial height. The values showed shorter lower anterior facial height and deviation of facial width parameters from the divine proportion indicating small mouth, nose, and narrow-set eyes with respect to the inter-temporal width.

Conclusion: There is soft-tissue facial balance of North Maharashtrian population in comparison with the golden proportion. However, certain parameters show some deviation from the divine proportion..

Key Words: golden proportion, facial esthetics, photographic evaluation, facial height, facial width.

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Introduction

The old adage 'beauty lies in the eye of the beholder' stipulated that the individual judgements were paramount and needed to be regarded since the assessment of facial attractiveness is very complex . In the current agene question that needs to be asked 'is beauty really in the eyes of the one who perceives' or is there some scientific backing? Why is one face seen as attractive and another as unattractive? What guides and validates our judgement?

Certain guidelines exist in a variety of form, from 'atlas' presentations of soft tisssue facial landmarks involving linear and angular parameters and ratios[1] to a plethora of photographic analyses.[2-5] More recent articles discussed angular and linear analyses of the soft-tissue profile, including ethnic differences.[6-7]

There is great interest in golden proportions as a measure for facial esthetics in the general public. Ricketts [8-9] was one of the first few orthodontists to apply it to the composition of facial hard and soft tissues. Proffit and Fields [10] wrote that the vertical height of the midface, from the supraorbital ridges to the base of the nose, should equal the height of the lower face, and in the lower face, the mouth should be about one third of the way between the base of the nose and the chin.

One of the primary concern in Prosthodontics is the selection of maxillary anterior artificial teeth. Lombardi[11] stated that the mold selected should have a pleasing proportion with facial anatomy and there by harmonize with factors necessary to unify it with realism. Several facial measurements have been proposed to aid in the selection of anterior teeth, some of which include the interalar width, bizygomatic wodth and interpupillary distance.[12-18]

Another aspect of interest on facial proportion lies in maxillofacial surgery and plastic surgery. Johnston et al[19] explain that in cases with skeletal discrepancies, the decision to use surgery or not relies heavily on the subjective judgement of the clinicians involved and the patient's perception of their facial appearance.

Since the golden proportion is considered as an important factor in facial esthetics, there is a need to evaluate the relationship between facial esthetics and the golden proportions. There is little information in the literature to evaluate the proportions of the frontal facial profile in the North Maharashtrian population. Thus, there is a need to establish a norm for orthodontic as well as surgical treatment goals.

This study examines the nature of our objectives in attempting to improve the facial appearance. Questions are addressed concerning the facial proportion on the North Maharashtrian population for the nature of an agreed 'ideal' set of values.

Materials and Method

The study sample consisted of photographs taken at the Department of Orthodontics and Dentofacial Orthopaedics at our institute. The sample consisted of 300 photographs; 145 males and 155 females. The age of the samples ranged from 18yrs – 28yrs.

Sample included subjects who showed well balanced faces, had Class I skeletal and dental pattern and with lip competency. Only subjects

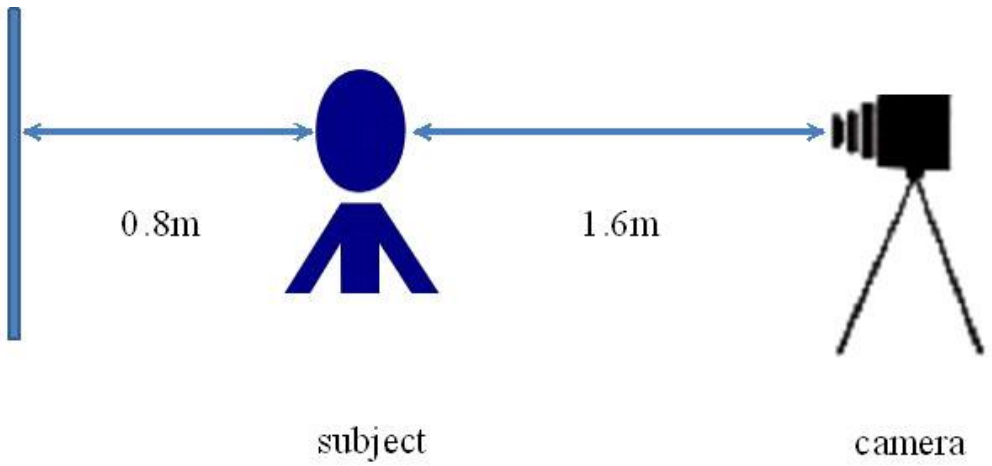

Fig 1: Method for taking frontal photograph of subject

belonging to the North Maharashtrian population were included in the study so as to achieve our primary aim and objective of assessing facial proportion in this given population.

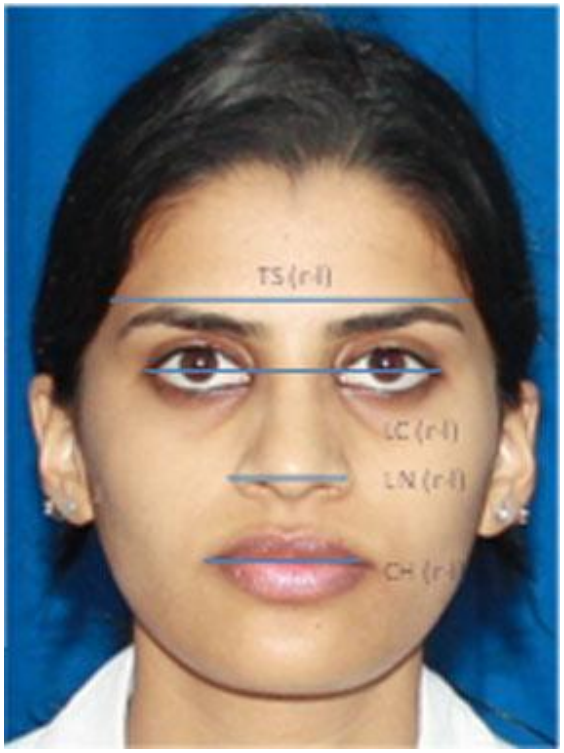

Fig 2: Landmarks and measurements for facial width analysis: TS [r-l]; LC[r-l]; LN [r-l]; and CH [r-l]. Three measurements of facial width components: 1, LN r-l: CHr-l; 2, CHr-l: LCr-l; 3, LCr-l: TSr-l.

Photographs were taken by a professional photographer with the camera (Canon DSLR 1000D) mounted on a tripod stand at a fixed distance from the subject and thus standardization was obtained (Fig 1). The patients were photographed with the lips in repose. The photographs were assessed and selected by an Orthodontist, Prosthodontist,Conservative dentist, an Artist, and an Oral surgeon. Photographic prints were taken and manually parameters were plotted and analysis was done. Three measurements for the proportions of total face heights were made, seven for the face height components, and three for face widths.

All landmarks were measured once per day for 3 days by an author. This was cross checked by the second author. The following landmarks were used as shown in Fig 2 and 3:

Trichion (TR), the point at the top of

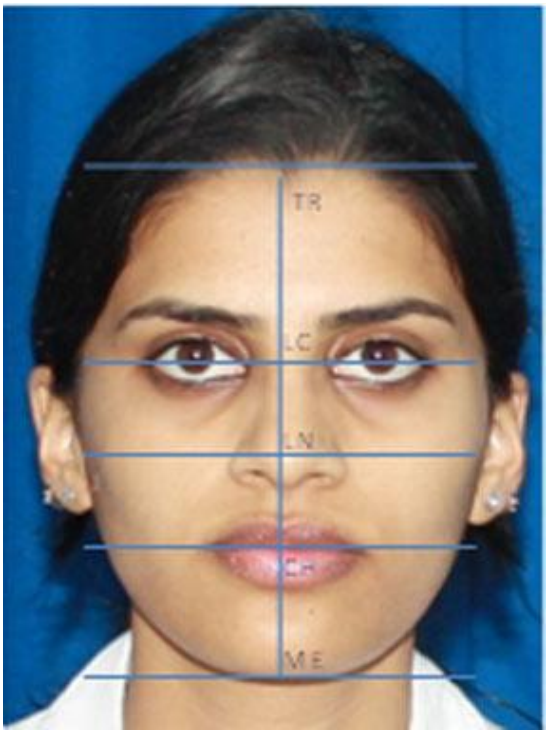

Fig 3: Landmarks and measurements for anterior facial height analysis: TR; LC; LN; CH; ME. Three measurements for proportion of total anterior height: 1, TR-LC:TR-ME; 2, TR-ME:LN-ME; 3, TR-ME:LC-CH. Seven measurements of face height components: 1, TR-ME:LC-ME; 2, TR-LC:LCME; 3,

1. Trichion (TR), the point at the top of the forehead at the junction (hairline) of the face and skull fascia;
2. TS, the width of the head at the temporal soft tissue above the ears at the level of the supraorbital ridges (eyebrow);
3. LC, the point at the lateral canthus of the eyes;
4. LN, the point at the lateral rim of the nose;
5. Cheilion (CH), the point at the corner of the mouth;
6. ME, soft-tissue menton.

Facial height was measured on the anterior face: 1, TR-ME; 2, LC-ME; 3, TR-LN; 4, TR-LC; 5, LNME; 6, LC-CH; 7, CH-ME; 8, LC-LN; and 9, LN-CH.

Facial width on the anterior face was measured: 10, TS-TS; 11, LC-LC; 12, LN-LN; and 13, CH-CH.

The facial balance in height and width was studied from the measurements as follows: proportion of total face height with TR-LC: TR-ME; LN-ME:TRME; and LC-CH: TR-ME.

ME:LC-CH [2.5, 2.4, and 2.8 respectively] showed proportionality with the total facial height. In addition, CH-ME:LC-CH, LN-CH: CH-ME had 90.2, and 92.1 %, respectively. The values of TR-LN: LN-ME (1.43, 88.4%), LN-ME: LC-LN (2.21, 136.6%) and LC-LN: LN-CH (1.14, 71.1%) deviated

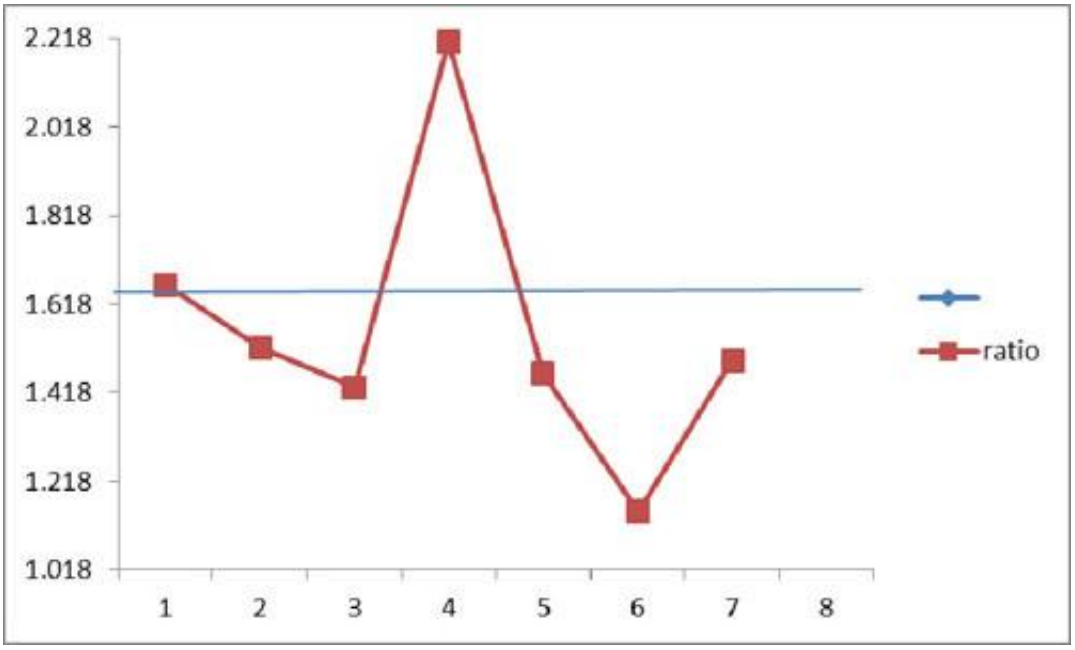

Fig 4: Graph of face height components

The proportion of face height components was studied with 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.

The proportion of face width components was measured: LN(r-l): CH(r-l); LC(r-l): CH(r-l); and TS (r-l): LC(r-l). Mean measurements were converted to percentages, assuming that the golden proportion was 100%.

Results

All landmarks were measured once per day for 3 days by an author. This was cross checked by the second author .Results were as seen in table 1. Subjects were similar to the golden proportion (100%) in the value of TR-ME:LC-ME. The three measurements of anterior facial height TR-LC: LN-

from the golden proportion as seen in the graph given in Fig: 4. The value of LC-ME:TR-LC was small (1.5, 93.9%) but close to the golden proportion. The face width parameters CH: LN [77.9%], LC: CH [121.1%], TS: LC [86.5%] showed deviations from the golden proportion.

Discussion

From the time of Euclid, the golden proportion has been intriguing one and all. This has become a universal standard for facial beauty regardless of race, age, sex etc. Peck and Peck[20-21] used historical art collections and scientifically established a link between occlusion and golden proportions. They pointed out that the general population prefers a fuller and more protrusive profile.

Phillips et al[22] reported differences in the evaluation of facial attractiveness between lay persons and dental specialists. They also reported that individuals perceive their own profile differently from orthodontists, oral surgeons and lay persons.

According to a study by Edler[23], agreement that facial beauty exists, some persons are universally regarded as attractive, and there is evidence that people can agree on attractiveness. Pancherz et al[24] found that the facial proportions of attractive individuals were closer to divine proportions as compared to those of non attractive ones.

Tatarunaite et al[25] showed that the overall facial attractiveness does not depend on any single feature; smiling and youthful facial appearance make women look more attractive but facial attractiveness is not significantly affected by these factors in men. Similarly de Castro et al[26] showed that agreeable smiles on evaluation were closer to the divine proportions .

Proffit and White[27] reported a ratio of widths of the orbits, eyes, nose, mouth, and mandible in frontal facial symmetry. The Eastman normal value for lower anterior facial height/ total anterior face height is 55% with a standard deviation of 2%. This value was found to be most attractive by lay judges and in clinical practice.[19,28]

Knight and Keith[29] showed that an increase in the lower anterior facial height percentage was associated with less attractive faces for female subjects, when judged by non-clinicians. In male subjects, less attractive faces had shorter LAFH percentages.

According to Filho et al[30], there exists a relationship between divine proportion and facial esthetics. The closer the ratios of mouth width / nose width and eye width/ mouth width were to the divine proportion, the more favourable facial esthetics were. Kawakami et al[31] reported in the Oriental population that the values of CH-ME:LC-CH, AL-CH: CH-ME, and AL-CH: LC-AL showed deviations from the golden ratio, and the deviations were greater in men. The deviations

Table 1: Facial analysis with golden proportion at total facial proportion, height, and width dimension

Facial proportion	Mean	Standard Deviation
TR-LC: TR-ME	2.529268	0.11
LN-ME:TRME	2.43605	0.132
LC-CH: TR-ME	2.828	0.134
Vertical Height		
TR-ME:LC-ME	1.6597	0.65
TR-LC: LC-ME	1.5242	0.12
LN-ME:TR-LN	1.4308	0.12
LC-LN: LN-ME	2.21185	0.31
CH-ME:LC-CH	1.46435	0.184
LN-CH: LC-LN	1.147355	0.157
LN-CH: CH-ME	1.488305	0.155
Horizontal Width		
LN r-l: CH r-l	1.261645	0.098
CH r-l: LC r-l	1.956245	0.235
LC r-l: TS r-l	1.398088	0.069

indicated a shorter AL-CH and a longer CH-ME than those of white people (the golden ratio).

In a similar study to check facial proportions in Japanese women, Mizumoto et al[32] found five of the 7 measurements of face height [TR- ME: LC-ME; TR-LC: LC-ME; LN-ME: TR-LN; CH-ME: LC-CH; LN-CH: CH-ME] were close to the golden proportion, whereas LC-LN/LNME and LN-CH/LC-LN deviated from the golden proportion. Those deviations could be related to a longer CH-ME and a shorter LN-CH.

In our study, 4 of the parameters of face height were close to the golden proportion. The values of TR-LN: LN-ME, LN-ME: LC-LN and LC-LN: LN-CH deviated from the golden proportion. The face width parameters CH: LN, LC: CH, TS: LC showed deviations from the golden proportion.

Conclusion

Most of the parameters for facial balance in North Maharastrian population showed proportionality when compared with the golden proportion. However, some parameters for the lower facial width and height deviated from the golden proportion.

Clinical Significance

The values obtained should be taken into consideration for planning Orthodontic treatment or Orthognathic surgery, Prosthodontic replacement and cosmetic restoration of teeth. There also is a need for assessment of facial golden proportions for the whole Indian population.

References:

1. Powell N, Humphries B. Proportions of the Aesthetic Face. New York: Thieme-Stratton Inc; 1984.
2. Czarnecki ST, Nanda RS, Currier GF. Perceptions of a balanced facial profile. Am J Orthod Dentofacial Orthop. 1993;104(2):180-7.
3. Baker BW, Woods MG. The role of divine proportion in the esthetic improvement of patients undergoing combined orthodontic/orthognathic surgical treatment. Int J Adult Orthodon Orthognath Surg. 2001;16(2):108-20.
4. Peerlings RH, Kuijpers-Jagtman AM, Hoesksma JB. A photographic scale to measure facial esthetics. Eur J Orthod. 1995;17(2):101-9.
5. Jefferson Y. Facial esthtetics – presentation of an ideal face. J Gen Orthod. 1993;4(1):18-23.
6. Fernandez-Riveiro P, Suarez-Quintanilla D, Smyth-Chamosa E, Suarez-Cunqueiro M. Linear photogrammetric analysis of the soft tissue facial profile. Am J Orthod Dentofacial Orthop. 2002;122(1):59-66.
7. Fernandez-Riveiro P, Smyth-Chamosa E, Suarez-Quintanilla D, Suarez-Cunqueiro M. Angular photogrammetric analysis of the soft tissue facial profile. Eur J Orthod. 2003;25(4):393-9.
8. Ricketts RM. The golden divider. J Clin Orthod. 1981;15(11):752-9.
9. Ricketts RM. Golden proportion and Fibonacci series. Am J Orthod. 1982;81(5):351-70.
10. Proffit WR, Fields HW. Contemporary Orthodontics. 3rd ed. St. Louis: Mosby; 1997. p. 157-63.
11. Lombardi RE. The principles of visual perception and their clinical application to denture esthetics. J Prosthet Dent. 1973;29(4):358-82.
12. Silverman SI. Physiologic factors in complete denture esthetics. Dent Clin North Am. 1967:115-22.
13. Cesario VA Jr, Latta GH Jr. Relationship between the mesiodistal width of the

maxillary central incisor and interpupillary distance. J Prosthet Dent. 1984;52(5):641-3.
14. Boucher CO. Swenson's complete dentures. 6th ed. St Louis: CV Mosby Co,1970:315-6.
15. Sears VH. Selection of anterior teeth for artificial dentures.J Am Dent Assoc 1941;28:929-35.
16. Young HA. Selecting the anterior tooth mold. J Prosthet Dent. 1954;4:748-60.
17. Kern BE. Anthropometric parameters of tooth selection. J Prosthet Dent. 1967;17(5):431-7.
18. Smith BJ. The value of the nose width as an esthetic guide in prosthodontics. J Prosthet Dent. 1975 ;34(5):562-73.
19. Johnston DJ, Hunt O, Johnston CD, Burden DJ, Stevenson M, Hepper P. The influence of lower face vertical proportion on facial attractiveness . Eur J Orthod. 2005;27(4):349-54.
20. Peck S, Peck L. Selected aspects of the art and science of facial esthetics. Semin Orthod. 1995;1(2):105-26.
21. Peck H, Peck S. A concept of facial esthetics. Angle Orthod. 1970;40(4):284-318.
22. Phillips C, Griffin T, Bennett E. Perception of facial attractiveness by patients, peers, and professionals. Int J Adult Orthodon Orthognath Surg. 1995;10(2):127-35.
23. Edler RJ. Background considerations to facial esthetics. J Orthod. 2001;28(2):159-68.
24. Pancherz H, Knapp V, Erbe C, Heiss AM. Divine Proportions in Attractive and nonattractive faces. World J Orthod. 2010 Spring;11(1):27-36.
25. Tatarunaite E, Playle R, Hood K, Shaw W, Richmond S. Facial attractiveness: A longitudinal study. Am J Orthod Dentofacial Orthop. 2005;127(6):676-82; quiz 755.
26. de Castro MV, Santos NC, Ricardo LH. Assessment of the 'golden proportion' in agreeable smiles. Quintessence Int. 2006;37(8):597-604.
27. Proffit WR, White RP Jr. Surgical- orthodontic treatment. St. Louis: Mosby-Year Book; 1991. 105-28.
28. Mills JR. Principles and practice of Orthodontics. Edinburgh: Churchill Livingstone.1982.
29. Knight H, Keith O. Ranking facial attractiveness. Eur J Orthod. 2005;27(4):340-8.
30. Filho EM, Martins MV, dos Santos da Silva MA, Castilho JC, de Moraes LC, Gil C TL. Divine Proportions and facial esthetics after manipulation of frontal photographs. World J Orthod. 2007 Summer;8(2):103-8.
31. Kawakami S, Tsukada S, Hayashi H, Takada Y, Koubayashi S. Golden proportion for maxillofacial surgery in Orientals. Ann Plast Surg. 1989;23(5):417-25.
32. Mizumoto Y, Deguchi T Sr, Fong KW. Assessment of facial golden proportions among young Japanese women. Am J Orthod Dentofacial Orthop. 2009;136(2):168-74.