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Evaluation of Facial Esthetics using Golden Proportion Values in Dravidian Population for Different Classes of Malocclusions

Prasanna Arvind T R, Navaneethan Ramasamy*, Sri Rengalakshmi

Department of Orthodontics, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Chennai, TamilNadu, India

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ABSTRACT

Improvement in esthetic appearance and functional occlusion are the pillars of contemporary orthodontic procedures. The aim of this study was to assess variations in facial proportions between skeletal classes I, II, III populations in order to establish objective departures from Golden Proportion norms. The study sample was divided into three groups based on the skeletal malocclusion, namely skeletal class I, class II and class III groups. Various markers were identified in these photographs in order to define facial symmetry and balance with the ideal values. Golden Proportion values were compared with that of the obtained results, and these values were checked for skeletal class I, II, III malocclusions. Our study showed a significant difference between skeletal class II and III malocclusions when correlated with Golden Proportion values. Skeletal Class I malocclusions showed a greater correlation with golden proportion values. Golden proportion ratios are more valid in cases of skeletal class I malocclusions. Hence, the objective of treating class II and class III malocclusions should be more focused on attaining values closer to the desired ratio for optimal facial balance and symmetry.

*Corresponding Author

Name: Navaneethan Ramasamy
Phone: +91 9962787531
Email: ethan.nava@gmail.com

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INTRODUCTION

The demand for elective procedures solely for improving esthetics is ever-growing. Orthodontists must have an objective outlook in assessing facial features which are regarded as esthetic and in harmony with the surrounding structures (Young and Smith, 1993). One of the main requirements for better esthetics is the balance between the proportions between the various structures of the face. Many linear and angular measures of soft tissue profile and different cephalometric analysis have been developed to determine ideal proportions (Ayub *et al.*, 2019). Improvement in facial esthetics is carried out using orthodontic or a combination of orthodontic and surgical procedures (Naini *et al.*, 2006). Most people request for improvement in facial esthetics and this percentage has only risen more rapidly over the past decade (Zachrisson, 2015). Maintaining appropriate facial height, width and symmetry are essential to ensure a harmonious balance between the muscles and soft tissues (Rossetti *et al.*, 2013). This esthetic opinion is influenced by multiple factors such as social outlook, cultural balance, ethnicity and age (Villegas *et al.*, 2015). Ensuring a harmonious outlook is dependent on the balance between proportions and symmetry. Ideal values are connected to these proportions and are explained by a ratio 1:1.618 (Lecocq and Trung, 2014). Texts on divine proportion existed since the times of Phidias and were technically and scientifically explained by

Filus Bonacci who assigned a numerical value to it (Maharjan and Joshi, 2018). These proportions are more important with respect to dentists in maintaining proportions of the face (Pini *et al.*, 2012). This particularly applies to orthodontic correction, given that the objectives required at the end of treatment include esthetic harmony along with functional stability (Saifuddeen and Masran, 2017). The aim of our study was to compare the facial proportions between the three different sagittal skeletal patterns and to estimate the deviation of these values from that of the golden proportions.

MATERIALS AND METHODS

The sample consists of frontal photographs of 60 individuals. The sample was divided into three groups of 20 based on their skeletal classification as skeletal class I, II & III. The facial photographs were obtained in natural head position (NHP) with 1.2mm maintained in all patients. All measurements were done after appropriate calibration. 10 photographs were selected and reassessed by the same author after 2 weeks to verify the reproducibility.

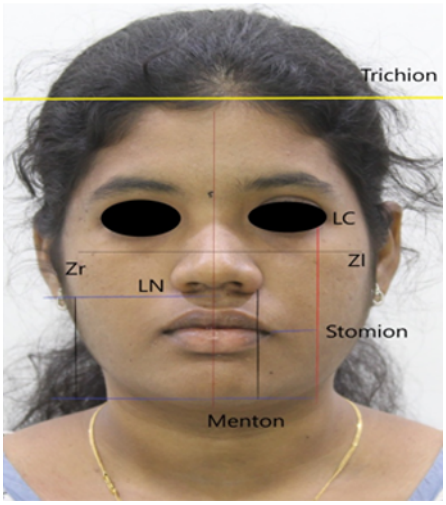

Figure 1: Landmarks and Parameters measured.

The soft tissue measurements that were measured on the photographs Figure 1 are as follows (a) Height of face given by the distance between Trichion to Menton (Tr-Me), (b) the facial width is given by the Distance between bizygomatic points (Zr-Zl), (c) Linear distance between the most inferior point of the chin and the point where lips merge (Me-St), (d) Linear distance between the point where lips merge and corner of the eye (St-LC), (e)Linear distance between the most inferior point of the chin and outer edge of the nostril (Me-Ln) and (f) Linear distance between the outer edge of the nostril and superior-most point of the forehead (Ln-Tr).

The following two ratios were checked to see if they followed divine proportions among the three skeletal patterns.

(a) The ratio of the width of face to the height of the face is supposed to be 1: 1.618.

(b) The ratio of Sto-Me: Me-Lc is supposed to be 1:1.618.

Statistical Analysis

Statistical tests were performed using SPSS software Ver 20.0 (SPSS Inc, Chicago). Oneway ANOVA and post Hoc Tukey's HSD test for multiple comparisons was applied. The significance level was set at 0.05.

RESULTS AND DISCUSSION

The Kappa coefficient ranged from 0.715 to 0.9, which rated the reliability of the test results to be from good in agreement. In Table 1, ANOVA test of variance was used to determine variations in the ratio between width to height of face in three skeletal malocclusions. Skeletal class I and III groups showed significant differences. But significant variations in Golden Proportion values were seen in Skeletal class II and III groups.

In Table 2, ANOVA test of variance was used to determine variations in the ratio between Sto-Me: Sto-LC in three skeletal malocclusions. Skeletal class I and III groups were statistically significant. Skeletal class II and III groups were also statistically significant. Variations from Golden Proportion Values were seen in Class II and Class III groups. Differences in values from Golden Proportion Values were seen in Class II and Class III groups. It is not consistently seen in most features of Class II, III patients in Dravidian Population.

Previously our team had conducted numerous clinical trials involving various topics like recycling of brackets (Kamisetty, 2015), resin penetration into enamel (Kumar *et al.*, 2011), Stress distribution on micro-implants (Sivamurthy and Sundari, 2016), retraction with mini implants (Felicita, 2017), Ball head mini-implants (Vikram *et al.*, 2017), Bonding adhesives (Samantha *et al.*, 2017), intrusion with mini-implant anchorage (Jain, 2014), Reviews like growth pattern prediction with gonial angle (Rubika *et al.*, 2015), Sleep apnoea (Viswanath *et al.*, 2015), Bisphosphate use in orthodontics (Krishnan *et al.*, 2018), Case reports in special situations (Felicita, 2017, 2018) and in vitro studies determination of craniofacial relations, apparatus for measurement of orthodontic force, facial analysis with photographs (Pandian *et al.*, 2018) etc. over the past 5 years.

Table 1: ANOVA test of variance for the ratio between width to height of the face.

	N	Mean	S.D	Sig.
Skeletal class I	20	1.62	0.02	0.89
Skeletal class II	20	1.66	0.30	0.60
Skeletal Class III	20	1.74	0.38	0.34

Table 2: ANOVA test of variance for the ratio between Sto-Me to Sto-LC.

	N	Mean	S.D	Sig.
Skeletal class I	20	1.63	0.07	0.93
Skeletal class II	20	1.64	0.16	0.00
Skeletal Class III	20	1.51	0.12	0.01

This study was done to evaluate the differences in facial proportions between skeletal class I, II, III malocclusions. Assessing variations in facial parameters provide valuable clinical information and improve the acumen of the examining specialist (Vikram *et al.*, 2017). Clinicians, whose main field of work is in the maxillofacial region would benefit greatly with guidelines that are available for assessing esthetic standards and parameters with respect to the soft tissues and muscle balance. Our study results were similar to Bashour et al., who stated skeletal class I malocclusions to be more in correlation with the Golden Proportion. Sforza et al. described sex dimorphism, the inclination to average values, youthfulness and facial symmetry as four important criteria for efficient treatment results (Sforza *et al.*, 1994). Understanding and applying these findings to routine clinical practice can improve comprehension and provide with better quality results (Mantelakis *et al.*, 2018).

Segregation of the face into one-thirds and fifths is a routine photogrammetric method for analyzing symmetry. In our study, all measures analyzed were uniform in the group selected, and we selected measurements that could be reproduced by different operators. Several 'neonatal' characteristics, such as the relatively large forehead and a rounded and smaller face in general, stated that 'babyness' is the characteristic that separates them from the normal group. Considering most parameters of the face, more correlated phases had a smaller face (Felicita, 2017). Gesch applied ideal proportions practically for improving facial esthetics (Gesch *et al.*, 2006). He stressed upon treating the dentition and the face based on the divine proportion. The lower $1/3^{rd}$ of the face predominantly influences facial appearance. The fullness of the lips and the importance of a pleasing smile are key factors in influencing general opinion. Vitruvian thirds in the lower face have to be modified to a 30% upper lip, 70% lower lip-chin projection (Naini *et al.*, 2006). In the present study, positive groups (Class I) showed good harmony in the lower third of the face with lower facial index (subnasale-stomion, stomion-menton) about the expected standards. Therefore, this expected ratio should be maintained during treatment. Lips and chin highly determine female beauty keeping in mind the divisions in the lower third of the face. Ferrario et al. reported that attractive women showed better facial characteristics in the upper third than non-attractive ones (Sforza *et al.*, 1994). Also, the length of the nose was smaller in the skeletal class I group. DeLeon et al. reported thickness of lips to be one of the main features of beauty perception (Deleon, 2018).

In some cases, image distortions may also influence the pictures taken and change the manner in which it is appreciated. In the present study, values for vertical length parameters which should be in relation determined by ideal proportions differed in the group between skeletal class II, III malocclusions (Katona *et al.*, 1995). Therefore, faces of skeletal class I proportions are closer to the ideal proportions (Moss *et al.*, 1995). Gomes et al. carried out significant research on neoclassical esthetics, while others seem to be updating (Gomes, 1990). According to their research, reductions in facial middle-third, in the distance between eyes and nose dimensions have occurred as well as relative enlargement of eyes and mouth width. These guidelines regarding facial beauty can improve patients facial appearance (Alsulaimani and Batwa, 2013). Clinicians must be aware that each person can have their beauty perception, so these results should be viewed with caution.

CONCLUSIONS

Facial beauty and determinants are one of the more arguable topics among surgeons, dentists and

orthodontists. Skeletal Class I malocclusions are closer to Golden Proportion ratios. Significant the difference was seen between Golden Proportion values and Class II, III malocclusions.

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Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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