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

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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.

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.

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). One-way 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.

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

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

| Skeletal class | N  | Mean | S.D  | Sig. |
|---------------|----|------|------|------|
| I             | 20 | 1.63 | 0.07 | 0.93 |
| II            | 20 | 1.64 | 0.16 | 0.00 |
| 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 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**

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**REFERENCES**

Alsulaimani, F. F., Batwa, W. 2013. Incisors’ proportions in smile esthetics. *Journal of Orthodontic Science*, 2(3):109–109.

Ayub, F. B., et al. 2019. The Propinquity of Golden Proportion in Orthodontics. *Journal of Orofacial & Health Sciences*, 10(1):7–7.

Deleon, E. 2018. Esthetics in Adult Orthodontics. In *Ronald E Goldstein's Esthetics in Dentistry*. John Wiley & Sons, Inc. Pages: 896-927.

Felicita, A. S. 2017. Quantification of intrusive/retraction force and moment generated during en-masse retraction of maxillary anterior teeth using mini-implants: A conceptual approach. *Dental Press Journal of Orthodontics*, 22(5):47–55.

Felicita, A. S. 2018. Orthodontic extrusion of Ellis Class VIII fracture of maxillary lateral incisor – The sling shot method. *The Saudi Dental Journal*, 30(3):265–269.

Gesch, D., et al. 2006. Epidemiological evaluation of the multifactorial aetiology of abfractions. *Journal of Oral Rehabilitation*, 33(1):17–25.

Gomes, L. 1990. Early Neoclassical Contributions. In *Neoclassical International Economics*, pages 10–27. Pages: 10-27.

Jain, R. K. 2014. Comparison of intrusion effects on maxillary incisors among mini implant anchorage, j-hook headgear and utility arch. *Journal of Clinical and diagnostic research*, 8:21–25.

Kamisetty, S. K. 2015. SBS vs Inhouse Recycling Methods-An Invitro Evaluation. *Journal of clinical and diagnostic research*, 9(9):4–8.

Katona, T. R., et al. 1995. Stress analysis of bone modelling response to rat molar orthodontics. *Journal of Biomechanics*, 28(1):27–38.

Krishnan, S., et al. 2018. Angular photogrammetric analysis of the soft-tissue facial profile of Indian adults. *Indian Journal of Dental Research*, 29(2):137–143.

Kumar, K. R., et al. 2011. Depth of resin penetration into enamel with 3 types of enamel conditioning methods: A confocal microscopic study. *American Journal of Orthodontics and Dentofacial Orthopedics*, 140(4):479–485.

Lecocq, G., Trung, L. T. T. 2014. Smile esthetics: Calculated beauty? *International Orthodontics*, 12(2):149–170.

Maharjan, A., Joshi, S. 2018. Clinical Evaluation of Maxillary Anterior Teeth in Relation to Golden Proportion, Red Proportion and Golden Percentage. *Journal of Nepal Health Research Council*, 16(1):11–15.

Mantelakis, A., et al. 2018. Proportions of the aesthetic African-Caribbean face: idealized ratios, comparison with the golden proportion and perceptions of attractiveness. *Maxillofacial Plastic and Reconstructive Surgery*, 40(1):20–20.

Moss, J. P., et al. 1995. The use of three-dimensional techniques in facial esthetics. *Seminars in Orthodontics*, 1(2):94–104.

Naini, F. B., et al. 2006. The enigma of facial beauty: Esthetics, proportions, deformity, and controversy. *American Journal of Orthodontics and Dentofacial Orthopedics*, 130(3):277–282.

Pandian, K. S., et al. 2018. Angular photogrammetric analysis of the soft-tissue facial profile of Indian adults. *Indian Journal of Dental Research*, 29(2):137.

Pini, N. P., et al. 2012. Analysis of the Golden Proportion and Width/Height Ratios of Maxillary Anterior Dentition in Patients with Lateral Incisor Agenesis. *Journal of Esthetic and Restorative Dentistry*, 24(6):402–414.

Rossetti, A., et al. 2013. The role of the golden proportion in the evaluation of facial esthetics. *Angle Orthodontist*, 83(5):801–808.

Rubika, J., et al. 2015. Gonial Angle as an Indicator for the Prediction of Growth Pattern. *World Journal of Dentistry*, 6(3):161–163.

Saifudddeen, S. M., Masran, M. R. 2017. Fibonacci sequence and orderliness as observed in the creations of Allah. *Online Journal of Research in Islamic Studies*, 1(1):103–122.

Samantha, C., et al. 2017. Comparative evaluation of two bis-GMA based orthodontic bonding adhesives - A randomized clinical trial. *Journal of Clinical and diagnostic research*, 11(4):40–44.

Sforza, C., et al. 1994. The mathematical definition of the shape of dental arches in human permanent healthy dentitions. *European Journal of Orthodontics*, 16(4):287–294.

Sivamurthy, G., Sundari, S. 2016. Stress distribu-
tion patterns at mini-implant site during retraction and intrusion—a three-dimensional finite element study. *Progress in Orthodontics*, 17(1):4–11.

Vikram, N., *et al.* 2017. The ball headed mini-implant. *Journal of clinical and diagnostic research*, 11(1):2–3.

Villegas, C., *et al.* 2015. Esthetics and New Approaches to Orthognathic Surgery. In *Esthetics and Biomechanics in Orthodontics*. Pages: 423-441.

Viswanath, A., *et al.* 2015. Obstructive sleep apnea: Awakening the hidden truth. *Nigerian Journal of Clinical Practice*, 18(1):1–7.

Young, T. M., Smith, R. J. 1993. Effects of orthodontics on the facial profile: A comparison of changes during nonextraction and four premolar extraction treatment. *American Journal of Orthodontics and Dentofacial Orthopedics*, 103(5):452–458.

Zachrisson, B. U. 2015. Esthetics in Tooth Display and Smile Design. In *Esthetics and Biomechanics in Orthodontics*. Elsevier. Pages: 54-73.