ORIGINAL ARTICLE

Evaluation of Recurring Esthetic Dental Proportion in Natural Dentition with an Esthetic Smile

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ABSTRACT

Background: Several proportions like golden proportion, golden percentage, Preston's proportion, recurring esthetic dental proportion have been described in the literature for smile designing procedures. The recurring esthetic dental proportion has been identified to be an important proportion for accomplishing esthetics and harmony in smile designing.

Aims:: To determine the existence of recurring esthetic dental proportion in the natural dentition of Malaysian students with a natural smile and to compare these proportions among different ethnic groups in Malaysia: Malay, Chinese and Indian.

Study design: Cross-sectional study

Methods: The study included one hundred dental and medical students. The digital camera was used to take photographs of the subjects and were analyzed using adobe photoshop CS4 software. The measuring tool provided by the software was used to calculate the width of maxillary central incisors, lateral incisors, and canines. Average width ratio of maxillary lateral incisor to central incisor and maxillary canine to lateral incisor were later determined to check the existence of recurring esthetic dental proportion in natural dentition.

Results: Data was statistical analyzed (descriptive statistics and t-test, the level of significance were set at $P<0.01$). Constant values of the recurring esthetic dental proportion were not found.

Conclusion: The natural dentition of Malaysian students did not show the recurring esthetic dental proportion in this study.

Keywords: Esthetics, Maxillary anterior teeth, smile.

INTRODUCTION

In aesthetic dentistry, creating a harmonious proportion while restoring or replacing anterior maxillary teeth is the essential task. In the search to develop aesthetically pleasing restorations, various proportions have been suggested to describe the relationship between maxillary anterior teeth[1]. These include golden proportion, golden percentage, recurring esthetic dental proportion, and Chu's proportion.

The most recommended guide to creating pleasing anterior restorations among various geometric proportions is golden proportion. It is approximately 1.618:1, and is constant, which means that the smaller portion is about 62% the size of the larger. The exclusivity of this ratio is that the ratio of the smaller portion to the larger portion is similar to the ratio of the larger portion to the whole[2,3]. Few studies recommend that golden proportion is valuable in achieving harmonious relationships between the teeth while others state that it is not the sole determinant in achieving dental esthetics.

Ward defined recurring esthetic dental proportion (RED) as the proportion of the successive width of the teeth being constant when progressing distally from the midline[4]. The RED proportion is found to be pleasing to both clinicians and patients, also can be used to arrange the teeth for a pleasant smile[5]. In this Proportion, the width of each successive tooth as seen from the front diminishes by the same proportion based on a linear coefficient progression. The width of the lateral incisor is decreased by a certain percentage from the width of the central incisor, and the width of each tooth distally is decreased by the same percentage from its mesial tooth. A study by Ward showed that RED proportion was preferred by seventy- five percent of North American dentists while designing smiles with normal-length teeth over the golden proportion[6]. The purpose of this study was to determine the prevalence of recurring aesthetic dental proportion in maxillary anterior teeth in a selected sample of Malaysian students.

The objectives of the study were to evaluate the presence of RED proportion in natural dentition with the aid of digital photographs and computer analysis and compare the RED proportion among the three different ethnic groups in Malaysians: Malay, Chinese and Indian.

MATERIAL AND METHODS

The present study involved 100 dental and medical students between the age group of 19- 23 years in Manipal university following institutional ethical clearance. Informed consent was obtained before participation from all students. Inclusion criteria were well-aligned anterior dentition. Exclusion criteria included any restored anterior teeth, misaligned anterior teeth, congenital or acquired facial and dental defects, midline diastema, history of orthodontic treatment. Each student was made to sit on a chair at a fixed place with the camera lens. The subject's position with the camera lens was standardized and fixed at a distance of 130 cm. Reference point considered was the anterior border of the ear lobe to the lens of the camera. At this position, the subject's eye was in straight line with the lens. Cheek retractor was used, and students were asked to close their mouth at the maximum interception, gaze at

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the camera lens and photograph was clicked. Frontal view photographs were taken by single investigator from distance of 1m using Nikon D200 camera, 135 mm lens with a tripod. Later, adobe photoshop CS4 extended software was used to analyze the photographs. The software provided measuring tool to record the width of maxillary central incisors, lateral incisors and canines as shown in figure 1.

Measurements: Calculation of RED proportion was done by dividing the width of each lateral incisor by the width of the adjacent central incisor and multiplying the resulting number by 100. Later, the width of each canine was divided by the width of adjacent lateral incisor, and multiplying the resulting number by 100. If both the values obtained were constant, the central incisor, lateral incisor, and canine were in RED proportion.

RESULTS

Table 1, shows the right lateral incisor / right central incisor ratio (female) was in the range of 56.25-84.88% and the mean value was 72.32% which was the closest to the ratio of right lateral incisor / right central incisor (male) which was 71.99% and the range was between 56.45-87.23%. The difference was only 0.3%.

For the ratio of right canine / right lateral incisor (female), the range was 49.15 – 88.57% and the mean was 74.40% when compared to right canine / right lateral incisor (male) where the range was 46.03 – 91.67% and the mean was 74.14%. for the ratio of left lateral incisor / left central incisor (female), the range was 48.81-86.89% and the mean value was 71.72% whereas the ratio of left lateral incisor / left central incisor (male) was in the range of 41.54-89.29% and the mean value was 70.61%. For the ratio of left canine / left lateral incisor (female), the range was 51.67-94.29% and the mean value was 70.08% whereas the ratio of left canine / left lateral incisor (male) was in the range of 56.00-94.87% and the mean value was 73.74%.

Paired sample t-test showed there was a statistically significant difference between the RED proportion of females (P>0.01) only in relation between left and right canine and lateral incisors as seen in table 5, while there was no statistically significant difference between RED proportion left and right lateral incisors and central incisor in females(table 4) (P=0.717). However, no statistically significant differences were also seen between RED proportion of right and left central and lateral incisor(table 2)and also right and left canine and lateral incisor (table 3) in males (P=0.0763), (P=0.794).

In Table 6, the comparison was made between races. The mean value for the ratio of right lateral incisor / right central incisor of Chinese was 72.40%, Malay was 72.58% and Indian was 71.59% where the minimum value among them was 56.25% and the maximum value was 87.23%. The mean value of right canine / right lateral incisor of Chinese was 72%, Malay was 76.19% and Indian 72.61% where the minimum value 46.03% and the maximum value was 91.67%. It was shown that Malay dominates with the highest mean value.

The mean value for the ratio of left lateral incisor / left central incisor of Chinese was 72.63%, Malay was 70.92%, and Indian was 69.57% where the minimum value among them was 41.54%, and the maximum value was 83.33%. The mean value of left canine / left lateral incisor of Chinese were 73.19%, Malay was 71.14% and Indian 70.53% where the minimum value 51.67% and the maximum value was 94.87%. The mean value of Indians was the lowest in all parameters obtained.

Fig. 1: Measuring the width of anterior maxillary teeth using the Adobe Photoshop CS4 Extended software

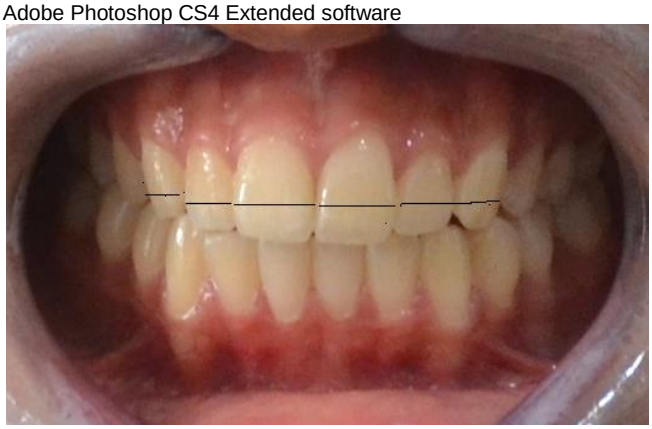

Table 1: Ratio of lateral incisor / right central incisor and canine/central incisor between male and female.

Variable	N	Min. value	Max. value	Standard deviation	Mean value
Right lateral incisor / right central incisor (Female)	49	56.25	84.88	5.93	72.32
Right canine / right lateral incisor (Female)	49	49.15	88.57	10.40	74.40
Left lateral incisor / left central incisor (Female)	49	48.81	86.89	6.96	71.72
Left canine / Left lateral incisor (Female)	49	51.67	94.29	10.85	70.08
Right lateral incisor / right central incisor (Male)	51	56.45	87.23	6.48	71.99
Right canine / right lateral incisor (Male)	51	46.03	91.67	10.12	74.14
Left lateral incisor / left central incisor (Male)	51	41.54	89.29	7.78	70.61
Left canine / Left lateral incisor (Male)	51	56.00	94.87	9.71	73.74

Table 2: Comparison of central/lateral ratio right and left side (Male)

	Mean	SD	p-value
CL/LI Ratio Left	72.33308	7.636830	0.0763
CL/LI Ratio Right	70.04109	8.661564	

Table 3:Comparison of lateral/ Canine ratio right and left side (Male)

	Mean	SD	p-value
LI/C Ratio Left	74.31408	0.794	0.794
LI /C Ratio Right	74.96282	13.61023	

Table 4: Comparison of central/lateral ratio right and left side (Female)

	Mean	SD	p value
LI/C Ratio Left	72.03089	6.368787	0.717
LI /C Ratio Right	71.61004	6.765837	

Table 5: Comparison of lateral/ canine ratio right and left side (Female)

	Mean	SD	p-value
LI/C Ratio Left	76.56920	12.9791	0.0131
LI /C Ratio Right	72.34735	13.6425	

Table 6: shows the ratio of lateral incisor / right central incisor and canine/central incisor between different race.

Variable	N	Min. value	Max. value	Standard deviation	Mean value
Right lateral incisor / right central incisor (Chinese)	40	58.93	85.29	5.40	72.40
Right canine / right lateral incisor (Chinese)	40	52.50	90.70	9.57	72.61
Left lateral incisor / left central incisor (Chinese)	40	41.54	83.33	6.63	72.63
Left canine / Left lateral incisor (Chinese)	40	51.67	94.87	7.22	73.19
Right lateral incisor / right central incisor (Malay)	28	60.71	87.23	6.70	72.58
Right canine / right lateral incisor (Malay)	28	58.33	91.67	10.88	76.19
Left lateral incisor / left central incisor (Malay)	28	48.81	81.54	8.21	70.92
Left canine / Left lateral incisor (Malay)	28	54.39	91.89	12.27	71.14
Right lateral incisor / right central incisor (India)	32	56.25	85.45	6.83	71.59
Right canine / right lateral incisor (Indian)	32	46.03	86.36	10.60	72.61
Left lateral incisor / left central incisor (Indian)	32	55.81	82.28	7.47	69.57
Left canine / Left lateral incisor (Indian)	32	56.00	83.33	7.94	70.53

DISCUSSION

Lombardi[7] was the first to propose the concept of 'repeated proportion' in contrast to Levin [2]golden proportion. Ward [5]was the first to study the importance of RED proportion and established that the RED proportion is reliable predictors. To achieve an esthetic restorative result, it is essential to determine a mathematical or geometrical relationship between teeth. It would be useful if statistically reliable relationships existed to support the existing relationship theories for determining the width of upper anterior teeth[5].

Sreenivasan[5] reported that the RED proportion did not exist between the widths of the maxillary anterior teeth in his study and was also corroborated by Hasanreisoglu et al[9], Shetty et al[10],Ahmed etal[11] and Rosenstiel et al[8]. The variation in outcomes among researchers and a lack of data on recurring esthetic dental proportion in different races among Malaysians brings the idea of designing the current study. This study was done on 100 Malaysian students. The results of this study showed that the ratio of the width of maxillary lateral incisors to the width of central incisors is between 56.45 and 87.23%, the mean value was 72.32%. The ratio of the width of canine to the width of lateral incisor is between 49.15 and 88.67% with the mean value of 74%. In the present study ratio between central and lateral incisors and between lateral incisor and canine is not constant. The ratio increases as moved distally. The mean value 72.32%, ratio of the width of maxillary lateral incisors to the width of central incisors, is in agreement with 70% RED proportion recommended by Ward, and also the mean proportion recommended by Fayyad [12] et al, which was between 66 and 78%.

When comparison was made between races the mean value for the ratio of Right lateral incisor / right central incisor of Chinese was 72.40%, Malay was 72.58%, and Indian was 71.59%. The mean value of Right canine / right lateral incisor of Chinese was 72.61.84%, Malay was 76.19% and Indian 72.61%.

The mean value for the ratio of left lateral incisor / left central incisor of Chinese was 72.63%, Malay was 70.92%, and Indian was 69.57%. The mean value of left canine / left lateral incisor of Chinese was 73.19%, Malay was 71.14% and Indian 70.53%. The values of RED proportion is not constant when progressing distally suggested by Ward and the more distal, the higher the values. No evidence was found in this study to support the application RED proportion to natural dentition in Malaysians.

CONCLUSION

The following conclusions can be derived from this study:

1. The RED proportion was not found in the natural dentition.
2. RED proportion did not exist in the six maxillary anterior teeth in Chinese, Malay, and Indians

Conflict of interest: Nil

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