Research Article

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Golden Proportion of Maxillary Anterior Teeth in Different Sexes in a Sample of Nepalese Population

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ABSTRACT

Introduction: Aesthetics seem to be primary concern among patients attending dental department for the replacement of missing teeth for which size and form of maxillary anterior teeth play an important role. Golden proportion is an essential and valuable guideline for evaluating symmetry, dominance, and proportion for diagnosis and treatment planning.

Objective: To assess the golden proportion of maxillary anterior teeth on the basis of sex in Nepalese population.

Materials and Method: An analytical cross-sectional study was conducted in four months (September to December 2020) duration in College of Medical Sciences - Teaching Hospital, Bharatpur after getting the ethical approval. Dimensions of anterior teeth and perceived width of anterior teeth viewed from front were measured using a digital caliper read to the nearest 0.01 mm. The perceived mesiodistal widths of the teeth were measured. Data were entered and analysis was done in SPSS v.21.

Result: Out of 65 participants, 25 (38.46%) were male and 40 (61.54%) were female. It showed statistically significant difference among male and female for perceived width of maxillary right lateral and left lateral incisor. One sample t-test was carried out showing statistically significant differences between mean ratios of width of maxillary anterior teeth compared with ideal golden proportion (0.618) with P value of 0.002 for lateral to central incisor and P value <0.001 for canine to lateral incisor.

Conclusion: No existence of golden proportion was found in perceived width of maxillary anterior teeth in both the sexes.

Keywords: Actual width; golden proportion; perceived width.

INTRODUCTION

Patient's concern for aesthetics is increasing the number of visits to dental clinics.[1] Maxillary anterior teeth morphology are important for dental and facial aesthetics.[2] Aesthetics determinants are gingival and tooth related.[3] Lombardi in 1973 introduced the concept of "Golden Proportion" in dentistry.[4] Levin described a system of aesthetic prediction by visual and perceptual principles by using dental grid for anterior aesthetics segments.[5] Snow proposed "Golden Proportion" according to which the mesiodistal width ratios for central incisor, lateral incisor, and canine are 1.618, 1, and 0.618 from the frontal views.[6] He mentioned that central incisor should be 60% larger than lateral incisor, which, in turn should be 60% larger than the canine.[6] Richer stated golden proportion as guideline

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for aesthetic anterior restoration.[7] Preston's study (1993) explained that golden proportion ratio was present in central and lateral incisor in 17% of all cases and did not exist in lateral incisor and canine.[8]

Fewer studies showed maxillary anterior teeth did not follow the golden proportion. Some studies followed width and height ratio of anterior teeth for golden proportion.[9,10]

Hence, this study was conducted to measure golden proportion ratio among males and females in tertiary centre in Chitwan using mesiodistal width of anterior teeth.

MATERIAL AND METHOD

An analytical cross-sectional study was conducted in patients and students over a period of four months (September to December 2020) in the Department of Prosthodontics and Maxillofacial Prosthetics, College of Medical Sciences–Teaching Hospital (COMS-TH), Bharatpur, Chitwan, Nepal. A total of 65 participants were selected for the study by convenience sampling. Sample size (n) was calculated using the formula: $n=Z^2pq/e^2$; Where, Z=1.96, p=occurrence of golden proportion within the range of 0.55 to 0.64=0.204%,[11] q=1-p, e=margin of error=0.1 (10%). The sample size was calculated to be 63.65 ≈ 65 after rounding off.

The inclusion criteria included natural anterior teeth, normal periodontal condition, and complete set of maxillary teeth whereas the exclusion criteria were: history of orthodontic treatment, spacing or crowding, missing maxillary teeth, intruded, extruded or rotated teeth in anterior region and anterior teeth with prosthesis. Ethical clearance was taken from the Institutional Review Committee College of Medical Sciences - Teaching Hospital (Ref. 2020-103) and Nepal Health Research Council (Ref. 2586). All participants signed informed consent prior to their participation.

Impression of maxillary arch was made with irreversible hydrocolloid in stock trays and poured with Type IV dental stone. The actual dimensions of the anterior teeth were measured by using digital vernier caliper that read to the nearest 0.01 mm. The perceived width of anterior teeth regarding the occurrence of the golden proportion were viewed from front and measured by drawing grids obtained by placing the cast on a flat surface and drawing vertical lines. The spaces in the grids were also measured by using the digital vernier caliper. The measurement was repeated for three times and mean of them was recorded.

The results were then statistically analysed. The data collection was done in MS Excel and analysis was done in IBM SPSS Statistics for Windows version 21 (IBM Corp, Armonk, New York, USA). Descriptive statistics like mean and standard deviation of measurements of participant's teeth and perceived width of anterior teeth was done and relation between width of lateral incisor to central incisor and canine to lateral incisor of right and left with golden proportion for male and female was carried out using one sample t-test.

RESULT

A total of 65 participants were included in the study and they were grouped according to sex. There were 25 males (38.46%) and 40 females (61.54%). The participants were aged between 17 and 34 years with an average age of 23.74±4.63 years. The measurements of participants' teeth are depicted in Table 1. Statistically significant difference was found among males and females for perceived width of both maxillary right and left lateral incisors (Table 2). In this study, the mean width of right lateral incisor to central incisor was found to be 0.66±0.12 while that of left lateral incisor to central incisor was found to be 0.75±0.27 (Table 3). One sample t-test was carried out which showed that there were statistically significant differences between the

Table 1: Descriptive statistics about measurements of participants' teeth (N=65).

Perceived width	Minimum	Maximum	Mean±SD
11	4	10.24	8.66±0.929
12	3.70	8.53	5.72±0.861
13	2.32	6.75	4.33±0.875
21	3.44	9.87	8.38±0.958
22	4.21	9.45	6.16±0.820
23	3.01	6.20	4.68±0.673

Table 2: Perceived width of anterior teeth among males and females.

Perceived width of tooth	Sex	Mean±SD	P value
11	M	8.74±1.16	0.65
	F	8.62±0.75	
12	M	6.05±1.00	0.024
	F	5.52±0.69	
13	M	4.38±1.06	0.74
	F	4.30±0.74	
21	M	8.66±1.30	0.06
	F	8.20±0.61	
22	M	6.45±0.86	0.02
	F	5.97±0.74	
23	M	4.76±0.80	0.49
	F	4.63±0.58	

Table 3: Width ratios for maxillary lateral to central incisors and their comparison with the golden proportion (0.618).

Width ratio	Ratio	All subjects		Female		Male	
		Mean±SD	P value	Mean±SD	P value	Mean±SD	P value
Right lateral incisor to central incisor	12w/11w	0.66±0.12	0.002	0.70±0.16	0.012	0.64±0.9	0.089
Left lateral incisor to central incisor	22w/21w	0.75±0.27	<0.001	0.79±0.41	0.040	0.73±0.11	<0.001

Table 4: Width ratios for maxillary canine to lateral incisors and their comparison with the golden proportion (0.618).

Width ratio	Ratio	All subjects		Female		Male	
		Mean±SD	P value	Mean±SD	P value	Mean±SD	P value
Right canine to lateral incisor	13w/12w	0.77±0.20	<0.001	0.74±0.22	0.009	0.74±(0.22)	0.009
Left canine to lateral incisor	23w/22w	0.77±0.14	<0.001	0.75±0.16	0.001	0.75±0.16	<0.001

mean ratios of width of maxillary anterior teeth compared with the ideal golden proportion, 0.618 (Table 3, 4). The P value was found to be 0.002 for right lateral to central incisor, <0.001 for left lateral to central incisor.

The width ratio of canine to lateral incisor for the right side is 0.77±0.20 and for left side is 0.77±0.14 (Table 4). One sample t-test was carried out to compare mean width ratios of canine to lateral incisor with golden proportion of 0.618. The P value was found to be <0.001 for right canine to lateral incisor and <0.001 for left canine to lateral incisor.

DISCUSSION

In recent years, concern for dental aesthetics is increasing day by day in daily practice of dentistry. Several guidelines have been provided by different authors regarding the achievement of better aesthetics. Golden proportion is one of them, in which visible width of lateral incisor is 62% (0.618) of central incisor and the visible width of canine is 62% (0.618) of lateral incisor.[12] This factor shows that the size of maxillary anterior teeth is important for dental and facial aesthetics.[2]

Golden proportion is the ratio between larger and a smaller component (1.618:1). It was found to be a reliable indicator for maxillary central incisor width determination.[13] Levin (1978) established the golden proportion between the dimension of central incisor, lateral incisor, and canine.[5] Several studies have shown that there is a golden proportion between the width of maxillary central incisor and lateral incisor.[8] However, some authors

have stated that golden proportion did not exist between the widths of maxillary anterior teeth (no golden standard were detected for the width ratio of maxillary lateral to central, canine to lateral incisor).[14] Similar to this, present study also showed that the width of lateral to central incisor on both left and right side golden proportion was not found. In addition to that, current study also showed that no occurrence of golden proportion exists between right and left canine to lateral incisor.

In this study, the ratio of central incisors, lateral incisors, and canine width were recorded with reference of standard ratio of golden proportion 1.618. The result showed no existence of such golden proportion in present study which was similar to the result of previous studies conducted by Wolfar et al. (2006).[15]

The mean ratios of width of maxillary anterior teeth when compared with golden proportion ratio for lateral to central incisor and canine to later incisor was statistically significant. Mean width ratio of right and left lateral to central incisors in male and female was 0.70 and 0.79; 0.64 and 0.73 respectively whereas the mean width ratio of right and left canine to lateral incisor in male and female was 0.77 and 0.77; 0.74, and 0.75 respectively which showed that golden proportion does not exist.

In current study, the sample size was limited to 65 participants only and error during fabrication of casts might have affected the results. Due to selection of limited participants from Chitwan, this study cannot be generalised for Nepal. So, further studies need to be conducted with greater sample size for better result of golden proportion existence.

CONCLUSION

This study concluded that no golden proportion was found to be existing between perceived widths of maxillary anterior teeth. It also concluded that sex has no relation with the perceived width of maxillary anterior teeth for golden proportion. Therefore, it is recommended that not only the golden proportion, other specific criteria like population characteristics and observation of smile in maxillary anterior need to be examined in future studies in order to evaluate the aesthetics.

Conflict of Interest: None.

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