Evaluation of golden proportion between maxillary anterior teeth in Kashmiri population

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Abstract
Background: One of the important tasks in cosmetic dentistry is to create harmonious proportions between the widths of maxillary anterior teeth when replacing these teeth. The “golden proportion” is a guideline introduced in this field.
Purpose: The objective of this study was to investigate the existence of golden proportion between the widths of the maxillary anterior teeth in Kashmiri population.
Materials and Methods: Digital vernier caliper was used to record the clinical tooth width on 100 subjects of both sexes in the age group of 21 – 30 years. The data obtained was statistically analyzed using paired student t-test (α=0.05)
Results: The golden proportion was not found between perceived maxillary anterior teeth widths. The results revealed that golden proportion was inconsistent in terms of relative tooth width.
Conclusion: The golden proportion is an inappropriate method to relate the successive widths of the maxillary anterior teeth in Kashmiri population.

Introduction
During smiling the facial aspects of maxillary anterior teeth are widely visible; therefore they bear a significant effect in cosmetic dentistry. One of the important and critical tasks in esthetic dentistry is creating a harmonious proportion when restoring or replacing these teeth¹. While treating dental patients, dentist must determine the shape of the tooth and proportion in order to achieve optimal results². The golden proportion is one of the geometric proportions that have been suggested as a guide to create pleasing anterior restorations. The golden proportion is a constant ratio between the larger and smaller length. The ratio is approximately 1.618:1. In terms of proportion, the smaller tooth is about 62% the size of the larger...
one. For example when the ratio between a central and lateral incisor is in golden proportion, the central incisor is 0.618 larger or 62% more than the size of the lateral incisor. This constant ratio has been used to determine the proportion of maxillary anterior teeth to achieve esthetic results.

This specific relation is unique, perfect, ideal, and desirable. It has been used from studying beauty to design esthetic restorations\textsuperscript{3-4}. It is also a valuable tool for the evaluation of symmetry, dominance, and proportion in the diagnosis of tooth arrangement and in the application of esthetic dental treatment\textsuperscript{5}. On the contrary, the researchers found that usage of the golden proportion is theoretical and its application is challenging\textsuperscript{6-9}. The studies have shown both the presence and the disapproval of golden proportion. The uncertainty of golden proportion in esthetic analysis and in smile design intended this study to evaluate the existence or presence of golden proportion in Kashmiri population.

**Materials and Methods**

One hundred Kashmiri subjects, 50 male and 50 female, with age ranging from 21-30 years participated in this study. The selection criteria required the subjects to have all their natural anterior teeth except for possibly the third molars, no history of orthodontic treatment, no tooth size alteration, rotation, spacing, crowding and restoration. Students not full filling this criteria were not enrolled in this study.

Entire procedure was made simple as the subjects for the study were evaluated in normal clinical situations rather than in complex environment. The digital vernier caliper was used to measure the widths of maxillary central, lateral and canine\textsuperscript{10}. The digital vernier caliper was modified using paper pins so that measurements can be accurately recorded. The widths of the maxillary incisors were measured at the mesio-distal contact points of teeth. The width of the canine was measured from the mesial contact point to the distal most point visible from the frontal view. Each measurement was made thrice by the same operator and the repetitive value was used for accuracy and calibration of results.

The golden proportion for each subject was assessed by multiplying the width of the larger component by 62% and compared the width of the smaller component for proportion to be analyzed. The width of central incisor was multiplied by 62% and compared with the width of the adjacent lateral incisor. Similarly the width of the lateral incisor and canine was evaluated for golden proportion. The measurements were recorded and statistically analyzed using Student’s paired t-test at \( \alpha=0.05 \)

**Results**

Data obtained were entered into Microsoft Excel sheet and analyzed statistically using SPSS statistical package version No. 10. Descriptive statistics were calculated for the frequency of participants having various ratios of golden proportions based on sex. Chi square analysis was used to find if there exists any association between sex and various ratios of golden proportions. Alpha error was set at 5% and \( P \) value less than 0.05 was considered statistically significant.

The data revealed no statistical significance in the ratio of golden proportions based on gender. The data obtained from this study is summarized in Table 1. The ratio of
1.2 and 1.3 were more common than 1.618 which was observed in 9% of the samples.

Table 1. Frequency and percentage of ratio in the study sample

<table>
<thead>
<tr>
<th>RATIO</th>
<th>MALES</th>
<th>FEMALES</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>0 (0%)</td>
<td>1 (1%)</td>
<td>1%</td>
</tr>
<tr>
<td>1.2</td>
<td>19 (38%)</td>
<td>17 (34%)</td>
<td>36%</td>
</tr>
<tr>
<td>1.3</td>
<td>15 (30%)</td>
<td>18 (36%)</td>
<td>33%</td>
</tr>
<tr>
<td>1.4</td>
<td>6 (12%)</td>
<td>5 (10%)</td>
<td>11%</td>
</tr>
<tr>
<td>1.5</td>
<td>6 (12%)</td>
<td>4 (8%)</td>
<td>10%</td>
</tr>
<tr>
<td>1.6</td>
<td>4 (8%)</td>
<td>5 (10%)</td>
<td>9%</td>
</tr>
</tbody>
</table>

Chi square value: 2.53   P=0.6 (Not significant)

Discussion

The golden proportion has been proposed in the literature as a useful application for achieving proportion and esthetics. The golden proportion (1.618: 1.0) describes the ratio between the dimensions of a larger and a smaller length. Various researchers have opined for and against the use of these mathematic proportions in dentistry. Levin observed the golden proportion between the width of central incisor, lateral incisor and the canine. Preston found 17% of his study samples had golden proportion between the width of the maxillary central and lateral incisors. Lombardi recommended a repeated ratio concept in contrast to golden proportion.

The results of the study indicated that golden proportion did not exist in majority of the Kashmiri population. The ratio of 1.2 and 1.3 were more commonly observed in 36% and 33% of individuals than 1.618. The ratio of 1.5 and 1.6 were found in 10% and 9% of the study group evaluated. The 1.2 ratio which was commonly observed is substantiated by Rosensteil et al., Javaheri and Shahnaz, Jahanbin et al., Decker, Sarver and Ackerman, Marguardt, Howells and Shaw, Amoric, Phillips et al., Wolfart et al. consider golden proportion to be a superior aspect of esthetics but the proportion is more artistic, theoretical and impractical in nature. It is also inappropriate to anticipate for every patient to possess this precise relationship because human are individuals with unique facial and dental features. Being one of the micro esthetics factors of esthetics it is not a major consideration whereas the other macro esthetic factors and principles play a significant role in determining esthetics.

The adherence to a particular proportion for all patients universally is impractical. The results of this study showed varied existence of specific ratio of 1.2 in 36% of study samples and 1.3 and 33% of samples. No major differences in proportion existed between the sexes. Findings of this study were substantiated by other investigations of de Castro et al., Ong et al., Wolfart et al., Shell and Woods done on non-Indian population. The results of this study have inferred that golden proportion is not seen in majority of Kashmiri population.

Though the width measurements were made to clinical precision there might be a 0.5 mm variation exist in the proximal contact area measurement which can be a
binding limitation in this study. From the results obtained and within the limitations of the study the following were appraised. Ethnic differences should be considered for esthetics and proportion studies. The golden proportion was not found between maxillary anterior teeth in majority of Kashmiri population and the ratio of 1.2 and 1.3 is more commonly seen in Kashmiri population. There were no major changes seen in the proportions between sexes and symmetry of teeth in Kashmiri population.

**Conclusion**
The golden proportion is an inappropriate method to relate the successive widths of the maxillary anterior teeth in Kashmiri population.

**References**