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Five Stage


Evaluation of natural smile: Golden proportion, RED or Golden percentage

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Creating and Assist the geometric or mathematical proportion related to six maxillary anterior teeth comported it with actually width of theses teeth it is importing aspect in Esthetic dentistry. Golden proportion, recurring esthetic dental (RED) proportion and golden percentage are new theories in this field.

## Introduction

Study of the face started thousands of years ago. Clinicians, artists, and sculptors are more interested in the face form and its features $[1]^{1 \mathrm{gr}}$. A beautiful smile is perhaps the most striking feature in the face. It is an expression which conveys various emotions like pleasure, happiness or amusement. The smile is a means of communicating emotions throughout the world and is an uniquely human gesture $[1]^{5 g r}$,. One of the critical aspects of esthetic dentistry is creating geometric or mathematical proportion to relate the successive width of anterior teeth. Golden proportion, golden percentage and recurring esthetic dental are theories introduced in this field.[1,2,4] ${ }^{234 \mathrm{~s} \mathrm{r}}$ Lombardi was the first to suggest the application of the golden proportion in dentistry. He said that the golden proportion was too strong for use in determining tooth size.[1] ${ }^{2 g r}$, He also described the use of a repeated ratio in the maxillary anterior teeth. This implies that an optimized dentofacial composition of the lateral to central incisor width and the canine to lateral incisor width are repeated in proportion.[1] ${ }^{2 \mathrm{gr}}$ He said that the width of the central incisor should be in golden proportion to the width of the lateral incisor and that the lateral incisor should be in golden proportion to the width of the canine, when viewed from the front.[2] ${ }^{3 g r}$ In addition, he devised a grid with the spaces in golden proportion and advocated the use of this grid to evaluate and
develop harmonious proportions of teeth.[3] ${ }^{\text {6gr }}$ However, in a more recent study, it was reported that the golden proportion did not exist between the widths of the maxillary anterior teeth in individuals in who have an esthetic smile. $[3]^{6 \mathrm{gr}}$

Ward suggested the recurring esthetic dental (RED) proportion. He based his suggestion on the result of his study in which he described RED proportion as the proportion of the successive width of the teeth remaining constant, when progressing distally from the midline.[4] $]^{4 \mathrm{gr}}$ Snow considered a bilateral analysis of apparent individual tooth width as a percentage of the total apparent width of the six anterior teeth. He proposed the golden percentage, wherein the proportional width of each tooth should be: canine $10 \%$, lateral $15 \%$, central $25 \%$, central $25 \%$, lateral $15 \%$, and canine $10 \%$ of the total distance across the anterior segment, in order to achieve an esthetically pleasing smile.[5] ${ }^{7 \mathrm{gr}}$ Aim to investigate validity ratio fit for actually esthetic dental smile and to investigate the existence and suitability of Golden proportion, Recurring Esthetic Dental, and Golden percentage between the true widths of maxillary anterior teeth in individuals with natural dentition.

## MATERIALS AND METHODS

Subject : forty dental students, 8 male students and 32 female students in the 20-25 age group with esthetic smile , were selected for the study

Inclusion criteria Subjects: Asian Iraqi origin; natural dentition in maxillary anterior region


#### Abstract

Exclusion criteria: Subjects who have undergone orthodontic treatment; maxillary anterior tooth size alterations


## method by which calculated the measurement

Subjects were positioned in the natural head position mesiodistal width of every sex upper anterior teeth measured and distant from right canine to left canine calculated all by Venire Caliper and The subject was asked to smile ,the smile captured by iphone pro 12 for document the smile .

## Measurements

The Golden proportion for each subject was measured thus: the width of the central incisor was multiplied by $62 \%$ and compared with the width of adjacent lateral incisor. Similar values indicate that the width of the central incisor is in golden proportion to the width of the lateral incisor By comparing the width of the lateral incisor multiplied by $62 \%$ with that of the canine, it can be determined whether the width of the lateral incisor is in golden proportion to the width of the canine.

RED proportion was calculated by dividing the width of each lateral incisor by the width of the adjacent central incisor and the resulting number was multiplied by 100. Similarly, the width of each canine was divided by the width of adjacent lateral incisor and the resulting number was multiplied by 100 . If the values obtained are constant, it means that the central incisor, lateral incisor, and canine are in RED proportion. The golden percentage was calculated by dividing the width of each central incisor, lateral incisor and canine by the total width of all six
maxillary anterior teeth and multiplying the resulting value by 100 , in order to obtain the golden percentage for each tooth. If the values from canine to canine were $10,15,25,25,15$, and $10 \%$, it indicates that the six maxillary anterior teeth are in golden percentage

## RESULTS

Table 1 gives the width of teeth starting from right canine to left canine and the distance from right canine to left canine

| no. | sex | LCW | RCW | LLW | RLW | LCAW | RCAW | CA-CA, D |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | F | 9 | 9 | 5 | 4 | 9 | 9 | 40 |
| 2 | M | 9 | 9 | 7 | 7 | 8 | 8 | 39 |
| 3 | M | 9 | 9 | 7 | 7 | 7 | 8 | 42 |
| 4 | F | 7.5 | 7.5 | 6 | 6 | 6 | 6.5 | 37 |
| 5 | M | 9 | 9 | 6.5 | 6.5 | 8 | 8 | 36 |
| 6 | F | 6 | 6 | 4 | 4 | 4 | 4 | 34 |
| 7 | F | 5 | 5 | 4 | 4 | 5 | 5 | 34 |
| 8 | M | 7 | 7 | 5 | 5 | 6 | 6 | 39 |
| 9 | F | 6 | 6 | 3 | 3 | 4 | 4 | 36 |
| 10 | F | 8 | 8 | 6 | 6 | 7 | 7 | 40 |
| 11 | F | 7 | 7 | 5 | 5 | 6 | 6 | 38 |
| 12 | F | 7 | 7 | 4 | 4 | 6 | 6 | 39 |
| 13 | F | 10 | 10 | 6.5 | 6.5 | 8 | 8 | 42 |
| 14 | F | 8 | 8 | 6 | 6 | 7 | 7 | 40 |
| 15 | F | 10 | 10 | 7 | 7 | 9 | 9 | 46 |
| 16 | F | 8 | 8 | 6 | 6 | 7 | 7 | 40 |
| 17 | F | 10 | 10 | 7 | 7 | 9 | 9 | 46 |
| 18 | F | 11 | 11 | 5 | 6 | 8 | 7.5 | 44 |
| 19 | F | 9 | 9 | 5 | 5 | 7 | 7 | 38 |


| 20 | F | 9 | 10 | 6 | 7 | 9 | 8 | 45 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 21 | F | 8 | 8 | 5.5 | 5.5 | 7 | 7 | 40 |
| 22 | F | 11 | 11 | 6 | 7 | 9 | 9 | 48 |
| 23 | F | 9 | 9 | 7 | 8 | 8.5 | 8.5 | 40 |
| 24 | M | 6 | 6 | 4 | 4 | 5 | 5 | 35 |
| 25 | M | 9 | 9 | 6 | 6 | 7 | 7 | 30 |
| 26 | M | 9 | 9 | 6 | 6 | 8 | 8 | 32 |
| 27 | F | 6 | 6 | 4 | 4 | 4 | 4 | 34 |
| 28 | F | 5 | 5 | 4 | 4 | 5 | 5 | 34 |
| 29 | M | 7 | 7 | 5 | 5 | 6 | 6 | 39 |
| 30 | F | 6 | 6 | 3 | 3 | 4 | 4 | 36 |
| 31 | F | 8 | 8 | 6 | 6 | 7 | 7 | 40 |
| 32 | F | 7 | 7 | 5 | 5 | 6 | 6 | 38 |
| 33 | F | 7 | 7 | 4 | 4 | 6 | 6 | 39 |
| 34 | F | 10 | 10 | 6.5 | 6.5 | 8 | 8 | 42 |
| 35 | F | 8 | 8 | 6 | 6 | 7 | 7 | 40 |
| 36 | F | 10 | 10 | 7 | 7 | 9 | 9 | 46 |
| 37 | F | 8 | 8 | 6 | 6 | 7 | 7 | 40 |
| 38 | F | 10 | 10 | 7 | 7 | 9 | 9 | 46 |
| 39 | F | 11 | 11 | 5 | 6 | 8 | 7.5 | 44 |
| 40 | F | 7 | 7 | 4 | 4 | 6 | 6 | 39 |

## Statistical analysis

All statistical analysis are calculated by using SPSS version 26 software.
Continuous data were expressed as means $\pm$ SD ,Std error of mean, minimum, and maximum .Categorical variables are presented as absolute numbers and percentages. Chart view was illustrated by line plots.

A cut off value was arrived at, to determine whether the subjects lie in the golden proportion range or not The cut-off value was calculated as follows

First, the difference between two groups was calculated, following which an average mean was calculated. Once the average mean was derived, values lying within the range of average mean +1.09 Standard deviation was considered to be in golden proportion.

Sixty five percent of the subjects had right central incisor in golden proportion to right lateral incisor.

Almost fifty eight percent of the subjects had left central incisor in golden proportion to left lateral incisor.

Table 2 give Golden proportion of right and left central incisor to right and left lateral incisor

The mean values and standard deviation for RED proportions for males and females are listed in Table 3. RED proportion between central incisor and lateral incisor lie in the $67.2-127.7 \%$ range. RED proportion between canine and lateral incisor lie in the $67.97-125.83 \%$ range.

The values obtained for golden percentage, beginning with the right side canine and moving to the left canine in this study were 17.43, 14.04, 20.701, 20.646, 14.04, 17.45 the relationship between the golden percentagefor each anterior tooth for men and women respectively.intable 4

Table 2 :

| parameters |  | N | mean $\pm$ SD | Std error | Minimum | Maximum |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| golden proportion for right central incisor of right lateral incisor | male | 8 | $5.03 \pm 0.77$ | 0.273 | 3.72 | 5.58 |
|  | female | 34 | $5.08 \pm 1.09$ | 0.192 | 3.1 | 6.82 |
|  | Total | 40 | $5.076 \pm 1.02$ | 0.162 | 3.1 | 6.82 |
| golden proportion for left central incisor of left lateral incisor | male | 8 | $5.03 \pm 0.77$ | 0.273 | 3.72 | 5.58 |
|  | female | 34 | $5.06 \pm 1.07$ | 0.19 | 3.1 | 6.82 |
|  | Total | 40 | $5.06 \pm 1.01$ | 0.16 | 3.1 | 6.82 |

Table 3:

| parameters |  |  | Std |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | N | mean $\pm$ SD | error | Minimum | Maximum |


|  | male | 8 | $71.32 \pm 4.6$ | 1.632 | 66.66 | 77.77 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Red proportion lateral <br> incisor/Central incisor <br> left side | female | 34 | $66.168 \pm 10.29$ | 1.82 | 45.45 | 80 |
|  | Total | 40 | $67.2 \pm 9.616$ | 1.52 | 45.45 | 80 |
| Red proportion <br> canine/Lateral incisor <br> left side | male | 8 | $119.04 \pm 9.62$ | 3.403 | 100 | 133.33 |
|  | female | 34 | $129.86 \pm 18.51$ | 3.27 | 100 | 180 |
|  | Total | 40 | $127.7 \pm 17.55$ | 2.77 | 100 | 180 |
|  | male | 8 | $71.32 \pm 4.6$ | 1.632 | 66.66 | 77.77 |
|  | female | 34 | $67.12 \pm 10.311$ | 1.822 | 44.44 | 88.88 |
|  | Total | 40 | $67.966 \pm 9.55$ | 1.51 | 44.44 | 88.88 |
| In | 8 | $120.83 \pm 6.35$ | 2.24 | 114.28 | 133.33 |  |



Figure 1: Indicates golden proportion relation between leftcentral incisor and left lateral incisor.

Table 4:

| parameters | N | Mean $\pm$ SD | Std error | Minimum | Maximum |  |
| :---: | :--- | :---: | :---: | :---: | :---: | :---: |
| golden percentage | male | 8 | $22.58 \pm 4.86$ | 1.72 | 17.14 | 30 |


| right central incisor | female | 34 | $20.23 \pm 2.75$ | 0.48 | 14.7 | 25 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Total | 40 | $20.701 \pm 3.347$ | 0.529 | 14.7 | 30 |
| golden percentage left central incisor | male | 8 | $22.58 \pm 4.86$ | 1.72 | 17.14 | 30 |
|  | female | 34 | $20.16 \pm 2.73$ | 0.483 | 14.7 | 25 |
|  | Total | 40 | $20.646 \pm 3.34$ | 0.528 | 14.7 | 30 |
| golden percentage right lateral incisor | male | 8 | $16.06 \pm 3.23$ | 1.14 | 11.42 | 20 |
|  | female | 34 | $13.53 \pm 2.52$ | 0.44 | 8.33 | 20 |
|  | Total | 40 | $14.04 \pm 2.827$ | 0.447 | 8.33 | 20 |
| golden percentage left lateral incisor | male | 8 | $16.06 \pm 3.23$ | 1.14 | 11.42 | 20 |
|  | female | 34 | $13.25 \pm 2.29$ | 0.4 | 8.33 | 17.5 |
|  | Total | 40 | $13.82 \pm 2.71$ | 0.428 | 8.33 | 20 |
| golden percentage right canine | male | 8 | $19.39 \pm 4.04$ | 1.43 | 14.28 | 25 |
|  | female | 34 | $16.94 \pm 2.75$ | 0.487 | 11.11 | 22.5 |
|  | Total | 40 | $17.43 \pm 3.159$ | 0.499 | 11.11 | 25 |
| golden percentage left canine | male | 8 | $19.09 \pm 4.16$ | 1.47 | 14.28 | 25 |
|  | female | 34 | $17.03 \pm 2.82$ | 0.49 | 11.11 | 22.5 |
|  | Total | 40 | $17.45 \pm 3.186$ | 0.503 | 11.11 | 25 |



Figure 2: Indicates golden proportion relation between rightcentral incisor and right lateral incisor

## DISCUSSION

It important to assist the actually width of maxillary anterior teeth and find the actually mathematic relation related to them ,This study was conducted on 40 dental students, 8 being male subjects and 32 female subjects. With respect to the theory of golden proportion, the results in this study were seen in relation to left lateral incisor width and left canine width as clinically calculated. This was observed in a total of 8 male out of 40 subjects no one of them was fulfill golden proportion of which and 32 female , 13 of them (40.625) that fulfill porporation for lateral incisor but for right and left canine there wasn't any relation The overall results showed that the golden proportion did not seem to exist, as MinooMahshid et al and Fayyad MA et al [7] ${ }^{10 G R}$ In their study of subjects with esthetic smile, they evaluated the existence of golden proportion by measuring the mesio-distal width of six anterior teeth, on scanned pictures of individuals. They arrived at the conclusion that golden proportion did not exist in natural dentition.[6,7] ${ }^{9,10 \mathrm{gr}}$ as these study was calculating m-d width of six anterior teeth clinically conclusion golden proportion did not exist in natural dentition

With respect to RED proportion, the results of this investigation showed that the ratio of the width of maxillary lateral incisors to the width of central incisors is between 67.2 and 67.966 The ratio of width of canine to width of lateral incisor is between 127.7and 125.83 . In the present study, the ratio between central and lateral incisors and between lateral incisor and canine is not constant. The ratio increases as one moves distally. The value 67.2 and 67.966 , which was the ratio of the width of maxillary lateral incisors to width of central incisors, is in agreement with the $70 \%$ RED proportion suggested by Ward,[4] ${ }^{4 \mathrm{gr}}$ and the mean proportion suggested by Fayyad et al, [7] ${ }^{10 g r}$ which was between 66 and $78 \%$.

The ratio between central and lateral incisors and between lateral incisor and canine is not constant, as suggested by Ward[4] ${ }^{4 \mathrm{gr}}$ Hence, there is no evidence in this study to support the RED proportion theory as applied to natural dentition.

As for using Golden percentage theory to correlate the six anterior teeth, the result of the present investigation suggests that the mean values for golden percentage for central incisor is 20.646_20.701\% The mean value for lateral incisors is $14.04-13.82 \%$. With respect to golden percentage of canines which was $17.43-17.45 \%$, the result of this study showed a mean value 14.04-13.82 \% The values for lateral incisor was in almost agree with those suggested by Snow,[5] who recommended a value of 15 as the golden percentage for lateral incisor with little less. The figures obtained for central incisor are lower than those suggested by Snow,[5] ${ }^{1 \text { ger }}$ who estimated $25 \%$ for central incisors. Canines have a higher value ( 7 addition )than those suggested by Snow, $[5]^{\text {4gr }}$ who recommended a golden percentage value of 10 for canines. In general, it appears that the width of central incisors is smaller and the width of canines is larger than those suggested by the golden percentage theory. A value of $20.701 \%$ for centrals, , and $17.45 \%$ for canines can't be adopted but lateral incisor canadopted to golden percentage , as these percentages are also not applicable to the natural dentition. variations in the values obtained in this study result from clinical measure of six anterior, as compared to previous study which All the measurements were taken with the help of the software Adobe Photoshop 7 as inBV Sreenivasan Murthy, NiketaRamani ${ }^{15 g r}$

## CONCLUSION

In the light of the results of this investigation the following conclusions can be derived:

1) The theory of Golden percentage was not found between clinical calculated maxillary anterior teeth only lateral incisor of natural dentition was related to it
2) The golden proportion was not found to exist between perceived clinical calculated maxillary anterior teeth on natural dentition.
3) RED proportion was not found to exist between clinical calculated the six maxillary anterior teeth
4) The different found in this study come from the way value of teeth measure, teeth calculated clinically and the value was statically analysis
5) finally no of these theory applicable for actually width of maxillary anterior teeth in compared with other studies using computer software Adobe Photoshop 7

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