



Determination of prevalence of golden proportions of the maxillary anterior teeth in the north Gujarat population: An anthropometric analysis

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Background and purpose: One of the trickiest procedures in aesthetic dentistry is restoring or replacing maxillary teeth while maintaining harmonious proportions. The purpose of the study was to identify the mesiodistal dimensions of the maxillary anterior teeth in the mixed population

of North Gujarat and their relationship to the ideal values of the golden proportion that are comparatively prevalent in the maxillary anterior region.

Methodology: One of the trickiest procedures in aesthetic dentistry is restoring or replacing maxillary teeth while maintaining harmonious proportions. The purpose of the study was to ascertain the mesiodistal dimensions of the maxillary anterior teeth in the mixed population of North Gujarat and their relationship to the ideal values of the golden proportion that are comparatively prevalent in the maxillary anterior region.

Results: The collected data were collated and put through a sample t-test. The ratio of 0.73 mm was found and thus the central incisor was wider than the right and left maxillary lateral teeth which did not follow the golden ratio. It was determined that there was an association between the golden ratio and the canine to lateral incisor, and the results were 0.63 mm.

Conclusion: The proportion of the maxillary right and left lateral incisor to the central incisor and the golden ratio did not correlate with the results. However, there was a correlation between the ratios of the maxillary right and left canines to the lateral incisor and the golden proportion.

KEYWORDS: Maxillary central incisor, Golden Proportion, Vernier Caliper

INTRODUCTION

A crucial component of cosmetic dentistry is developing a geometric or mathematical ratio that relates the space between each maxillary anterior tooth. [1] Numerous studies have demonstrated that individuals are mostly interested about replacing anterior teeth than missing posterior ones because aesthetics are thought to be more significant than dental function. [2] The most important responsibilities in cosmetic dentistry while restoring or replacing maxillary anterior teeth is to establish harmonic proportions between their widths.

Prior to start of restoring anterior teeth, it is always crucial to follow the principles of smile design. Without using smile design principles, the dentist has no plan for restoring the teeth. Without a comprehensive treatment strategy, teeth may be over- or under-prepared, resulting in a restoration with deteriorated aesthetics and no practical purpose. Additionally, sufficient information must be given to the laboratory technician to enable the creation of excellent restorations. Only giving the technician a stone model conveys very little aesthetic information.

The "golden proportion" idea is put up as the keystone of smile design theory. [3] Early on, in the 4th century BC, Aristotle recognized the importance of proportion in aesthetics. The Pythagoreans and the Greek geometrician Euclid both described the golden ratio in the sixth century BC. The smaller piece is around 62% the size of the bigger section, or a ratio of approximately 1.61803:1. [2] The proportion of the smaller component to the bigger part is equal to the proportion of the larger part to the entire, which makes it special.

Numerous research shows the value of the golden ratio, although some studies assert that the golden ratio does not exist. There are some researches that support the golden ratio. When Lombardi originally suggested using the golden ratio in dentistry, he quoted, "It has proved too strong for dental use." [4] In order to correlate the consecutive width of the anterior teeth, when

seen from the labial side, Levin[3] suggested the use of Golden proportion. According to Snow[5], the golden ratio's concept can be applied to identify and improve symmetry and proportion for an aesthetically pleasing smile.

There are numerous researches that refute the validity of the golden ratio because there was no connection between their findings and the outcome of the study. Hasanreisoglu et al [6] evaluated the size of anterior teeth, the presence of the golden ratio, and numerous dental and facial measurements using full-face and anterior teeth photos, gypsum casts of the maxillary arches, and measurements of 100 Turkish dental students. The results showed that the size of the central incisors and canines varies depending on the subject's gender; they also disproved the existence of the golden ratio and revealed that females have proportional relationships between the width of the bizygomatic and the width of the central incisor, the distance between the canines, and the width of the inter-alar.

Mashid et al [2] evaluated the smiles of attractive individuals having golden proportion between the widths of the maxillary teeth. The maxillary anterior teeth's width ratios were studied for the presence of the golden ratio, and it was found that these ratios are uncommon in smiles that are aesthetically pleasant.

It is confusing for both the physician and technician to cope with several contradicting concerns while using the golden ratio. Since there are a variety of opinions on the golden ratio that greatly vary among people in distinct population groupings. In the southern region of the Indian subcontinent, some research has been done to determine whether the golden ratio exists, but we were unable to locate any comparable research in the northern Gujarat subcontinent. Since there seems to be a gap in the literature, it was crucial to conduct research that would offer the required details to formally establish the existence of the golden ratio and its significance in aesthetic dentistry across the Indian subcontinent.

MATERIAL AND METHOD

A prospective study was done in the Department of the Prosthodontics, Narsinhbhai Patel Dental College and Hospital, Sankalchand Patel University, Visnagar. Patients of the Dental College who had been reported to the Department were included as participants. After they met the inclusion and exclusion criteria, a sample size of 100 people was suggested for the study based on the pilot study, preserving equal numbers of male and female participants (50 male and 50 female).

There were no missing or twisted teeth in the anterior region, no periodontal disease, no crowding or gap between the teeth, no history of orthodontic treatment, and presence of all anterior teeth. Subjects with any sort of prosthesis with respect to the maxillary anterior teeth were eliminated.

The arch of the patient informed the choice of the metal stock tray. Using irreversible hydrocolloid (DPI, Algitex, Mumbai, India), a maxillary impression was created. When the impression had set, it was removed from the mouth and immediately poured using dental stone (Type III, KalabhaiKalrock, Mumbai, India). The impression material had been mixed in

accordance with the manufacturer's instructions. The dental stone was removed from the impression once it had been cured, and dental plaster (Type II, KalabhaiKalrock, Mumbai, India) was put into the cast's foundation. Examiners were calibrated, and the average value was taken and recorded after two different examiners read the teeth three times each. Using a computerized vernier caliper, the anterior maxillary teeth's dimensions were calculated (Fig. 1). The mesiodistal widths of the teeth were calculated (Fig. 2). Examiners were calibrated, and the average value was taken and recorded after two different examiners read the teeth three times each.



Figure 1

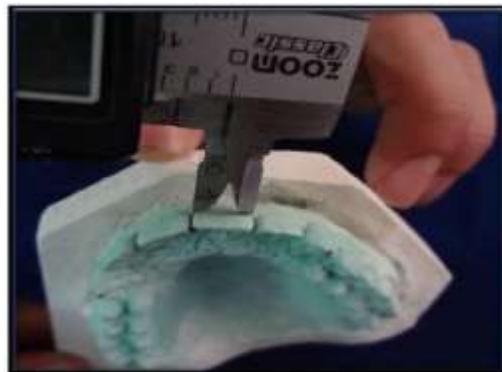


Figure 2

RESULTS

Descriptive statistics of the values were obtained and calculated and statistically analyzed for one sample t – test. The mean values for the Maxillary Central Incisor for both sides were 8.32 ± 0.81 and 8.35 ± 0.77 mm respectively. For the right and left Lateral Incisor it was found 6.09 ± 0.77 and 6.07 ± 0.77 mm respectively. Also mean for the right and left canine it was 3.8 ± 0.43 and 3.91 ± 0.61 accordingly (Table: 1).

The maxillary anterior teeth's ratio was compared using the golden ratio. The ratio of the right and left maxillary lateral to the central incisor was calculated to be 0.73 mm. In light of this, no connection between Lateral to Central Incisor and Golden Ratio was found. However, it was found that there was an association between the results and the golden ratio for the canine to lateral incisor, which was 0.63 mm (Table 2). As a result, the examination of ratio of the maxillary canine to maxillary lateral teeth showed that there was a correlation between that ratio and the golden ratio, but not between the lateral to central incisor.

Table 1

| Sr. No. | Right | | | Left | | |
|---------|-----------------|-----------------|--------|-----------------|-----------------|--------|
| | Central incisor | Lateral Incisor | Canine | Central incisor | Lateral Incisor | Canine |
| 1. | 10 | 7 | 5 | 9 | 7 | 4 |
| 2. | 9 | 8 | 4 | 9 | 8 | 5 |

| | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|
| 3. | 9 | 7 | 5 | 9 | 7 | 5 |
| 4. | 8 | 7 | 4 | 8 | 7 | 4.5 |
| 5. | 9.5 | 7.5 | 4 | 10 | 7.5 | 5 |
| 6. | 8 | 6 | 3.5 | 8.5 | 6 | 3.5 |
| 7. | 10 | 7 | 5 | 10 | 8 | 5 |
| 8. | 8.5 | 6 | 4 | 8.5 | 6 | 4 |
| 9. | 8.5 | 6 | 4 | 8.5 | 6 | 4 |
| 10. | 10 | 6.5 | 3.5 | 10 | 7 | 8 |
| 11. | 10 | 8 | 5 | 10 | 8 | 4.5 |
| 12. | 9 | 5 | 3.5 | 9 | 5 | 4 |
| 13. | 9.5 | 7 | 4.5 | 9.5 | 7 | 4.5 |
| 14. | 8.5 | 5 | 3.5 | 8.5 | 6 | 3.5 |
| 15. | 9.5 | 7.5 | 4 | 9.5 | 7 | 5 |
| 16. | 8.5 | 7 | 4 | 8.5 | 7 | 4 |
| 17. | 9.5 | 7.5 | 4 | 9.5 | 7 | 4 |
| 18. | 8 | 6 | 3 | 8 | 6 | 3 |
| 19. | 9 | 7 | 4.5 | 9 | 7 | 4.5 |
| 20. | 8.5 | 7 | 4 | 8.5 | 7 | 3.5 |
| 21. | 9 | 7.5 | 3.5 | 9 | 7.5 | 4 |
| 22. | 8 | 6 | 3 | 8.5 | 6 | 3.5 |
| 23. | 9.5 | 7.4 | 4.3 | 9.5 | 7.5 | 3.5 |
| 24. | 8.5 | 6 | 3.8 | 8.4 | 6 | 3.9 |
| 25. | 8 | 6 | 3.5 | 8 | 6 | 3.5 |
| 26. | 9 | 6.7 | 3.7 | 8.8 | 6.3 | 3.8 |
| 27. | 9.5 | 7.5 | 4 | 9.5 | 7 | 5 |
| 28. | 8.5 | 7 | 4 | 8.5 | 7 | 4 |
| 29. | 9.5 | 7.5 | 4 | 9.5 | 7 | 4 |
| 30. | 8 | 6 | 3 | 8 | 6 | 3 |
| 31. | 9 | 7 | 4.5 | 9 | 7 | 4.5 |
| 32. | 8.3 | 6.2 | 3.7 | 8.3 | 6.1 | 3.5 |
| 33. | 8.5 | 6 | 3.8 | 8.4 | 6 | 3.6 |
| 34. | 8.8 | 6.3 | 3.7 | 8.6 | 6.3 | 3.5 |
| 35. | 7.4 | 5.2 | 3.3 | 7.3 | 5 | 3.4 |
| 36. | 7.8 | 5.7 | 3.8 | 7.9 | 5.7 | 4 |
| 37. | 7.5 | 5.5 | 3.5 | 7.8 | 5.7 | 3.6 |
| 38. | 8.3 | 5.6 | 3.7 | 8.5 | 5.5 | 3.8 |
| 39. | 7.4 | 6.3 | 3.9 | 7.5 | 6.4 | 3.9 |
| 40. | 7.5 | 6.4 | 3.8 | 7.3 | 6.3 | 3.8 |

| | | | | | | |
|-----|------|-----|-----|-----|-----|-----|
| 41. | 8.9 | 6.9 | 4 | 8.6 | 6.6 | 4.2 |
| 42. | 7.4 | 5.2 | 3.3 | 7.3 | 5 | 3.4 |
| 43. | 7.8 | 5.7 | 3.8 | 7.9 | 5.7 | 4 |
| 44. | 7.5 | 5.5 | 3.5 | 7.8 | 5.7 | 3.6 |
| 45. | 9.1 | 7 | 4.5 | 8.8 | 7 | 4.5 |
| 46. | 8.8 | 6.3 | 3.7 | 8.6 | 6.3 | 3.5 |
| 47. | 7.4 | 5.2 | 3.3 | 7.3 | 5 | 3.4 |
| 48. | 7.8 | 5.7 | 3.8 | 7.9 | 5.7 | 4 |
| 49. | 7.5 | 5.5 | 3.5 | 7.8 | 5.7 | 3.6 |
| 50. | 8.3 | 5.6 | 3.7 | 8.5 | 5.5 | 3.8 |
| 51. | 6.6 | 5.1 | 3.1 | 6.7 | 5 | 3.2 |
| 52. | 8.8 | 6.3 | 3.7 | 8.6 | 6.3 | 3.5 |
| 53. | 7.4 | 5.2 | 3.3 | 7.3 | 5 | 3.4 |
| 54. | 7.8 | 5.7 | 3.8 | 7.9 | 5.7 | 4 |
| 55. | 7.5 | 5.5 | 3.5 | 7.8 | 5.7 | 3.6 |
| 56. | 8.3 | 5.6 | 3.7 | 8.5 | 5.5 | 3.8 |
| 57. | 10.1 | 7.2 | 5.1 | 10 | 7.4 | 5.3 |
| 58. | 8.6 | 6.4 | 3.8 | 8.7 | 6.1 | 3.8 |
| 59. | 8.3 | 6.1 | 3.7 | 8.4 | 6 | 3.9 |
| 60. | 7.7 | 6.1 | 3.8 | 7.5 | 6.3 | 3.9 |
| 61. | 8.8 | 6.3 | 3.7 | 8.6 | 6.3 | 3.5 |
| 62. | 7.4 | 5.2 | 3.3 | 7.3 | 5 | 3.4 |
| 63. | 7.8 | 5.7 | 3.8 | 7.9 | 5.7 | 4 |
| 64. | 7.5 | 5.5 | 3.5 | 7.8 | 5.7 | 3.6 |
| 65. | 8.3 | 5.6 | 3.7 | 8.5 | 5.5 | 3.8 |
| 66. | 6.2 | 4.3 | 3.3 | 6.3 | 4.5 | 3.6 |
| 67. | 8.5 | 6 | 4 | 8.5 | 6 | 4 |
| 68. | 8.5 | 6 | 4 | 8.5 | 6 | 4 |
| 69. | 9.4 | 5.7 | 3.6 | 9.6 | 5.8 | 3.7 |
| 70. | 7.3 | 6.6 | 3.8 | 7.4 | 6.4 | 4 |
| 71. | 8.8 | 6.3 | 3.7 | 8.6 | 6.3 | 3.5 |
| 72. | 7.4 | 5.2 | 3.3 | 7.3 | 5 | 3.4 |
| 73. | 7.8 | 5.7 | 3.8 | 7.9 | 5.7 | 4 |
| 74. | 7.5 | 5.5 | 3.5 | 7.8 | 5.7 | 3.6 |
| 75. | 8.3 | 5.6 | 3.7 | 8.5 | 5.5 | 3.8 |
| 76. | 7.4 | 4.7 | 3.7 | 7.4 | 4.5 | 3.6 |
| 77. | 8.9 | 6.3 | 3.9 | 8.7 | 6.1 | 3.8 |
| 78. | 8.5 | 6 | 4 | 8.5 | 6 | 4 |

| | | | | | | |
|------|-----|-----|-----|-----|-----|-----|
| 79. | 8.5 | 6 | 4 | 8.5 | 6 | 4 |
| 80. | 8.5 | 6 | 4 | 8.5 | 6 | 4 |
| 81. | 9.4 | 5.7 | 3.6 | 9.6 | 5.8 | 3.7 |
| 82. | 7.3 | 6.6 | 3.8 | 7.4 | 6.4 | 4 |
| 83. | 8.8 | 6.3 | 3.7 | 8.6 | 6.3 | 3.5 |
| 84. | 7.4 | 5.2 | 3.3 | 7.3 | 5 | 3.4 |
| 85. | 7.8 | 5.7 | 3.8 | 7.9 | 5.7 | 4 |
| 86. | 7.5 | 5.5 | 3.5 | 7.8 | 5.7 | 3.6 |
| 87. | 8.3 | 5.6 | 3.7 | 8.5 | 5.5 | 3.8 |
| 88. | 6.6 | 4.1 | 3 | 6.8 | 4.3 | 3.1 |
| 89. | 8.8 | 6.3 | 3.7 | 8.6 | 6.3 | 3.5 |
| 90. | 7.4 | 5.2 | 3.3 | 7.3 | 5 | 3.4 |
| 91. | 7.8 | 5.7 | 3.8 | 7.9 | 5.7 | 4 |
| 92. | 7.5 | 5.5 | 3.5 | 7.8 | 5.7 | 3.6 |
| 93. | 8.3 | 5.6 | 3.7 | 8.5 | 5.5 | 3.8 |
| 94. | 8.4 | 5.7 | 3.8 | 8.4 | 5.6 | 3.8 |
| 95. | 7.5 | 5.5 | 3.5 | 7.6 | 5.5 | 3.5 |
| 96. | 8.6 | 6.5 | 4 | 8.7 | 6.2 | 3.7 |
| 97. | 7.7 | 5.4 | 3.9 | 7.7 | 5.2 | 4 |
| 98. | 8.5 | 6 | 4 | 8.5 | 6 | 4 |
| 99. | 8.5 | 6 | 4 | 8.5 | 6 | 4 |
| 100. | 9 | 6.3 | 5 | 9 | 6.1 | 4.9 |

| TOOTH | RATIO (mm) |
|--|------------|
| Width of Right Lateral Incisor to Width of Right Central Incisor | 0.73 |
| Width of Right canine to Right Lateral Incisor | 0.63 |
| Width of Left Lateral Incisor to Width of Left Central Incisor | 0.72 |
| Width of Left canine to Left Lateral Incisor | 0.64 |

Table 2. Proportions of maxillary anterior teeth width relative to each other and significance level of one sample t – test for comparison with golden proportion

DISCUSSION

Aesthetics is based on subtle principles. One of the foretold criteria of aesthetics is proportion which can be calculated using the formula that will determine the ratio between the segments of each component. The "golden proportion" (1.618:1.0), a mathematical constant ratio, dictates the dimensions between bigger and shorter lengths.

This particular relationship is exceptional, flawless, ideal, and desirable. To construct aesthetically pleasing repairs, it has been utilized in the study of beauty. [3,5] In addition, it can be used to assess tooth arrangement and guide cosmetic dental treatments by evaluating symmetry, dominance, and proportion. [7]

Dental aesthetics is influenced and characterized by interaction between various aesthetically significant variables. Therefore, understanding the golden ratios may be helpful to physicians working in the aesthetic field, but it's important to take into account ethnic variances. The main determining factors in visually acceptable cases are the size and shape of the maxillary central incisors. [1]

The placement of the maxillary anterior teeth has the biggest impact on aesthetics, and only a few standards describe their proportions, therefore it was reasonable to undertake the study to determine the "average proportions" in complete dentition and to compare them with the Golden Proportion. [8]

Casts and photographs are now used in place of extracted teeth, which were once used to measure tooth sizes. [1] But measuring the ratios from the obtained castings would provide reliable measurements of the teeth; for this reason, in this study, measuring the dimensions of the tooth from the cast was done and the findings obtained were compared for the golden ratio.

For the maxillary anterior teeth, a mean and standard deviation were found (Table 1). According to Table 2, the ratio of the maxillary lateral incisor to the central incisor was 73% (0.73 mm). The outcomes matched those of the study by Rosenstiel et al. [9], which described that their results were 70%.

The results of this study agree with Magne [10] study that predicted that the maxillary lateral and central incisors should have a tooth-to-tooth ratio of 78%. Wolfart [11] recommended a ratio between 43 and 81% based on the preferences of dentists and patients. As a result, there was no correlation between the golden ratio and the ratio between the maxillary lateral incisor to the central incisor.

Another ratio for the canine to lateral incisor (Table 2) was 63% (0.63 mm). The findings were consistent with those of Parnia et al [1], in which it showed that the tooth-to-tooth ratio for canine to lateral incisor was also 63%.

Later research revealed that the ratio of the maxillary canine to the lateral incisor adheres to the golden ratio. Ward [12], Gillen et al [13], and Rosenstiel et al. everyone agreed with Mahshid et al [2] in which he stated that there is no golden ratio amongst the diameters of the maxillary anterior teeth. [9] Although the Maxillary Canine to Lateral Incisor ratio complied with the golden ratio, the assessment of the Maxillary Lateral Incisor to Central Incisor ratio did not.

Snow's notion, which lacked any evidence, did not include using the golden ratio for diagnosis or achieving the symmetry, dominance, and proportion for an aesthetically pleasing smile. They couldn't thus be compared to our results.

Individual dental aesthetics shouldn't be standardized in the same way due to the diversity in nature. It should be understood that aesthetics differs widely from person to person, even though we should adhere to some essential criteria while arranging aesthetic therapy. Therefore, it is essential to consider both the wide range of natural tooth proportions as well as the specific dentofacial characteristics of each person when restoring or replacing the maxillary anterior teeth. Individual cultural traits and conceptions of beauty must also be taken into account.

CONCLUSION

The current study's findings led to the following inferences:

- The proportion of the maxillary right and left lateral incisor to central incisor did not correlate with the findings for the golden ratio.
- However, there was a correlation between the findings and the ratio of the maxillary right and left canines to the lateral incisor and the golden ratio.

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