

# Correlation between the Inner Canthal Distance and the Upper Central Incisor Mesiodistal Width Using the Decreasing Function of the Golden Ratio

KAJAL HAYAT<sup>1</sup>, HANZALA WAQAR<sup>2</sup>, YASIR HUSSAIN<sup>3</sup>, SHAHWAR AHMAD<sup>4</sup>, MUHAMMAD SALMAN KHAN<sup>5</sup>, ZAHEER BABAR<sup>6</sup>

<sup>1</sup>Lecturer Medical Education, KMU-Institute of Medical Sciences, Kohat

<sup>2</sup>Lecturer Prosthodontics, <sup>4</sup>Demonstrator Biochemistry,

<sup>5</sup>Demonstrator Oral Surgery, <sup>6</sup>Demonstrator Community Dentistry, KMU-Institute of Dental Sciences, Kohat

<sup>3</sup>Senior Dental Surgeon, THQ Hospital Alizai, Lower Kurrum

Correspondence to Dr. Hanzala Waqar, E-mail: [hanzalawaqar93@gmail.com](mailto:hanzalawaqar93@gmail.com), Cell: 0334-9118631,

## ABSTRACT

**Background:** Optimal aesthetics without sacrificing function is one of the main goals of prosthodontists. The face is the most noticeable aspect of the body, and a grin significantly increases one's sense of self-worth. Since aesthetics and subsequently self-esteem are both impacted by the loss of anterior teeth, this frequently causes psychological anguish for the patient. The quality of life and self-esteem of patients are improved by the proper tooth location and choice employing the art of dentogenics to simulate real teeth.

**Aim:** To determine whether there is a relationship between the average mesiodistal width of the upper central incisor and the inner canthal distance when the ICD is multiplied by the decreasing golden ratio, as well as to evaluate the significance of this relationship in predicting mesiodistal width of the upper central incisor in subjects with edentate disease.

**Methodology:** This cross-sectional study was carried out at Department of Prosthodontics, Bacha Khan College of Dentistry Mardan from October 2022 to March 2023. Four hundred and fifty dentate Pakistani subjects without dental or facial abnormalities, aged 18 to 40, were examined. With the use of vernier callipers, the central upper incisors were noted mesiodistally amongst the interproximal contact sites and inner canthal space. The inner canthal space was multiplied by 0.618, and the width of the central incisor was calculated by dividing the result by 2.

**Results:** Statistically significant finding demonstrated with inner canthal distance was exposed to the golden ratio. There was only a modest link among the practical mesiodistal width of the central upper incisors and the estimated central upper incisor width.

**Conclusion:** For edentulous patients, choosing the width of the upper central incisors using the decreasing value of the inner canthal distance's golden ratio was not a valid predictor.

**Keywords:** Edentulous, Golden ratio, Inner canthal distance (ICD)

## INTRODUCTION

Optimal aesthetics without sacrificing function is one of the main goals of prosthodontists. The face is the most noticeable aspect of the body, and a grin significantly increases one's sense of self-worth<sup>1</sup>. Since aesthetics and subsequently self-esteem are both impacted by the loss of anterior teeth, this frequently causes psychological anguish for the patient. The quality of life and self-esteem of patients are improved by the proper tooth location and choice employing the art of dentogenics to simulate real teeth. More predictable and aesthetically acceptable outcomes have been produced as a result of recent advancements in computer techniques<sup>2</sup>. For both dental and facial aesthetics, the kind and size of the upper anterior teeth are essential. The intentional dentolabial placement of the central upper incisors within the arch makes them more prominent when seen from the front. According to research by Schillingburg et al<sup>3</sup> the width of the upper central incisors, canines and lateral incisors together for 37%, 31% and about 32% of the total width. Various anthropometric metrics are proposed to estimate the mesiodistal breadth of the missing central upper incisors individuals based on facial anthropology. These measurements include the interalar width, intercommissural width, and interpupillary distance<sup>4</sup>. Also recommended as an anthropometric factor to forecast the width of the central upper incisors is the inner (medial) canthal distance of the eyes. The inner canthal distance grows up to 93% by the age of five. ICD reaches maturity between the ages of eight and eleven, and after the age of sixteen, measures remain unchanged<sup>5</sup>. Inner canthal distance typically ranges from 28 to 35mm. It is a dependable anatomical parameter for choosing the width of the upper central incisor because there have been no reports of variances based on sex, race (black or white), or age. It is known as the golden ratio

when the size or percentage of a minor to bigger component is equal to the larger part's proportion to the total<sup>6</sup>.

The term "golden ratio" or "golden proportion" refers to certain proportions because of their enormous significance in mathematics and architecture as well as their expressions in nature. According to the grin design idea, the golden ratio is essential. Golden proportion has been taken into account for several facial features.<sup>7</sup> Researchers have attempted to calculate ratios between several anthropometric measurements and the width of the central upper incisors in the literature. The central upper incisor width in our group has not, however, been correlated with any of the face anthropometric measures using the golden ratio. In the golden ratio, the outcome is multiplied by 0.618 for any decreasing function and by 1.618 for any ascending function<sup>1-7</sup>.

The current study's goals are to determine whether there is a relationship between the average mesiodistal width of the upper central incisor and the inner canthal distance when the ICD is multiplied by the decreasing golden ratio, as well as to evaluate the significance of this relationship in predicting mesiodistal width of the upper central incisor in subjects with edentate disease.

## MATERIALS AND METHODS

This cross-sectional study was conducted at Prosthodontics Department, Bacha Khan College of Dentistry Mardan from 1<sup>st</sup> October 2022 to 31<sup>st</sup> March 2023 after getting the ERC approval of the institution. Using the WHO sample size calculator, the sample size was determined. The sample size was obtained using a mean of 28.69 and a standard deviation of 1.78 with a margin of error of 0.15<sup>3</sup> and a 95% confidence level. The approach of non-probability purposive sampling was applied. The research covered all patients, of either gender, with ages ranging from 18 to 40 after obtaining the written consent form. Participants with severe attrition, orthodontic treatment, missing upper anterior teeth, crowding, interproximal spacing, upper anterior teeth that had been

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restored with crowns and bridges, orbital disease, congenital or acquired orofacial anomalies, facial surgery or facial trauma were also omitted from the study. With a tenth of a millimetre precision, digital vernier callipers were used to measure the mesiodistal breadth of the upper central incisors. As reference points, the interproximal contacts were employed. The gauge's pointed members were kept equivalent to the incisal margins & perpendicular to the tooth's facial surface when measurements were taken. The average of this value was recorded after five measurements were made. The usual width of a single upper central incisor was computed by addition of the measurements of the two central upper incisors at the interproximal interaction sites and dividing the result by two. The inner canthal distance was measured by keeping the patients head motionless, positioning the digital vernier calliper on the fore-head of the patient, and gently touching the angles of the medial palpebral fissures of the orbits. Five times for each patient, the space among the angles of the medical canthus was measured, and the average was then determined. The data analysis programme utilized was SPSS-24. Pearson's correlation coefficient was applied. P-values under 0.05 were considered significant.

## RESULTS

In this study, 425 patients who met the inclusion criteria were taken into account. It was 27.53 3.46 years on average. The average of

the combined central incisor width, the average of the mesio-distal central incisor width, the average of the inner canthal distance, and the average of the ICD's golden ratio were determined to be respectively 16.01mm, 7.47mm, 20.24mm, and 8.57mm (Table 1). Out of 450 patients, 299(66%) were male and 151(34%), making up the study's patient population. The correlation between the MCIW values and the ICD's golden ratio for all individuals was 0.216. Figure 1 illustrates a positive association between the MCIW variables and the inner canthal distance golden ratio as determined by Pearson correlation coefficients (r). The connection, however tenuous, was significant.

The mean of the ICD and MCIW data was used to create descriptive statistics for gender and age. Although there was a favourable but insignificant correlation between men and women ( $r=0.064$ ;  $p=0.21$ ), It was favourable but insignificant ( $r=0.287$ ;  $p=0.01$ ) for women. Regarding age groupings, there was a little positive relationship as well (Table 2).

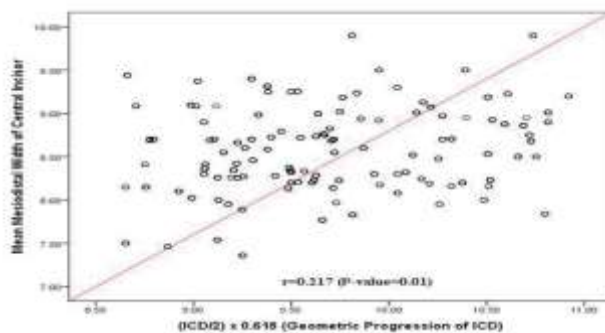
Table 1: Descriptive analysis of numerical variables

Variables	Mean±SD
Age (years)	27.53±3.46
Mean mesiodistal width of upper CI (mm)	7.47±0.36
Combined width of CI [mm]	16.01±1.03
Inner canthal distance [mm]	20.24±1.77
ICD/2 x 0.618 (Golden ratio of ICD) [mm]	8.57±0.47

Table 2: Golden ratio and the average mesiodistal breadth of the central upper incisor in relation to gender

Gender	Mesiodistal width of upper CI	Golden ratio of ICD	Correlation between MCIW and golden ratio of ICD (r)	P-value
Male	7.49±0.38 mm	9.57±0.28 mm	0.064	0.21
Females	7.46±0.34 mm	7.65±0.71 mm	0.287	0.01

Fig. 1: Correlation among the golden ratio of the mean mesiodistal width and the inner canthal distance of the upper central incisor



## DISCUSSION

Although it is below than the values stated by Ahmad et al<sup>8</sup> the mean mesiodistal breadth of the central incisors in the current research is in keeping with the findings of Schillingburg et al<sup>3</sup>. When the individuals were divided based on gender, it was discovered that females had wider central incisors on average than men. Pisulkar et al<sup>9</sup>, Amini et al<sup>10</sup> and Pandey et al<sup>11</sup> have all reported variations in the mesiodistal width of central incisors grounded on sex of the patients. Though, all of these researches showed a complex mean central incisor width of males as compared to that of females, which the current study does not back. The variances may be partially accounted for by variations in calculating methods and in the racial makeup of the communities under study.

The average ICD of our study's participants was practically identical to Kumari's<sup>12</sup> although it was lower than the values given by Shrestha et al<sup>13</sup> and Vijitha et al<sup>14</sup> higher than those reported by those three groups. In terms of gender, there was a considerable disparity in the mean ICD measures. ICD readings for males were substantially higher on average than with females. This result is consistent with the research conducted by Tadano et al<sup>15</sup>. But

when males and females were compared in the study by Deshmukh et al<sup>16</sup>, there was no discernible variance in the mean values of ICD.

In relation to central incisor width, inner canthal distance has been addressed in past study to a lesser extent. The link between the central incisor width and the inner canthal distance, which is subject to the golden ratios declining function, was shown to be poor in the current study. In contrast to females, where there was no significant link between these lengths ( $P>0.05$ ), men had a marginally significant association among inner canthal distance and central incisor width. Further evidence that its increase is less age reliant on comes from the weakly positive connection among central incisor width and inner canthal distance with regard to age change. These results disagree with those of Tadano et al<sup>15</sup>, who discovered a connection between the inner canthal distance and the central incisor width when they exposed it to geometric evolution. This could be brought on by the populations' varying ethnic composition.

## CONCLUSION

The inner canthal distance was substantially smaller in men than in females in our group, although males had smaller mean central incisor widths than females when the mesiodistal central incisor and inner canthal distance were measured on 450 patients. The findings of our study indicate that choosing the central upper incisor width for edentulous individuals in our demographic may not be as accurate as it always was based on inner canthal distance in terms of the golden ratio.

**Conflict of interest:** Nil

## REFERENCES

- Jain AR, Nallaswamy D, Ariga P, Ganapathy DM. Determination of correlation of width of upper anterior teeth using extraoral and intraoral factors in indian population: a systematic review. *World J Dent* 2018;9(1):68-75.
- Kumar KA, Gupta SH, Sandhu HS. Determination of mesiodistal width of upper anterior teeth using inner canthal distance. *Med J Armed Forces india* 2015;71:S376-81.

3. Shillingburg Jr HT, Kaplan MJ, Grace SC. Tooth dimensions - a comparative study. *J Southern California Dent Assoc* 1972;40(9):830-9.
4. Liao P, Fan Y, Nathanson D. Evaluation of upper anterior teeth width: a systematic review. *J Prosthetic Dent* 2019;122(3):275-81.
5. Parciak EC, Dahiya AT, AlRumaih HS, Kattadiyil MT, Baba NZ, Goodacre CJ. Comparison of upper anterior tooth width and facial dimensions of 3 ethnicities. *J Prosthetic Dent* 2017;118(4):504-10.
6. Mishra MK, Singh RK, Suwal P, Parajuli PK, Shrestha P, Baral D. A comparative study to find out the relationship between the inner inter-canthal distance, interpupillary distance, inter-commissural width, inter-alar width, and the width of upper anterior teeth in Aryans and Mongoloids. *Clin Cosmetic investigational dent* 2016;22:29-34.
7. Kumar KA, Gupta SH, Sandhu HS. Determination of mesiodistal width of upper anterior teeth using inner canthal distance. *Med J Armed Forces india* 2015;71:S376-81.
8. Ahmed N, Halim MS, Ab-Ghani Z, Abbasi MS, Aslam A, Safdar J, et al. The analysis of facio-dental proportions to determine the width of upper anterior teeth: a clinical study. *J Clin Med* 2022;11(24):7340.
9. Pisulkar S, Nimonkar S, Bansod A, Belkhode V, Godbole S. Quantifying the selection of upper anterior teeth using extraoral anatomical landmarks. *Cureus* 2022;14(7).
10. Amini P, Saeed B, Darabi R, Amini R, Pourmohrefi P. Relationship of upper anterior teeth and some facial landmarks. *Acad J Health Sci* 2022;37(3):51-7.
11. Pandey A, Kayastha B, Bhattarai R. Assessment of the relationship of inner-canthal distance and interalar width to the inter-canine width amongst the population of Chitwan. *J Chitwan Med Coll* 2022;12(3):35-8.
12. Kumari C, Memon A, Khahro MM, Ghauri MQ, Wali A, Dherwani V. Correlation assessment between inter-commissural width and upper inter-canine teeth in south-west population of Sindh Pakistan. *Prof Med J* 2023;30(04):541-5.
13. Shrestha S, Yadav SK. Facial indicator in the determination of upper central incisor length in Nepalese population—A clinical study. *Asian J Med Sci* 2022;13(12):157-61.
14. Vijitha D, Madhumita S. Evaluation of interalar, inter commissural and intercanthal distance in determination of the width of upper anteriors to aid in artificial teeth selection in south Indian population. *Int J Esthetics Restorative Dent* 2022; 28:1-8.
15. Tadano M, Matsunaga Y, Saito K, Suzuki Y, Nakamura T, Hoshikawa S, et al. The correlation between the inner canthal distance and uppermesiodens in children. *Pediatr Dent J* 2023.
16. Deshmukh K, Radke U, Mowade T, Banerjee R, Chandak A, Deshpande S, et al. Evaluation of various facial landmarks with the intercanine distance - an observational study. *Prosthetic Rehab* 2016.