

Clinical Crown Length, Width and the Width/Length Ratio of the Maxillary Central Incisor Among Patients Reporting to a Tertiary Care Center in Nepal

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ABSTRACT

Introduction: The most important aspect of dental and facial esthetics is the display of anterior teeth. It becomes a primary consideration to restore the correct size and proportion of anterior teeth for patients seeking prosthodontic treatment. There is tremendous influence of geographic location, race, ethnic background, gender in determining the size and proportion of anterior teeth. There is paucity of data regarding the width, length and width/length ration of central incisors in Nepalese population.

Methods: An Observational, descriptive study was conducted in patients visiting T.U. Dental Teaching Hospital. Maxillary impression was made in alginate impression material and poured in dental stone. A digital caliper was used for the measurements, with a precision of 0.01 mm. The maximum mesiodistal width and the maximum crown length of the maxillary central incisors was recorded for each tooth. These data was tabulated and the width/length ratio was calculated. Data was analyzed using Statistical Package for Social Science Version 17 (SPSS Ver. 17) and descriptive statistics was calculated.

Results: A total of 127 participants were included in the study of which 64 (50.39%) were males and 63 (49.61%) were females. The mean width/length ratio for right and left central incisors are 0.89 and 0.86 respectively for males and 0.89 on both the sides for females. In case of right central incisors, males had higher mean crown width and length than female and these differences were found to be statistically significant. In case of left central incisor, there was a statistically significant difference in mean crown length between male and female, males having higher length score than female.

Conclusion: Males had higher mean crown width and length than female and these differences were found to be statistically significant. The width/length ration for central incisor ranged from 0.86 to 0.89. Knowledge about the size and proportion of upper anterior teeth allows dental rehabilitation taking into consideration the local parameters of a population.

Key words: Central incisor, Crown length, Crown width, Golden proportion

Conflict of Interest: None

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INTRODUCTION

The goal of prosthodontic rehabilitation includes not only oral health and function, but also a final cosmetic outcome which depends upon the shape, size, color, texture, and harmony of teeth and their surrounding tissues.¹ One of the most important aspects of dental and facial esthetics is the display of anterior teeth.² Because

the focus of many adults has shifted toward esthetics, it becomes a primary consideration for patients seeking prosthodontic treatment.³ The major challenge in modern dentistry is to create a natural facial and dental appearance.⁴ Additional factors that might influence the ideal smile are ethnicity, personality, or simply the perception of what is “ideal” by a specific group or population.⁵ However, the patient’s perception of dentofacial esthetics does not necessarily match the dentist’s perception, which highlights the importance of establishing an esthetic diagnosis prior to treatment.⁶ When planning treatment, dentists have to understand beauty, harmony and proportion, as perceived by society.²

The relative dimensions of teeth seem to be among the most objective dental criteria within the esthetic checklist because they can be easily and physically controlled. The definition of ideal tooth dimensions, however, remains a difficult task due to individual variations and proximal/incisal tooth wear. To provide “magic numbers” for the clinician, mathematic theorems such as the “golden proportion” and the “golden percentage” have been proposed, considering classic elements of art and architecture.⁷

The maxillary central incisor is considered to be the primary reference tooth, more important than the rest of the anterior teeth in regards to the visible coronal tooth structure.⁸ For esthetic purposes, the maxillary anterior teeth must be in proportion to facial morphology.¹⁰⁻¹² The ideal maxillary central incisor should be approximately 0.8 width, compared with length or approximately 80% width compared with height,⁷ but it has been reported to vary between 66% and 80%.¹² The occurrence of golden standard for the width-to-height ratio of maxillary central incisor within the range of 75% to 80% was found in 20.4% of the population.¹³ The existence of golden standard among ethnicities were as follows: 22.7%

of Chinese, 21.4% of Indians and 15.4% of Malay.¹⁴ A higher width-to-length ratio means a squarer tooth, and a lower ratio indicates a longer appearance. However, significant gender differences in width to length ratios were recorded in previous studies.^{15,16} The objective of this study is to determine clinical crowns length, width and width/length ratios of the maxillary central incisors and to determine a standard tooth dimensions in the patients.

METHODS

An Observational, descriptive study was conducted in patients visiting T.U. Dental Teaching Hospital (TUDTH) from June 2022 - Sept 2022. Ethical approval was obtained from Institutional Review Committee, Institute of Medicine, Tribhuvan University [Ref:182(6-11)E2 079/080] before conducting the study. Patients 18 years and above with all of the 6 maxillary anterior teeth completely erupted were included in the study. The exclusion criteria included patient with restorations, porcelain laminate veneers, crowns in the anterior maxillary segment patients with signs of gingival alteration, hyperplasia, inflammation, altered passive eruption, or gingival recession. Patient with dental caries, restorations, extreme occlusal wear, extrusion, obvious deformities or tooth mobility were also excluded from the study. Other exclusion criteria were patient with anterior maxillary teeth traumatism, attrition, occlusal adjustment, dental malformation, malposition or diastema and previous orthodontic treatment.

Estimation of sample size was done with the following formula, using the prevalence of golden standard for the width-to-height ratio of maxillary central incisor within the range of 75% to 80% in a previous study.¹³

$$n = Z^2 p q / d^2$$

Where,

$$Z=1.96$$

n = minimum desired sample size

p = prevalence of edentulism in the desired population = 20.4% = 0.204

$q = 1 - p = 0.796$

d = least estimated difference of prevalence = 0.07

From the above formula, the minimum desired sample size was estimated to be 127.

The oral examination was done in dental chair by the Principal Investigator using mouth mirror and probe. The purpose, procedures, risk and benefits of the study was explained to patients. An informed consent and their willingness and participation in the study was ensured. They were assured of maintaining confidentiality of their personal and other data collected from them. Maxillary impression was made in alginate impression material and poured in dental stone. A digital caliper was used for the measurements, with a precision of 0.01 mm. The measurements were recorded in millimeters by a trained examiner. Each measurement was made three times and an average value was calculated. The maximum mesiodistal width (perpendicular to the longitudinal axis of the tooth) and the maximum crown-root length, (parallel to the longitudinal axis of the tooth and between the most apical point of the gingival margin and the most incisal point of the anatomic crown) of the maxillary central incisors was recorded for each tooth. The height or vertical length of teeth corresponded to the distance between the clinical cervix and the incisal edge, parallel to the major axis of the crown. The width corresponded to the horizontal distance, perpendicular to the axial axis of the clinical crown measured between the wider mesiodistal portion in relation to the point of contact of each tooth. These data was tabulated and the width/length ratio was calculated.

Data was analyzed using Statistical Package for Social Science Version 17 (SPSS Ver. 17). Descriptive statistics was calculated using frequency measurements, dispersion and the mean with a standard deviation. Differences in the central incisor proportions according to sex was analyzed using the t-test. The significance level was set at 5% ($P < .05$).

RESULTS

A total of 127 participants were included in the study of which 64 (50.39%) were males and 63 (49.61%) were females. The mean width/length ratio for right and left central incisors are 0.89 and 0.86 respectively for males and 0.89 on both the sides for females. (Table 1)

In case of right central incisors, males had higher mean crown width and length than female and these differences were found to be statistically significant (p -value 0.001 for width and p -value 0.010 for length). In case of left central incisor, there was a statistically significant difference in mean crown length between male and female (p -value 0.002), males having higher length score than female (Table 1).

The width of right and left central incisor were positively correlated with moderate correlation ($r = 0.353$) and correlation was statistically significant (p -value < 0.001) (Figure 1).

The length of right and left central incisor were positively correlated with strong correlation ($r = 0.744$) and correlation was statistically significant (p -value < 0.001) (Figure 2).

The width length ratio of right and left central incisor were positively correlated with strong correlation ($r = 0.560$) and correlation was statistically significant (p -value < 0.001) (Figure 3).

Table 1: Variation in clinical crown length, width and the width/length ratio of maxillary incisors according to gender

Side	Parameter	Male Mean±SD	Female Mean±SD	p-value
Right	Width (mm)	8.47±0.67	8.07±0.68	0.001*
	Length (mm)	9.62±0.95	9.11±1.26	0.010*
	Width/ length ratio	0.89±0.09	0.89±0.11	0.536
Left	Width (mm)	8.12±0.85	7.88±0.93	0.139
	Length (mm)	9.51±1.04	8.88±1.20	0.002*
	Width/ length ratio	0.86±0.10	0.89±0.13	0.067

Independent t test, p-value<0.05 statistically significant

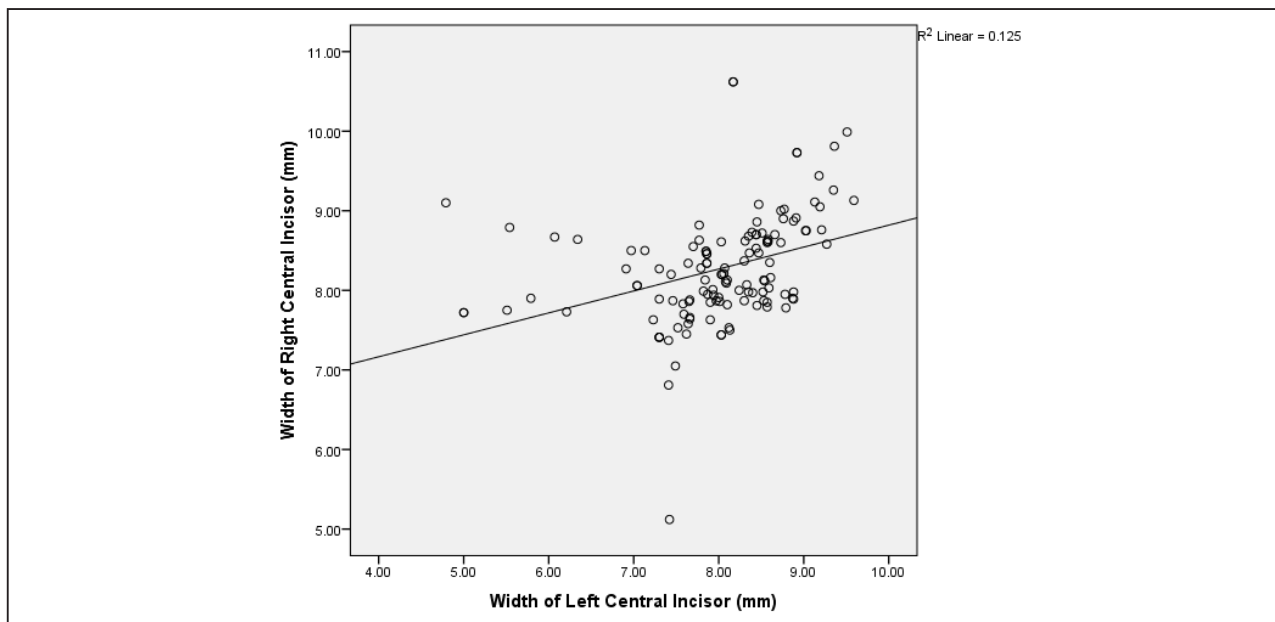


Figure 1: Scatter plot showing correlation between width of right and left central incisor in study participants ($r=0.353$, $p\text{-value}<0.001^*$) $p\text{-value}<0.05$ statistically significant*

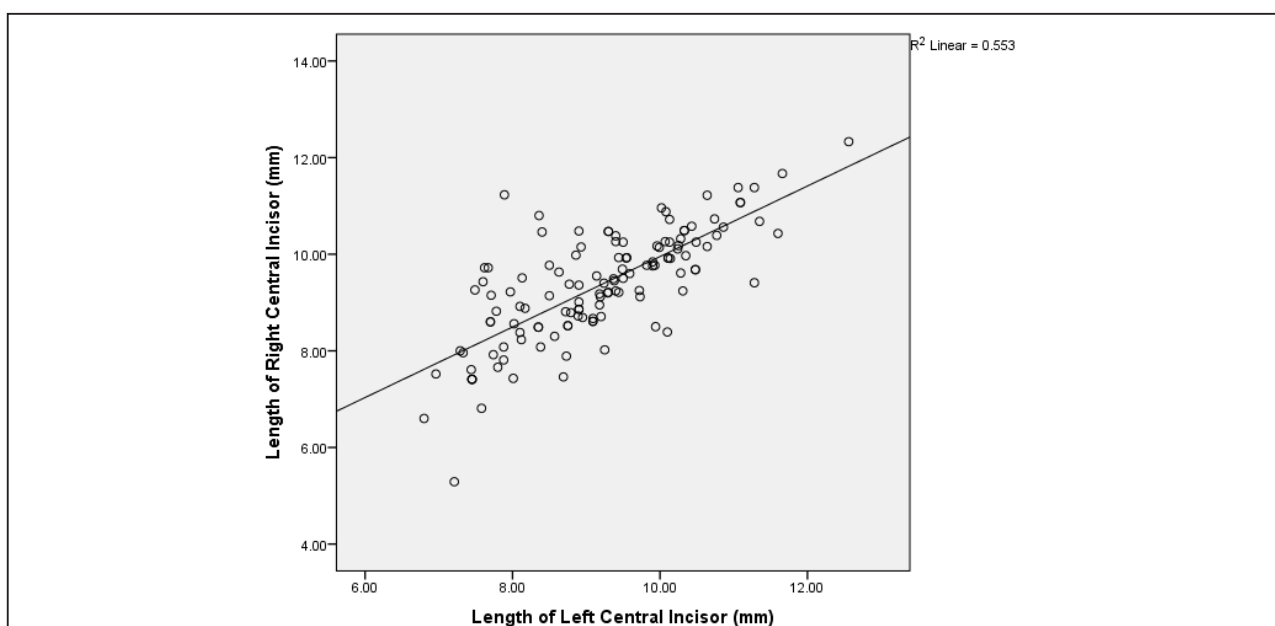


Figure 2: Scatter plot showing correlation between length of right and left central incisor in study participants ($r=0.744$, $p\text{-value}<0.001^*$) $p\text{-value}<0.05$ statistically significant*

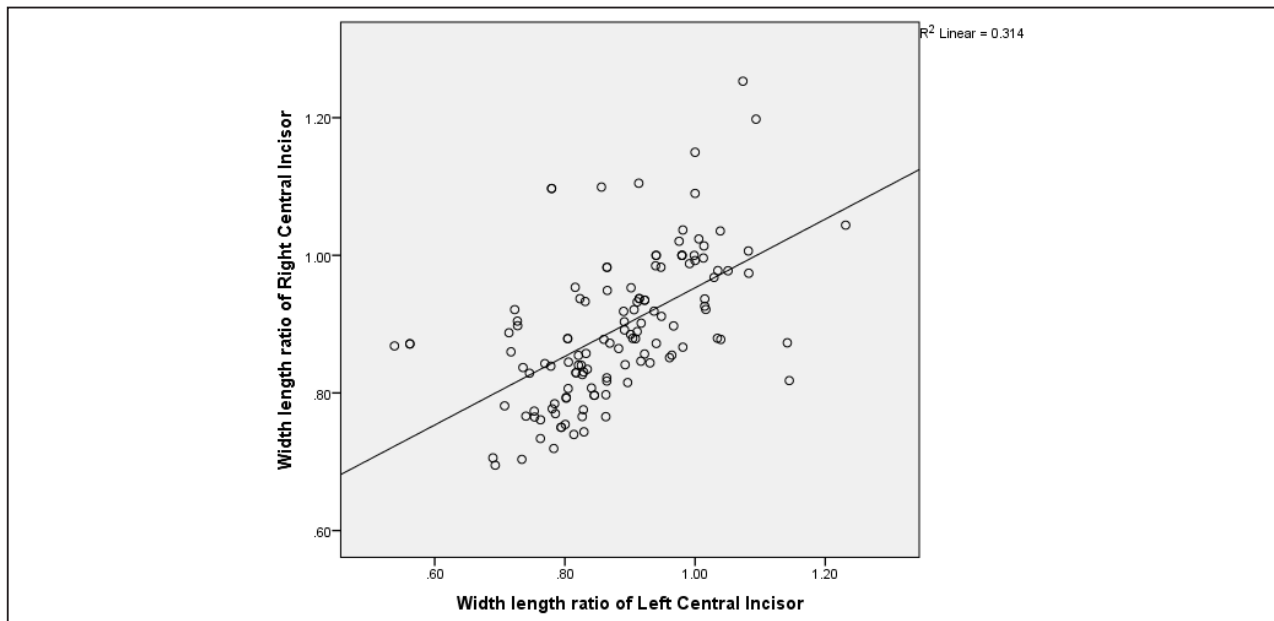


Figure 3: Scatter plot showing correlation between width length ratio of right and left central incisor in study participants ($r=0.560$, $p\text{-value}<0.001^*$) $p\text{-value}<0.05$ statistically significant*

DISCUSSION

The size and form of the maxillary anterior teeth are important for both dental and facial esthetics. The current study explores correlation between the dimensions of maxillary right and left central incisors and association of width/length ratio of the maxillary central incisor with gender.

The width and length of right and left central incisor were positively correlated and correlation was statistically significant. Males had higher mean crown width and length than female and these differences were found to be statistically significant. In a previous study by Sterrett et al., they found significantly increased maxillary anterior teeth width and length measures in Caucasian males, compared to females.⁷ In Turkish population, Hasanreisoglu et al., reported that the dimensions of the central incisors varied by gender.⁸ They also reported that, overall, men's teeth were bigger than women's teeth. Owens et al.¹⁷ measured the width of the maxillary central incisor in several racial groups and reported variations in most

of them, with men again having wider central incisors than women.

The width/length ratio for both central incisors were 0.89 and in males it was 0.86 for right central incisor and 0.89 for left central incisor. These values are slightly higher than the proposed ideal maxillary central incisor width to length ratio which is approximately 0.8 width, but the ratio has been reported to vary between 0.72 and 1.24.^{7, 18-21} However, significant gender differences in width to length ratios were recorded in previous studies.^{15,16,19} In a study by Brisman,¹⁸ the width to length ratio of 0.75 was preferred when a variety of tooth shapes were assessed by dental students and patients. In another study mean width/height ratio of maxillary central incisor was found to be 0.86 for male and 0.89 for female.²⁰

Analyzing esthetics of facial appearance involves different methods, such as directly measuring with a caliper, measuring on photographs, cephalometry analysis and usage of computer images.²¹ Digital caliper was used in this study for measurements because it is

easily available, less technique sensitive and economical.

Many authors point out the need for achieving proportions in the smile that harmonize with the face.¹ The ideal maxillary central incisor should be approximately 80% width compared with height, but it has been reported to vary between 66% and 80%. The value ranged between 86% to 89% in our study population. Application based on the golden ratio of the frontal view of the six upper anterior teeth constitutes a strict measure for the clinician in oral rehabilitation.¹ However, there are contradictory reports indicating that this mathematical proportion does not apply when defining a beautiful smile, where the width and the height of teeth are much more important.

Racial and gender differences in the average dimensions of the maxillary anterior teeth have been reported, but the results were valid only for specific isolated populations. In addition, some populations demonstrated no correlation between dental morphology and gender.⁸ In our study males had larger central incisor compared to females. There is lack of adequate research regarding dimension and proportion of anterior dentition in Nepalese population. This indicate the need for evaluation of anterior dentition for comparisons among different populations or racial groups.

CONCLUSION

Knowledge about the size and proportion of upper anterior teeth allows dental rehabilitation taking into consideration the local parameters of a population. Males had higher mean crown width and length than female and these differences were found to be statistically significant. The width/length ration for central incisor ranged from 0.86 to 0.89. The outcome of the study provided clinically useful information regarding anterior tooth proportion in a sample of Nepalese population, which may be used

during prosthetic and restorative treatment of maxillary anterior teeth. The major limitation of this study is that the sample size is small and the study will be conducted in a single center.

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