

GENDER-WISE VARIATIONS OF WIDTH, LENGTH, AND WIDTH-LENGTH RATIO OF RIGHT AND LEFT MAXILLARY CENTRAL INCISORS (MCI)

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ABSTRACT

Objective: Current study aimed compare variations of width, length, and width-length ratio of MCIs among patients presenting with replacement of posterior teeth.

Materials and Methods: A total of 120 participants male and female subjects with age between 18 to 40 years, having angle class I occlusion and anterior permanent teeth present, presence of anatomically whole MCI, from which good diagnostic cast can be obtained, and no restorations in MCI. Measurements of all these parameters were performed with digital vernier caliper. The clinical crowns of MCI were calculated, the maximum length of the crown and mesio-distal (MD) breadth between the incisal point of the MCI crown and the apical point of the gingival margin. Sample t-test will be applied to compare the effect of gender on width, length, and width-length ratio in both genders. The level of significance was kept 0.05.

Results: The males were 54(53.3%) and females were 56(46.7%). The mean age was 30.12 ± 7.25 years. The width of central incisors on right and left sides were $7.96 \pm 0.53\text{mm}$ and $7.83 \pm 0.61\text{mm}$ respectively. The length of right and left central incisors were $8.27 \pm 1.15\text{mm}$ and $8.06 \pm 1.57\text{mm}$. The ratio of width/length on right and left side was 0.98 ± 0.11 and 1.02 ± 0.29 respectively. There was not statistical difference mean width among genders ($p = 0.201$ right side, $p=0.388$ left side).

Conclusion: There was no sexual dimorphism for width but width to length ratio was statistically different among gender, higher in females.

Keywords: Maxillary Central Incisor, Mesiodistal Width, Macro esthetics, Diagnostic Cast

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INTRODUCTION

Dentists face difficulty in making functionally and esthetically pleasing dentures especially during the

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selection of teeth in the esthetic zone. Selection of appropriate size of upper six front teeth are important in this aspect, which readily affects the desirable beauty, appeal and self-esteem of the person (dental esthetics).¹ Dental esthetics is defined in glossary of prosthodontic terms (GPT) as “The philosophy and theory of beauty in dentistry, particularly as it relates to the form and/or color of a dental restoration; the subjective and objective components and principles that underlie the attractiveness and beauty of an object, design, or principle.”²

Dental-facial appearance influences the social attractiveness of people. It's often quite challenging for dentists to provide restorations such as fixed or removable prosthesis for patients with missing teeth in the esthetic zone. It is important to derive the dimensions of anterior teeth, specifically the MCI for a successful treatment because MCI is evident of all anterior teeth during posed smile.¹ Among maxillary incisors the

prominent teeth with maximum visibility and large surface area is MCI, they are also dominant because their dimensions can be seen in full size during smile.¹

It is found that sexual dimorphism determines the length of teeth differed between populations. It is predisposed by many factors such as genetic, epigenetic, and environmental factors.³ It is found through different evidences that the MCIs dimension can be affected by various factors like: gender, ethnicity, symmetry of left and right and measuring methods,⁴ the above-mentioned factors are presented in different research articles with different opinions about how these factors affected the MCI's dimension.⁴

Literature has proposed some further groups for dental facial esthetics. First macroesthetics, referring to the face along with esthetically proportional harmony in several structural aspects. Second mini esthetics, which includes that how teeth are shown to the viewers and perceived by observers and third micro esthetics, which includes the dental aspect, including teeth arrangement in arch along with shade, shape and size proportionality.⁵ In the present study the Micro esthetics approach will be followed especially in the aspect of the dimensions (width, length and width-length ratio) of MCI.

Several studies showed effect of gender on width, length and width-length ratio in which different results are obtained in relation to the average value of width, width-length ratio and length of both male and female subjects.^{1,4,5} Study done by Qamar et al¹ in which the cast of male and female subjects were used to calculate the length of MCI by the means of a digital caliper, where in results there is noticeable difference in male and female individuals' MCI length as according to him mean length is 9.081⁵ mm in males and 9.4172 mm in females. According to the study done by Botross et al⁵ mean length of MCI in males is 10.37 mm and 10.1⁴ mm in females. Average width of MCI is 8.87 mm in males and 8.69 mm in females, while width-length in male and female subjects is 0.86. A study done by Alvarez-Alvarez et al⁴ showed significant difference in width-length ratio of male and female subjects, p-value<0.01.

The objective of present study is to investigate the gender wise variations of width (Wd), length (L), and width to length (W-L) ratio of MCI in patients coming to Peshawar dental college which will help the practicing dentist, undergraduate and postgraduate dental students to select the appropriate artificial MCI teeth for complete and removable partial dentures in both genders. This will help to determine and compare variations of width, length, and width-length ratio of MCIs.

METHODOLOGY

After obtaining institutional review board approv-

al certificate the current cross-sectional study was carried out at the Department of Prosthodontics, Peshawar Dental College, Peshawar (1st January to 30th July 2022). A consecutive non-probability sampling technique was used. The sample size was calculated from prevalence according to the results of the study conducted by Qamar K et al, where mean crown length of maxillary right central incisor is 10.22 mm, mean width of crown is 7.99 mm, standard deviation (SD) is 0.84mm and crown width-length ratio is 0.91 was found. Considering the results of study done by Khan M et al and using world health organization (WHO) sample size calculator, Sample size calculated is 120 patients. Confidence interval is kept 95% and margin of error is 5%. A set inclusion criterion was followed including male and female subjects with age between 18 years till 40 years having angle class I occlusion and anterior permanent teeth present. Patients with anatomically sound MCI, from which good diagnostic cast can be obtained and having no restorations done to MCI. Exclusion criteria included subjects with gingival alteration, hyperplasia, inflammation, gingival recession, macrodontia, microdontia, hypodontia, history of periodontal surgery, any type of restorations presents in MCI, trauma, attrition, occlusal adjustment, intruded, extruded or rotated MCI present, malposition or diastema present, previous orthodontic treatment, supplemental or supernumerary teeth present in the region of MCI. The data was collected by a customized proforma.

Maxillary arch impression was made for each subject with hydrocolloid impression of irreversible type material (Alginate) in a metallic tray. The powder and liquid of the impression material was mixed in accordance with given specification in a rubber bowl and spatula. Preloading was performed for an accurate recording of interdental grooves areas. Upon removal from mouth, the recorded impressions were thoroughly checked for any obvious defects. Unsuitable impressions were repeated. To follow and maintain the disinfection protocols impressions were water rinsed followed by dipping in the disinfectant solution, waiting for 1 minute, rinsing again gently with running tap water and was covered with a damp cotton and poured within 10 minutes with dental stone, in the laboratory. After removal of the cast from the impression, a subject number with (M) for male and (F) for female was written on the cast with a permanent marker.

The width and length of teeth under consideration were measured (by principal author) using a digital Vernier caliper having a precision of 0.01mm. Maximum MD with and maximum gingiva-incisal length of teeth were recorded. The length, width and width-length ratio values were recorded in millimeters (mm) from the casts and was recorded in the table.

Data was analyzed using Statistical Package for Social Sciences (SPSSversion23). Descriptive statistics was presented for both qualitative and quantitative variables. Mean \pm S.D was calculated for quantitative variables like age, length, width, and width-Length ratio. Qualitative variables like gender were presented as frequency and percentage. Effect modifiers like age, gender and BMI was controlled through stratification Distribution of categorical variables i.e., length, width and width-length ratio in millimeters. Independent Sample t-test was applied to compare the effect of gender on width, length, and width-length ratio between male and female subjects. The level of significance was kept 0.05. Reliability was tested with Pearson correlation coefficient. R value of 0.90 or higher was considered as excellent agreement between the observations.

RESULTS

The males were 54(53.3%) and females were 56(46.7%) as shown in Fig 1. Most common age group was 31-40 years having 64(53.33%) followed by 18-30 years with 56(46.67%) participants. (Fig 2)

The mean age was 30.12 ± 7.25 years ranging from 18 to 40 years. The width of central incisors on right and left sides were $7.96 \pm 0.53\text{mm}$ and $7.83 \pm 0.61\text{mm}$ respectively. The length of central incisors on right and left sides were $8.27 \pm 1.15\text{mm}$ and $8.06 \pm 1.57\text{mm}$ respectively. The ratio of width/length on right and left side were 0.98 ± 0.11 and 1.02 ± 0.29 respectively. (Table 1)

The Two Sample t-test testing the difference width to length ratio by Gender (mean in Female = 0.99 ± 0.12 , mean in Male = 0.96 ± 0.11) suggests that the effect is

positive, statistically not significant, and small (difference = 0.03, 95% CI [-0.01, 0.07], $p = 0.201$). Similarly, the mean width of right ($p=0.710$) and left central incisor ($p=0.388$) was not statistically significant. (Table 2)

The Two Sample t-test testing the difference of width of left central incisor by Gender (mean in Female = 7.79 ± 1.80 , mean in Male = 8.31 ± 1.30) indicates that the effect is minor, negative, and not statistically significant (difference = -0.52, 95% CI [-1.10, 0.06] $p = 0.076$, 95% CI [-0.70, 0.03]). The mean difference (-0.52) between females and males was not statistically ($p=0.076$). The width to length ratio among genders was statistically significant ($p=0.043$) and was higher in female (1.08 ± 0.38). (Table 3)

Width ($p=0.000$), length ($p=0.83$) and width to length ratio ($p=0.78$) on right side among age groups was not statistically different. Detailed mean and SD are given in table 4. Good inter and intra reliability was observed (R value > 0.8)

DISCUSSION

The current study aimed to determine and compare variations of width, length, and width-length ratio of MCIs. Mean width of both upper right and left central incisors and their width/length ratios were determined. There was no sexual dimorphism.

Several studies have been done on effect of gender on width, length, and width-length ratio in which different results are obtained in relation to the mean value of width, length and width-length ratio of both male and female subjects. Study done by Qamar k et al¹ is in accordance with our results, in which the cast of male and female subjects were used to calculate the

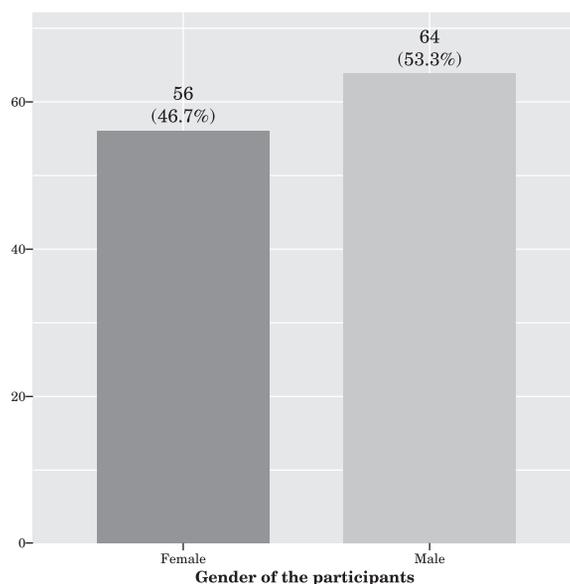


Fig 1: Gender distribution of the participants

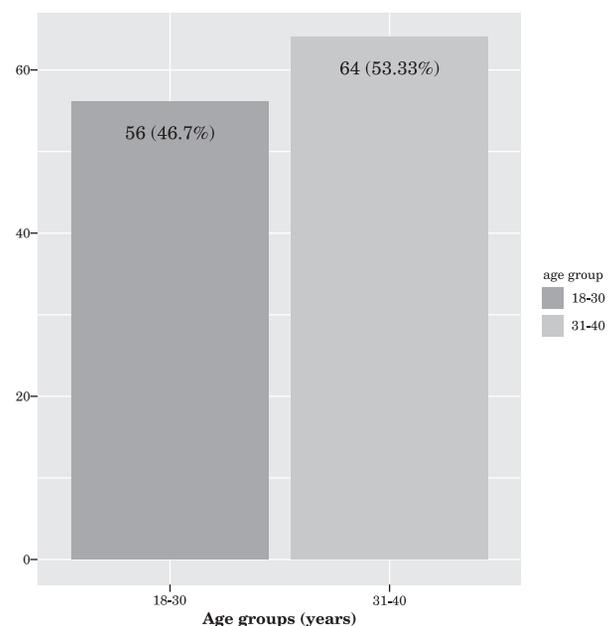


Fig 2: Age distribution of the participants

TABLE 1: MEAN OF AGE, WIDTH (WD), LENGTH (L), AND WIDTH TO LENGTH (W-L) RATIO OF RIGHT AND LEFT CENTRAL INCISORS

Characteristic	Mean \pm SD
Age (years)	30.12 \pm 7.25
Width of central incisor right (mm)	7.96 \pm 0.53
Length of central incisor right (mm)	8.27 \pm 1.15
Width of central incisor left (mm)	7.83 \pm 0.61
Length of central incisor left (mm)	8.06 \pm 1.57
Width/Length right	0.98 \pm 0.11
Width/Length left	1.02 \pm 0.29

TABLE 2: COMPARISON OF WIDTH (WD), LENGTH (L), AND WIDTH TO LENGTH (W-L) RATIO FOR RIGHT CENTRAL INCISOR AMONG GENDERS

Characteristic	Female, N = 56 ¹	Male, N = 64 ¹	Mean Diff ²	95% CI ^{2,3}	P-value ²
Width of central incisor right (mm)	7.98 \pm 0.55	7.94 \pm 0.51	0.04	-0.16, 0.23	0.710
Length of central incisor right (mm)	8.17 \pm 1.17	8.35 \pm 1.14	-0.18	-0.60, 0.24	0.388
Width/Length right	0.99 \pm 0.12	0.96 \pm 0.11	0.03	-0.01, 0.07	0.201

¹ Mean (SD), ² Welch Two Sample t-test, ³ CI = Confidence Interval

TABLE 3: COMPARISON OF WIDTH, LENGTH AND WIDTH TO LENGTH RATIO FOR LEFT CENTRAL INCISOR AMONG GENDERS

Characteristic	Female, N = 56 ¹	Male, N = 64 ¹	Difference ²	95% CI ^{2,3}	P-value ²
Width of central incisor left (mm)	7.80 \pm 0.60	7.85 \pm 0.63	-0.05	-0.27, 0.17	0.76
Length of central incisor left (mm)	7.79 \pm 1.80	8.31 \pm 1.30	-0.52	-1.1, 0.06	0.076
Width/Length left	1.08 \pm 0.38	0.97 \pm 0.16	0.11	0.00, 0.22	0.043

TABLE 4: COMPARISON OF WIDTH, LENGTH AND WIDTH TO LENGTH RATIO FOR RIGHT CENTRAL INCISOR AMONG AGE GROUP

Characteristic	18-30, N = 56 ¹	31-40, N = 64 ¹	Mean Diff ²	95% CI ^{2,3}	P-value ²
Width of central incisor right (mm)	7.94 \pm 0.54	7.98 \pm 0.52	-0.04	-0.24, 0.15	0.71
Length of central incisor right (mm)	8.28 \pm 1.26	8.26 \pm 1.07	0.03	-0.40, 0.45	0.83
Width/Length right	0.97 \pm 0.12	0.98 \pm 0.11	-0.01	-0.05, 0.04	0.78

¹ Mean \pm SD, ² Welch Two Sample t-test, ³ CI = Confidence Interval

length of MCI by the means of a digital caliper, where in results there is significant difference between length of MCIs of male and female subjects as according to him mean length is 9.0815 mm in males and 9.4172 mm in females.

A study done by Alvarez-Alvarez L et al⁴ showed significant difference in width-length ratio of male and female subjects, p-value<0.01. According to the study done by Botross M et al⁵ mean length of MCI in males is 10.37 mm and 10.14 mm in females. Mean width

of MCI is 8.87 mm in males and 8.69 mm in females, while width-length in male and female subjects is 0.86.

Our findings showed that the width of central incisors on right and left sides were 7.96 \pm 0.53mm and 7.83 \pm 0.61mm respectively. The length of central incisors on right and left sides were 8.27 \pm 1.15mm and 8.06 \pm 1.57 mm respectively. Our findings showed that the ratio of width/length on right and left side were 0.98 \pm 0.11(98%) and 1.02 \pm 0.29(100.2%) respectively. Regarding dental measurements, distinct width ranges

are acknowledged for both genders and various ethnic groups. Only a small proportion of people have contralateral parts that are perfectly symmetric. The presence or absence of a link between dental dimensions and face parameters is contingent upon the ethnic gender of the sample. Cinelli et al⁷ observed variations in values in both men and women; CI as 85% and 86%; for LI 76% and 79%; and for Canine as 77% and 81%. However, Bakhtawer Saleem et al⁸ conducted a study in which they concluded that tooth dimension showed high precision in length/ width ratio. Since it showed the least variance in both genders, the crown width –to –length was recognized as the most reliable standard. Another study⁹ showed that males have 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. Another study done by¹⁰ Chan et al showed that there is no statistically significant difference in the maxillary anterior tooth dimensions for the right and left sides of the arch. Length and width dimensions of the central incisor (CI) were greater than those of lateral incisor (LI) and Canine (C) for both genders, suggesting CI to be the dominant anterior tooth. Some gender differences in tooth dimensions does exist. Variations in results across different populations can be due to genetic, environmental factors, tool of measurements and sample size of the studies.

Despite the limitations of current study such as small sample size, alginate impression where rubber-based impression might have done much better and human errors in measuring the dental casts; the findings of our study are useful and conclusive in this context. Nevertheless, efforts were ensured to standardize the methods.

CONCLUSION

There was no sexual dimorphism for width, but W/L ratio was statistically different among gender, higher in females.

REFERENCES

- 1 Qamar K, Das G. Effects Of Gender And Facial Profiles On The Size Of Maxillary Central Incisors. *Pakistan Oral & Dental Journal*. 2017;37(1): 179-82
- 2 Anon. The Glossary of Prosthodontic Terms: Ninth Edition. *J Prosthet Dent* 2017;117(5):e1–105.
- 3 Fibryanto E, Tjin RR, Prahasti AE, Kusnoto J. Difference in average length of maxillary incisors between the deuteromalayid and protomalayid sub-races. *World Journal of Dentistry* 2021;12(2):111–4.
- 4 Álvarez-Álvarez L, Orozco-Varo A, Arroyo-Cruz G, Jiménez-Castellanos E. Width/Length Ratio in Maxillary Anterior Teeth. Comparative Study of Esthetic Preferences among Professionals and Laypersons. *J Prosthodont* 2019;28(4):416–20. Available at: <https://pubmed.ncbi.nlm.nih.gov/28513973/>. Accessed September 25, 2024.
- 5 Botross BM, Elmahallawi OSE, Ezz El-Arab AM. Efficacy of gender on the width-length ratio of maxillary anterior teeth in an Egyptian population and establishment of a guideline for esthetical accepted ratio of teeth dimensions to gingival display. *Advanced Dental Journal* 2019;1(1):1–10. Available at: https://adjc.journals.ekb.eg/article_30094.html. Accessed September 25, 2024.
- 6 Alqahtani AS, Habib SR, Ali M, Alshahrani AS, Alotaibi NM, Alahaidib FA. Maxillary anterior teeth dimension and relative width proportion in a Saudi subpopulation. *J Taibah Univ Med Sci* 2021;16(2):209–16. Available at: <https://pubmed.ncbi.nlm.nih.gov/33897325/>. Accessed September 25, 2024.
- 7 Cinelli F, Piva F, Bertini F, Russo DS, Giachetti L. Maxillary Anterior Teeth Dimensions and Relative Width Proportions: A Narrative Literature Review. *Dentistry Journal* 2024, Vol. 12, Page 3 2023;12(1):3. Available at: <https://www.mdpi.com/2304-6767/12/1/3/htm>. Accessed September 25, 2024.
- 8 Saleem B, Mahmood A, Butt AM, et al. Analysis of Width, Height and Width/Height Ratio of Crowns of Maxillary Anterior Teeth. *Pakistan Journal of Medical & Health Sciences* 2022;16(06):46–46. Available at: <https://pjmhsonline.com/index.php/pjmhs/article/view/1364>. Accessed September 25, 2024.
- 9 Bhochohibhoya A, Shrestha R, Guragain M, Sharma R, Joshi K. Clinical Crown Length, Width and the Width/Length Ratio of the Maxillary Central Incisor Among Patients Reporting to a Tertiary Care Center in Nepal. *Journal of Nepalese Prosthodontic Society* 2022;5(2):71–7. Available at: <https://www.nepjol.info/index.php/jnprossoc/article/view/55737>. Accessed September 25, 2024.
- 10 Chan HY, Millar BJ, Chan HY, Millar BJ. Biometric Assessment of Maxillary Anterior Tooth Dimensions in a Hong Kong SAR Population. *Open J Stomatol* 2022;12(10):267–80. Available at: <https://www.scirp.org/journal/paperinformation?paperid=120409>. Accessed September 25, 2024.

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