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# The Role of Head Circumference in Determining Tooth Size for Completely Edentulous Patients in a Multi-ethnic Pakistani Sample

Muhammad Aamir Ghafoor Chaudhary[1], Mohammad Ismail[2], Saad Khan[3], Syed Adil Tanvir[4], Syed Amer Ali[5], Syed Hamza Zia[6]

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## ABSTRACT

**Objective:** To determine whether a relationship exists between the maximal fronto-occipital circumference (MFOC) and the combined width of maxillary anterior teeth (CWMAT) that could be used for estimating tooth size in edentulous patients.

**Materials and Methods:** This cross-sectional study was conducted at the G-7 campus of Riphah International University (Islamic International Dental College and Hospital) Islamabad, Pakistan, for 6 months (July 2019 to December 2019). The MFOC and CWMAT were measured through standardized procedures for 100 male and 100 female subjects including patients, paramedical staff, house officers and students. Subjects were categorized based on age, gender and ethnicity.

**Results:** Mean age of the study sample was 25.96 years. Mean MFOC was 554.24 ± 23.408 while mean CWMAT was 50.98 ± 4.895. The mean ratio of MFOC to CWMAT was 11.08 for males and 10.84 for females. A significant number of subjects were Punjabis (65%) followed by Pashtun (27%) and Kashmiris (8%). The mean ratio of MFOC to CWMAT based on ethnicity was 10.96 ± 1.083. Pearson's correlation analysis showed a weakly significant association between the MFOC and CWMAT (0.15).

**Conclusion:** Due to the limitations of this study, the MFOC may not be a reliable measurement to accurately determine the size of the maxillary anterior teeth.

**Keywords:** Anthropometric, Ethnicity, Head Circumference, Maxillary Anterior Teeth.

[1]Associate Professor, Department of Prosthodontics, Islamic International Dental College, Riphah International University, Islamabad, Pakistan

[2,3,4,5,6]Student of Final Year BDS, Islamic International Dental College, Riphah International University, Islamabad, Pakistan

**Corresponding author:**

Muhammad Aamir Ghafoor Chaudhary, Department of Prosthodontics, Islamic International Dental College, Riphah International University, G-7 Campus, Islamabad, Pakistan, Email: aamir.ghafoor@riphah.edu.pk, Mobile: +923215162802



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## INTRODUCTION

Tooth loss is a concern for the patient both aesthetically and functionally, and it requires a prosthesis that is both, aesthetically pleasant and functionally comfortable and efficient. In partially edentulous cases, sufficient natural teeth are usually present to guide the process of artificial tooth selection. However, in completely edentulous patients, the dentist faces a challenge when selecting the teeth to be used in the prosthesis when the pre-extraction records are not available. Restoration of aesthetics and function nowadays is the major concern in dental treatment as facial aesthetics have gained importance. So, the prosthesis needs to appear more life-like and more suitable for every individual patient. According to Fenton and Chang,[1] the prime determinant of denture aesthetics is the size, shape, colour and the successful selection and placement of anterior maxillary teeth.

Physiological and aesthetically pleasing tooth arrangement is an important consideration in dentures fabrication. When the records are not available, we have other landmarks including anthropometric parameters, which can guide selecting anterior maxillary teeth.[2] "Berry's Biometric Ratio Method" proposed that the maxillary central incisor tooth had a definite proportional ratio to face sizes. The tooth was one-sixteenth of the face width and one-twentieth of the face length.[3] According to the "Anthropometric Cephalic Index Method" upper central incisor width could be determined by dividing either the transverse circumference of the head by 13 or the bizygomatic width by 3.3.[4] Abdullah[5] proposed formula and the inner canthal distance was used as the final central incisor width. Anthropometric measurements of the skull or head can also be used as a reference for selecting the mesiodistal width of the maxillary anterior teeth.[6,7]

To this end, most of the existing research has been done on Caucasian or Indian samples. However, variations related to cultural and ethnic groups have also been found.[8] Therefore, it is imperative to evaluate the role of skull anthropometry in the anterior teeth selection for completely edentulous patients in different ethnic and cultural groups of the Pakistani population. The aim of this study is to provide the researchers and dentists with the average values to consider while determining tooth size for the anterior maxillary segment in our local population. The objective of this study is to determine whether a relationship exists between the maximal fronto-occipital circumference (MFOC) and the combined width of maxillary anterior teeth (CWMAT) that could be used for estimating tooth size in edentulous patients. This data will provide the researchers and dentists with the average values to consider while determining tooth size for the anterior maxillary segment in our local population.

## MATERIALS AND METHODS

This cross-sectional study was carried out in the G-7 Campus of Riphah International University, Islamic International Dental College and Hospital, Islamabad from July to December 2019. The convenience non-probability sampling technique was used to include 200 subjects according to the following selection criteria: male and female Pakistani nationals with fully erupted permanent teeth; subjects within the age range of 21 up to 50 years; and subjects with no history of orthodontic treatment or permanent tooth extraction. Individuals were excluded if they presented with morphologically abnormal teeth, cracked, grossly carious maxillary teeth restored with fixed protheses (crowns and bridges), malalignment or crowding of maxillary teeth, any syndromic condition e.g., Down's syndrome, any congenital dental defects, parafunctional habits and maxillary teeth presenting with drifting, attrition, abrasion or erosion.

For the study data collection Ethical approval was taken from Hospital Ethical Review Committee. The sample of 200 subjects included an equal number of males and females and comprised of patients, house officers, students at different university programs and paramedical staff. They were approached in various locations within the campus and verbally informed about the study and its objectives. Subjects who consented to participate were seated in an office chair or dental unit as per the availability at the spot/location. Initially, the basic demographic information of the subject was recorded on the proforma including age, gender, and ethnicity. Confidentiality was ensured by not recording the names of the participants. It was ensured that the subjects were in a comfortable and upright position and facing forwards before any measurements were taken. Two investigators played their part in the data collection. One investigator carried out the measurements of the subjects while the other investigator noted them down on a proforma.

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The maximal fronto-occipital circumference (MFOC) was measured by placing a non-stretchable plastic tape (calibrated in millimetres) just on the occipital prominence and the supraorbital ridges following the lateral side of the head. It was ensured that the measuring tape was properly placed on both points before noting down the reading. To ensure accurate measurements of the head circumference female subjects were requested to lift their hair above the occipital area as to prevent the placement of tape over the lumps of hair which could cause a hurdle in measurements.

The combined width of the six maxillary anterior teeth (CWMAT) was measured by asking the already seated subjects to extend their necks as far backwards as possible for proper head support. The greatest mesiodistal crown widths of the six-permanent maxillary anterior teeth were measured with the help of dental floss placed on the anatomical distal contact points of the right canine to the left canine. For this purpose, a sharp H & E pencil was used to mark the floss at both ends inside the mouth. The distance between the marked points was measured with a scale (calibrated in millimetres) and noted down on the proforma. To ensure cross infection control, a new length of floss was used for every patient, and the pencil was disinfected with a topical disinfectant spray before reuse.

For data analysis, Statistical Package for the Social Sciences (SPSS) version 22 was used. The mean, standard deviation, ratio, minimum and maximum values of CWMAT and MFOC were generated based on gender and ethnic groups. The Pearson's correlation and regression tests were applied to find any associations between the study variables. A *p*-value less than 0.05 was considered significant.

## RESULTS

The sample size included 100 male and 100 female dentulous subjects, who were distributed based on age, gender and ethnicity. The mean age of the study sample was 25.96 years. The mean MFOC was 554.24 ± 23.408mm while the mean CWMAT was 50.98 ± 4.895mm.

The mean ratio of MFOC to CWMAT was 11.08 for males and 10.84 for females. On the ethnic front, the majority of the participants were Punjabis (65%) followed by Pashtuns (27%) and Kashmiris (8%). The mean ratio of MFOC to CWMAT based on ethnicity was 10.96 ± 1.083: for Punjabis, this ratio was 10.83 ± 1.112; for Pashtuns 10.94 ± 0.902; and for Kashmiris 11.54 ± 1.141.

Pearson's correlation coefficient value was 0.15, which suggested a weak correlation between MFOC and CWMAT. It was found that for every millimetre increase in the MFOC, there would be a 0.03mm increase in the CWMAT as per the following equation: [33.2+0.03(MFOC)], where 33.2 is the correlation coefficient. Regression analysis showed that the above equation will be accurate for only 15.3% of the cases.

**Table 1. Ratio of MFOC: CWMAT based on gender and ethnicity**

| Variable | | N (Percentage) | MFOC: CWMAT Mean Ratio |
|---|---|---|---|
| **Sex** | **Male** | 100 | 11.08 |
| | **Female** | 100 | 10.84 |
| **Ethnicity** | **Punjabis** | 130 (65%) | 10.83 ± 1.112 |
| | **Pashtuns** | 54 (27%) | 10.94 ± 0.902 |
| | **Kashmiris** | 16 (8%) | 11.54 ± 1.141 |
| | **Mean** | - | 10.96 ± 1.083 |

## DISCUSSION

Many biometric guidelines have been used to quantify the selection of maxillary six anterior teeth, but no universally accepted method currently exists.[8,9] The present research was carried out at a private dental hospital in Islamabad Capital Territory on 200 subjects that included an equal number of males and females. The objective of this study was to find a correlation between the maximal fronto-occipital circumferences (MFOC) and combined inter-canine width of maxillary anterior teeth (CWMAT) in a subset of the Pakistani population.

The subjects included in this study were between the ages of 21-35 years. This was because the study was carried out on university grounds and most of the subjects were students of undergraduate programs. Another reason for this discrepancy could be the inclusion criteria which required the subjects to have sound maxillary anterior teeth, which are mostly present in subjects belonging to this age group. A significant number of subjects were Punjabis (65%) followed by

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Pashtuns (27%) and Kashmiris (8%). This was somewhat expected because the study centre was situated in an area that has a dominant Punjabi population.

The mean width of maxillary anterior teeth in the study sample was 50.98mm, which was significantly higher than the values reported by Baleegh et al[10] (38.37 mm), Qamar et al[11] (46.01mm), Hussain et al[9] (46.01mm), Arun Kumar et al[12] (48.85mm), and Deogade et al[6] (43.86mm). In this study, the mean ratio of MFOC to CWMAT was 11.08 in males and 10.84 in females. Earlier work by Banerjee et al[13] showed the mean ratio of MFOC to CWMAT to be 10.14 in males and 10.09 in females, which was smaller than the ratio obtained in the present study. Differences in the CWMAT and ratio of MFOC to CWMAT can be explained by differences in these biometric dimensions based on ethnic and morphological characteristics of different populations.[14]

Pearson's correlation coefficient values obtained from the data show that a significant correlation exists between the MFOC and CWMAT in the Pakistani population. However, a correlation value of 0.15 suggests this to be a weak correlation between MFOC and CWMAT. The regression analysis shows that for every millimetre increase in the MFOC, there will be a 0.03mm increase in the CWMAT [33.2+0.03(MFOC)]. This regression analysis shows that the above equation will be accurate for only 15.3% of the cases.

For this ratio to be used as a biometric guideline for selecting a suitable size of prosthetic teeth, more research needs to be done on a wider sample with a better representation of all major ethnic groups. In this study, only one variable was studied i.e., maximal fronto-occipital circumference. Future studies may consider other variables as well, for example, bi-zygomatic width,[15] inter-alar width,[11] inner canthal distance[6] and inter-pupillary distance[9].

The present study has limitations as this study has been performed on a very small Pakistani population, so the results obtained stated that combined width of maxillary anterior teeth can be calculated by studying the maximal fronto-occipital circumference (MFOC) but for general population MFOC is not be a reliable measurement to determine the size of the maxillary anterior teeth. This study can have better future implications if this study is performed on larger population size including subjects based on age, gender and ethnicity.

## CONCLUSION

The present study has limitations, so keeping this in mind a conclusion can be given that the combined width of maxillary anterior teeth can be calculated by studying the maximal fronto- occipital circumference (MFOC) for a small percentage of the Pakistani population. On a general level, it can be stated that MFOC is not a reliable measurement to determine the size of the maxillary anterior teeth for the Pakistani population.

## DISCLAIMER

None.

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## CONFLICT OF INTEREST

No conflict of interest was declared by the authors.

## ETHICAL STATEMENT

There weren't any ethical issues with the study, the ethical approval was provided by the Ethical Review Board at Riphah International University (Ref. No. IIDC/IRC/2019/05/001).

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## AUTHORS CONTRIBUTION

Conception and design of the study: M.A.G. Chaudhary

Acquisition of data: S. Khan, S.A. Ali, S.H. Zia

Analysis and interpretation of data: M. Ismail, S.A. Tanvir

Drafting of the manuscript: M. Ismail, S. Khan, M.A.G. Chaudhary

Critical review of the manuscript: M.A.G. Chaudhary, M. Ismail

Approval of the final version of the manuscript to be published: M.A.G. Chaudhary, M. Ismail, S. Khan, S.A. Tanvir, S.A. Ali, S.H. Zia

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