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ORIGINAL ARTICLE

Analysis of Width, Height and Width/Height Ratio of Crowns of Maxillary Anterior Teeth

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ABSTRACT

Background: The vital role of the prosthetic dentistry is not only the restoration of function, comfort and health of oral tissues but also esthetics in general. Upper jaw anteriors commonly seen in smile and contribute to the beauty of a smile. This study may help us to determine standard ideal tooth dimension of maxillary anterior six teeth to restore pleasing esthetics.
Aim: To determine the mean width, height and width/height ratio of clinical crowns of natural maxillary anterior six teeth.
Setting: Department of Prosthodontics, dental OPD LUMHS Jamshoro.
Duration: Six months from 2018 to 2019
Design: Cross-sectional descriptive.
Methods: A total of 101 Volunteer subjects with maxillary anterior six teeth present in mouth were included in the study. Impression of maxillary arch was made. The maximum mesiodistal width perpendicular to the longitudinal axis of the tooth and maximum cervicoincisal (CI) length parallel to the longitudinal axis of the maxillary central incisors, lateral incisors, and canines were recorded and width/height ratio was calculated. The final measurements were recorded into proforma.
Results: The average age of the subjects was 24.74±3.89 years. The average crown width / length ratio was 0.78±0.12mm for right central incisor and 0.78±0.12mm left central incisor. The average crown W/H ratio was 0.63±0.16mm for right lateral incisor and 0.63±0.14mm left central incisor. Similar the mean crown W/H ratio was 0.64±0.16mm right canines and 0.65±0.18mm left canine.
Conclusion: The tooth dimension showed high precision in length/width ratio. Since it showed the least variance in both genders, the crown width-to-length ratio was recognized as the most reliable standard.
Keywords: Crown length, Crown width, Ideal tooth dimensions, Maxillary anterior teeth.

INTRODUCTION

The primary objective of Prosthetic dentistry includes not only the restoration of function, comfort and health of oral tissues but also esthetics in general[1]. Maxillary anterior teeth are the teeth commonly seen in smile and contribute to the beauty of a smile[2,3]. Likewise, it has been established that people are more worried about replacing lost anterior teeth than they are about restoring their misplaced aesthetics with posterior teeth[4].

Selection of lost maxillary anterior teeth of an appropriate size is one of the challenging tasks in dentistry[5]. When a person is fully edentulous, it is difficult to obtain details on the size of the missing teeth. If the size and shape of replaced teeth are not in harmony with patient's face and remaining teeth, social and psychological problems might arise[6].

In order to achieve the goal of natural esthetic expression, it is essential to make a thorough study of several facial and oral factors. While selecting the maxillary anterior teeth, factors to be considered are shape, size, texture, color, position of teeth, face form, age, gender, ethnicity, personality and occupation of the patient[1,2,3].

"Golden proportion", "Golden percentage", "Divine Proportion", and "Repeated Ratio" are some studies which have been proposed that relates the relative widths of maxillary anterior teeth[2,3,6,7,8]. Inter-commissural width, bizygomatic width, inter-alar width, and inter-pupillary distance are anthropometric measures that help determine the right proportions of the anterior teeth in respect to the face[9]. However, due to individual differences, perspective, and proximal/incisal tooth wear, defining optimal tooth dimensions stays a tough process (attrition)[2].

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Khan M and Khan MA discovered that right central incisor had a crown length of 10.22mm, the right lateral incisor had a crown length of 7.96mm, and the right canine had a crown length of 8.88mm. The crown width of the teeth on the left side was similar to that on the right side. The average crown width for the right central incisor was 7.99mm, 7.96mm for the right lateral incisor, and 8.28 mm for the right canine. The length of the crown on the left side of the teeth was about equal to the breadth of the crown on the right side. Right central incisor crown width/length ratio was 0.91, right lateral incisor crown width/length ratio was 0.72, and right canines crown width/length ratio was 0.71. The crown width/length of the left side teeth was virtually comparable to the right side crown width[1].

The rationale of this study was to determine normal clinical crown width, height and width/height ratio of maxillary anterior six teeth. This study will help us to determine standard ideal tooth dimension of maxillary anterior six teeth to restore the pleasing esthetics.

MATERIAL AND METHODS

After getting permission from Ethical Review Board, this cross-sectional descriptive study with Non-probability consecutive sampling technique was performed at department of Prosthodontics, dental OPD LUMHS Jamshoro from July 2019 to June 2020. The sample size is calculated by using Open epi online sample size calculator using mean and standard deviation 8.28±0.511 for crown width[1] margin of error 0.1 at 95% confidential level. The sample size stands to be n=101

Inclusion Criteria:

- Volunteer subjects with maxillary anterior six teeth present in mouth.

- Volunteer subjects with sound tooth structure (Tooth/teeth without caries, restorations, attrition or fracture).
- Either gender with age range from 18 to 30 years.

Exclusion Criteria:

- Gingival and periodontal problems (Gingival hyperplasia, inflammation, recession, or mobility)
- Previous periodontal surgery
- Fractured tooth/teeth
- Teeth with caries, restorations, attrition, malformation or malposition
- Diastema, interdental spacing, or crowding
- Orthodontically treated teeth/Teeth with brackets
- History of altered incisal/proximal tooth surfaces

Data Collection Procedure: The study was conducted of patients who were met inclusion criteria. Approval of CPSP and Institutional ethical committee would be taken. Selected patients were told about the study's nature, goal, methods, risks, and advantages before to their participation. Patients' informed permission and willingness to participate in the trial were acquired in their native language.

The maxillary arch was imprinted using alginate impression material in stock trays (Cavex CA37 - Alginate). In a mixing bowl, the manufacturer's specified amounts of powder and water were distributed and combined with a metal spatula. The imprint tray was filled with the impression mix and placed in the subject's mouth. It was then removed once the material had been set according to the manufacturer's specified setting recommendations. The impressions that were deemed unsuitable for the research (incomplete impressions, distorted impressions, crooked impressions, air bubbles or gaps in impressions, rough or chalky stone models) were discarded and the process repeated. After the removal of impression, it was washed under running tap water and dipped in disinfectant (SERPRO) for one minute. Within 10 minutes, the impression was transported to the laboratory and filled with type IV dental stone (Kopo-Hard CKH-52). Pouring was done using the manufacturer's specified powder/liquid ratios. The same stone was used to pour and foundation all of the anatomical markers. During the impression pouring technique, care was taken to avoid the integration of air bubbles. Between one and three hours after pouring, the castings were collected. The castings were cut, cleaned, and dried for 24 hours on a bench.Teeth dimensions was measured on casts using extra-fine sharp ended digital caliper, with a precision of +0.01 mm. Dots was marked on mesial and distal contact areas, and on the most apical point of the marginal gingiva and incisal edge of each tooth. The maximum mesiodistal width perpendicular to the longitudinal axis of the tooth and maximum cervicoincisal length parallel to the longitudinal axis of the maxillary central incisors, lateral incisors, and canines was recorded and width/height ratio was calculated. The measurements was recorded three times in millimeters' and the mean was considered as the final value. All measurements was made on the facial surface of the tooth. The final recordings was arranged in a table. One operator was performed all the measurements.

Data Analysis Procedure: Data analysis was conducted by using SPSS statistical software version 20.0. Mean and standard deviation was calculated for quantitative variables like age, width, and height and width to height ratio. The frequency and percentage was calculated for qualitative variables like gender. Effect modifier like age and gender was controlled by stratification. Independent T-test was applied post-stratification. P-value <0.05 was taken as significant.

RESULTS

Age distribution of subject is shown in figure 1. The average age of the subjects was 24.74±3.89 years. There were 41(40.59%) males and 60(59.41%) females with gender ratio 1:1.5 as shown in figure 2.

Measurement of width, height and W/H ratio of the crown is shown in table 1. The average crown width was 5.59±1.03 mm for right central incisor, 4.71±0.97 mm for right lateral incisor and 4.99±1.22 mm right canine. Similarly average crown width of left central incisor was 5.08±1.24 mm left lateral incisor was 4.13±1.09 mm and left Canine was 5.08±1.24mm.

Regarding height of crown, the average crown height was 7.69±1.37 mm for right central incisor, 6.61±1.50mm for right lateral incisor and 7.91±1.68 mm right canine. The average crown height of left central incisor was 7.70±1.38 mm left lateral incisor was 6.64±1.52mm and left Canine was 7.89±1.64mm.

The average crown width / length ratio was 0.78±0.12mm for right central incisor and 0.78±0.12mm left central incisor. The average crown W/H ratio was 0.63±0.16mm for right lateral incisor and 0.63±0.14mm left central incisor. Similar the mean crown W/H ratio was 0.64±0.16mm right canines and 0.65±0.18mm left canine. The left side teeth crown width/ length was nearly equal to right side crown width. The degree of precision in each tooth ratio was very high.

Stratification analysis was performed and observed that mean width, height and W/H ratio were not significant difference among the age groups as presented in table 2. Mean width, height of all maxillary anterior was statistically difference between gender but W/H ratio was not statistically significant as shown in table 3.

Fig. 1: Age distribution of the patients (n= 101)

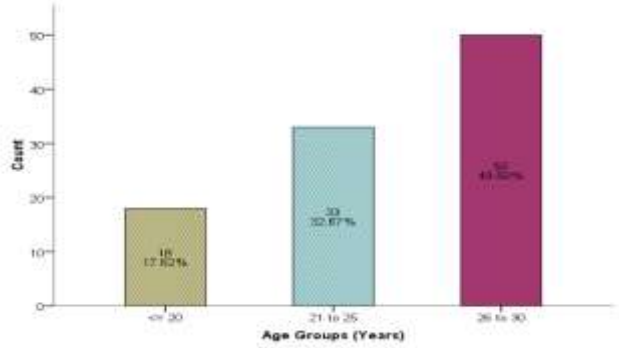

Fig. 2: Gender distribution of the patients (n=101)

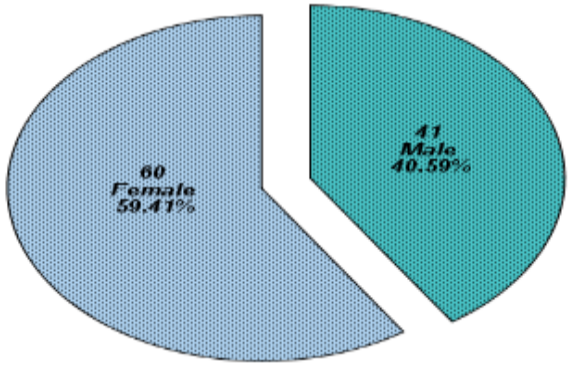

Table 1: Mean Width, Height And Width/Height Ratio Of Clinical Crowns Of Natural Maxillary Anterior Six Teeth

Natural maxillary anterior	Mean ± SD		
	Width	Height	W/H ratio
Right Canine	4.99±1.22	7.91±1.68	0.64±0.16
Right Lateral	4.71±0.97	6.61±1.50	0.63±0.16
Right Central	5.95±1.03	7.69±1.37	0.78±0.12
Left Canine	5.08±1.24	7.89±1.64	0.65±0.18
Left Lateral	4.13±1.09	6.64±1.52	0.63±0.14
Left Central	5.97±1.07	7.70±1.38	0.78±0.12

Table 2: Comparison of mean w/h ratio of clinical crowns of natural maxillary anterior six teeth by age groups

Natural maxillary anterior	Age Groups (Years)						P-Value
	<= 20 (n=18)		21 to 25 (n=33)		26 to 30 (n=50)		
	Dimension W/H Ratio						
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation	
Right Canine	.65	.23	.63	.14	.64	.14	0.907
Right Lateral	.60	.13	.62	.14	.65	.18	0.506
Right Central	.77	.11	.79	.12	.78	.12	0.916
Left Canine	.66	.24	.67	.19	.64	.15	0.709
Left Lateral	.60	.13	.61	.14	.65	.14	0.228
Left Central	.76	.08	.79	.13	.77	.13	0.594

Table 3: Comparison of mean w/h ratio of clinical crowns of natural maxillary anterior six teeth by gender

Natural maxillary anterior	Gender				P-value
	Male		Female		
	Dimension W/H Ratio				
	Mean	Std. Deviation	Mean	Std. Deviation	
Right Canine	.66	.12	.63	.18	0.389
Right Lateral	.64	.14	.62	.17	0.676
Right Central	.78	.10	.78	.13	0.786
Left Canine	.68	.17	.64	.19	0.264
Left Lateral	.63	.13	.63	.15	0.836
Left Central	.79	.10	.77	.13	0.312

DISCUSSION

For numerous years, the fundamental goal of dental practitioners was to maintain health and functionality. Advanced dentistry, on the other hand, aims for a final aesthetic outcome that matches the form, size, colour, texture, and symmetry of naturally healthy teeth and their accompanying tissues, in addition to health and function. Ethnicity, personality, the size and location of teeth and clinical crowns, or even the notion of what is "perfect" by a given group or demographic, can all impact the ideal smile[2,10,11]. The size, form, and positioning of the maxillary anterior teeth is the most crucial component for a harmonic look, especially when observed from the front. These have an impact on periodontal space, dental stability, aesthetics, and periodontal wellness[12,13].

For all individuals contemplating tooth replacement, aesthetics is the most important factor to address. In Orthodontics, Prosthodontics, and other restorative dentistry patients, anterior teeth are critical for aesthetics. Knowing the average length and breadth of crowns in each demographic can aid the physician in properly restoring these teeth. Because these teeth generally command a person's grin, the width-to-height ratio of the maxillary central incisors has been proposed to be crucial in regards of overall dental attractiveness. When the coronal width-to-height ratio is equivalent to 60%, or 0.6, the central incisor is considered to be in golden proportionality[14]. A width-to-height ratio of 75-80 %, on the other hand, is seen to be the utmost aesthetically beautiful[15,16]. Lesser values are supposed to lead in a long, narrower tooth, whilst higher values are thought to lead in a shorter, broad tooth.

The goal of this study was to determine the average width, height, and width/height ratio of clinical crowns on natural maxillary front teeth. The participants' mean age was 24.743.89 years. With a gender ratio of 1:1.5, there were 41(40.59%) men and 60(59.41%) females. The measurements for this research were collected on dental casts of individuals, which are simple to assess and provide more reliable findings. The measurement was taken with an extra sharp ending digital vernier caliper with a minimum count of +0.01.

Other authors[17] adopted similar approaches, and the size of the maxillary central incisor has been widely investigated in excised teeth[1,18,19]. Its dimensions have also been connected with several face parameters, assisting clinicians in anterior dentition aesthetic design.

Since they can be reliably and physically regulated, comparative tooth dimensions appear to be one of the most accurate dental criteria on the aesthetic evaluation. There was less variety in tooth sizes in this research. In the right and left side tooth dimensions, the variation in crown width, height, and W/H ratio was quite small. In right and left side crown width was 5.59±1.03 mm and 5.97±1.07 for central incisor, 4.71±0.97 mm and 4.13±1.09 for lateral incisor as well as 4.99±1.22 mm and 5.08±1.24 for canine. Similarly in right and left side crown height was 7.69±1.37mm and 7.70±1.38 mm for central incisor, 6.61±1.50 mm and 6.64±1.52 mm for lateral incisor as well as 7.91±1.68 mm and 7.89±1.64for canine. According to our findings, the subsequent hierarchy for maxillary crown breadth and length for the population investigated was established: centrals > canines > laterals (based on data from previous papers)[20,21,22]. Other studies have found that there are considerable disparities in male and female tooth size, with male teeth being 2-6 % bigger than female teeth in terms of crown measurements. This remark is corroborated by the findings of this research, which revealed that males had a higher average crown breadth and height than females[23,24].

The width/length ratio for every tooth is important in clinical practise because it enables you to calculate the lost length from the current width, which is typically constant. In our study, the degree of precision was very high. In right and left side WH ratio was approximate similar in our study i.e. 0.78±0.12 and 0.78±0.12 for central incisor, 0.63±0.16 and 0.63±0.14 for lateral incisor as well as 0.64±0.16 and 0.65±0.18 for canine. These observations are in total agreement with Orozco-Varo et al[17] and also similar with Marcushamer et al[25].

In our study, comparison of measurement of maxillary anterior teeth height width and WH ratio was not statistically significant among age groups however height and width difference was observed in gender. Mean crown width of the right and left maxillary anterior canine, lateral and central teeth was significantly high in male as compare to female. This finding is similar as other studies[11,26], regarding measurement of maxillary anterior teeth height was statistically significant between male and female. Mean crown height of the right and left maxillary anterior canine, lateral and central teeth was significantly high in male than female. This finding is similar as other studies[1].

Since the WH ratio maxillary anterior tooth has clinical important and this study results showed that an average WH ratio were 63% to 78% for maxillary anterior (central, lateral and canine). The present investigation found that there was no statistically substantial difference in mean WH ratio between male and female participants. This conclusion is reinforced by a prior study that demonstrated just a little variation between male and

female tooth WH ratios.[10] As a result, because it exhibited the least change across genders, the crown width-to-length ratio was recognized as the most consistent standard.[19,27]

CONCLUSION

There was no significant difference in maxillary anterior tooth size for the right and left sides of the arch, as per the outcomes of this analysis. For both genders, the length and breadth dimensions of CI were higher than those of LI and C, indicating that CI is the predominant anterior tooth. Men and women had statistically meaningful tooth measures, although the mean variations were modest and may not be clinically important. Moreover, instead of providing criteria for each gender separately, tooth dimensions recommendations might be offered for the whole population. As it showed the least variance across genders, the crown width-to-length ratio was regarded as the most consistent standard.

Conflict of interest: Nil

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