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RESEARCH ARTICLE

RELATIONSHIP BETWEEN MAXILLARY AND MANDIBULAR ANTERIOR TEETH WIDTH TO THE LENGTH OF INDEX AND LITTLE FINGER IN MALES AND FEMALES: A COMPARATIVE STUDY

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ABSTRACT

The primary consideration for patients seeking prosthodontic treatment is esthetics. The esthetic restoration has an important psychological effect on the edentulous patient. When anterior teeth are selected for completely edentulous subjects, the mesiodistal width of the maxillary central incisors is important because they are the most prominent teeth in the arch when viewed from the frontal aspect. Various modalities have been suggested for selecting the size of the anterior teeth like inter-alar distance, inter-canthal distance, bi-zygomatic width, intercanine width.The anthropometric measurements like finger length can serve as a basic guide in estimating the size of anterior teeth in males and females when no pre-extraction records are available.

Methodology: For the study middle aged group (30- 45yrs) participants were selected based on the inclusion criteria. An impression of both the arches were made using irreversible hydrocolloid impression material. The measurements of the index and little finger were recorded.

Results: A significant correlation between the maxillary and mandibular anterior teeth width with length of index and little finger was found which can be related as (K_1 × Index finger length – K_2) and (R_1×Little finger length – R_2). Information regarding average tooth dimensions, when considered with length of index and little fingers, and the maxillary and mandibular anterior teeth, may help guide prosthodontists to impart a dental appearance that is harmonious with overall facial esthetics.

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INTRODUCTION

The primary consideration for patients seeking prosthodontic treatment is esthetics. The esthetic restoration has an important psychological effect on the edentulous patient. The development in the field of material science and newer techniques has led to a greater number of treatment options that can maximize the likelihood of an attractive outcome. Toward this end, the size and form of the maxillary anterior teeth are important for both dental as well as facial esthetics. Therefore to have the maxillary anterior teeth restoring optimal dento-labial relations in harmony with the overall facial appearance should be the goal. Patients often expect to appear similar to when they had their natural teeth while receiving the new dentures.

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It is important to do the correct selection of the artificial teeth for achieving a pleasant esthetic outcome. When no pre-extraction records are available, the selection of proper anterior teeth size for edentulous patients can be difficult. Any error at this stage can result in rejection by the patient in otherwise well constructed, comfortable and efficient dentures. When anterior teeth are selected for completely edentulous subjects, the mesiodistal width of the maxillary central incisors is important because they are the most prominent teeth in the arch when viewed from the frontal aspect (Heartwell, 1986; Mavroskoufis, 1980; Lavelle, 1972; Sanin, 1971). Many methods are suggested to aid in tooth size determination but different opinions have been reported regarding their significance. They must be harmonious with surrounding oral environment in terms of size, colour, and form. To appear attractive, the maxillary anterior teeth must be proportionate to facial morphology (Ricketts, 1982; Marquardt, 2002). Three methods are commonly used today for selecting the width of the 6 maxillary anterior teeth:

The first is Berry's biometric ratio method, which is based on the 1:16 maxillary central incisor width to bi-zygomatic width ratio introduced in 1905 (Berry, 1905). The Trubyte Tooth Indicator is based on the biometric ratio, and can be used for estimating the width, length, and outline and profile forms of the maxillary anterior. Secondly, interalar width measurement is also used as a method to determine denture tooth. Thirdly, the distance between the relaxed corners of the mouth represents an appropriate width for the 6 maxillary anterior teeth (canine to canine) (Lieb *et al*., 1967). In 1914 Williams found a relationship between the size of faces and the size of teeth (Williams, 1914). Pound determined face width by measuring the distance from zygoma to zygoma. The length is determined from hairline to gnathion. These measurements are divided by 16 indicate the length and width of the maxillary central incisor (Winkler, 2000). These anatomic measurements all have been proposed for selection of correct size of anterior teeth. However, there is less scientific data in the available literature to use as a guide for defining the proper shape and size of anterior teeth. Anthropometric measurements were used to determine proportions of body parts since antiquity, when sculptors and mathematicians followed the Golden proportion, later specified as a ratio of 1.618:1 (Misch, 2000). Gender variations in the dimensions of the anterior teeth have been noted for most racial groups, with men exhibiting wider anterior teeth than women (Sterret *et al*., 1999; Lavelle, 1972). Earlier studies have shown that there is significant correlation between the maxillary and mandibular anterior teeth with the index and little finger length (Ahila, 2014). However, no study has considered gender differences. In line with these observations, this study was designed to assess the possibility of any correlation between mesiodistal width of maxillary and mandibular anterior teeth and length of index and little fingers in males and females in Indian population so that it can serve as a simple and precise method for estimating mesiodistal width of maxillary and mandibular anterior teeth. This feature of human anthropometry seems to remain an unturned stone in the field of dentistry. The research hypothesis was that there would be a significant relationship between the mesiodistal width of maxillary and mandibular anterior teeth and length of index and little fingers in males and females.

MATERIALS AND METHODS

The patients reporting to the Department of Prosthodontics and Crown and bridge, JSS Dental College, Mysore participated in this study. A total of 50 participants were taken for this study based on inclusion criteria. Written informed consent of the participants were obtained. Ethical clearance was obtained from Institutional ethical committee. They were grouped into two groups. Group A- Males and Group B - Females. The inclusion criteria were: (Heartwell, 1986) no missing maxillary or mandibular anterior teeth (Mavroskoufis, 1980) anterior teeth without gingival or periodontal problems (Lavelle, 1972) dentition without interdental spacing or crowding (Sanin, 1971) unrestored anterior teeth (Ricketts, 1982) no history of orthodontic treatment. The exclusion criteria were (Heartwell, 1986) dental malocclusion (Mavroskoufis, 1980) supra-erupted teeth (Lavelle, 1972) altered passive eruption (Sanin, 1971) developmental anomalies (Ricketts, 1982) anodontia (Marquardt, 2002) apparent loss of tooth structure due to attrition, fracture, caries, or restorations. Irreversible hydrocolloid (Zelgon plus–Dentsply India) impressions of the maxillary and mandibular arches were made in stock trays and poured with dental stone (Denstone–Vankaj, India).

Fig 1. Measurement of mesiodistal width of anterior teeth on the cast using brass wire

Fig. 2. Measurement of index and little finger length using digital vernier caliper

The width of the anterior teeth was measured from the maximum distance between the mesial and distal contact points of the tooth on a line perpendicular to the long axis using a brass wire and metallic ruler. To measure the length of the index and little finger a new acrylic device was prepared. Putty impression of index finger was made and poured with dental stone. A mold was prepared. The cast was stabilized in it. Autopolymerizing acrylic resin was added in the mold space. A slot was created using carborundum disc.

Fig. 3. Digital vernier caliper

The length of the little and index finger were measured from the tip of the finger to the lower border of the line using a digital vernier caliper with a precision of 0.01 mm. Each parameter was measured three times and the average value was recorded.

RESULTS

For this study 50 maxillary and mandibular casts were measured to evaluate the width of the maxillary and mandibular anterior teeth. The statistical analysis was done using SPSS 20. From Table 1 and 2, it was observed that, in males the mean value of mesiodistal width of maxillary anterior teeth was 56.7 mm with range from 53.5 mm to 60mm where as in females, the mean value was 55.56mm with range from 46.5 mm to 65.0mm. In males the mean value of mesiodistal width of mandibular anterior teeth was 45.93mm with range from 43mm to 56mm where as in females, the mean value was 44.03mm with range from 38.5mm to 50mm.

Table 1. Descriptive statistics of length of index finger and little finger and mesiodistal width of maxillary and mandibular incisors in males

Descriptive Statistics- males						
Variables	N	Minimum	Maximum	Mean	Std. Error	Std. Deviation
Index finger length	25	65.00	81.06	71.6327	1.23439	4.78079
Little finger length	25	54.74	71.51	61.9273	1.22026	4.72607
Mesio distal width of maxillary incisors	25	53.5	60.0	56.700	.5769	2.2345
Mesio distal width of mandibular incisors	25	43.0	56.0	45.933	.8603	3.3320

Table 2. Descriptive statistics of length of index and little finger and mesiodistal width of maxillary and mandibular incisors in females

Descriptive Statistics- females						
Variables	N	Minimum	Maximum	Mean	Std. Error	Std. Deviation
Index finger length	25	59.64	67.73	62.7860	.68294	2.64503
Little finger length	25	46.83	58.96	51.6280	.94497	3.65986
Mesio distal width of maxillary incisors	25	46.5	65.0	55.567	1.3565	5.2538
Mesio distal width of mandibular incisors	25	38.5	50.0	44.033	.9174	3.5530

Table 3. Sex specific correlations between index finger length and mesiodistal width of maxillary anterior teeth

Coefficients[a]							
gender	Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
			B	Std. Error	Beta		
male	1	(Constant)	31.202	10.233		3.049	.009
		avg_index	.361	.143	.574	2.530	.025
female	1	(Constant)	-5.396	26.950		-.200	.844
		avg_index	.982	.429	.536	2.289	.039

a. Dependent Variable: Maxillary

Table 4. Sex specific correlations between little finger length and mesiodistal width of mandibular anterior teeth

Coefficients[a]							
gender	Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
			B	Std. Error	Beta		
male	1	(Constant)	16.608	14.410		1.153	.270
		avg_little	.496	.232	.510	2.138	.052
female	1	(Constant)	19.662	9.010		2.182	.048
		avg_little	.484	.174	.610	2.778	.016

a. Dependent Variable: Mandibular

In males, the mean value of length of index finger was 71.63mm with range from 65mm to 81.06mm where as in females, the mean value was 62.78mm with range from 59.64mm to 67.73mm. In males, the mean value of length of little finger was 61.92mm with range from 54.74mm to 71.51mm where as in females, the mean value was 51.62mm with range from 46.83mm to 58.96mm. The coefficient of correlation by Spearman's method between measured variables and mesiodistal width of maxillary and mandibular anterior teeth were measured. From table 3 and 4, it was observed that in males and females, mesiodistal width of the anterior teeth is significantly and positively correlated with all parameters studied. Regression analysis was performed for prediction of mesiodistal width of anterior teeth using all parameters.

In males, the following Regression equations were reliable to determine the mesiodistal width:

Maxillary anterior teeth width = 31.202 + (average length of index finger X 0.361).

Mandibular anterior teeth width = 16.608 + (average length of little finger X 0.496)

In females, the following Regression equations were reliable to determine the mesiodistal width

Maxillary anterior teeth width = (average length of index finger X 0.982) -5.396

Mandibular anterior teeth width = 19.662 + (average length of little finger X 0.484)

DISCUSSION

One of the most confusing and difficult aspects of complete denture prosthodontics is the selection of appropriately sized maxillary anterior denture teeth. Many attempts have been made to quantify the selection of anterior teeth for complete dentures, but little consensus on an effective method has been reached (Cesario, 1984). Creating geometric or mathematical proportion to relate the successive width of anterior teeth is one of the critical aspects of esthetic dentistry. The golden proportion, when applied to the dentition, indicates that if the perceived width of each anterior tooth is approximately 62% the size of its adjacent anterior tooth, then it is considered esthetically pleasing (Ricketts, 1982; Marquardt, 2002). Golden proportion and Reccuring Esthetic Dental (RED) proportion are unsuitable methods to relate the successive width of the maxillary anterior teeth in natural dentition (Sreenivasan murthy, 2008). Cesario found that a ratio of 6.6 existed between the inter-pupillary distance and the central incisor width in white men and women, and also in black-women (Cesario, 1984).

Latta *et al* concluded that the relationships among the width of the mouth, the interalar width, the bizygomatic width, and the inter-pupillary distance might be used as references if applied in combination, although racial and gender differences were detected when anatomic measurements were evaluated individually (Latta, 1991). Kern found that 93 %of nasal-width was equal to or within 0.5 mm of the four maxillary incisors (Kern, 1967). The inter alanasal width is a reliable guide for selecting the mold of anterior teeth and that the incisive papilla provides a stable anatomical landmark for arranging the labial surfaces of the central incisors at 10 mm anterior the posterior border of the papilla (Mavroskoufis, 1980). The width of the nose, when measured in digital photograph can be utilized as a guide for the selection of the maxillary anterior teeth width (Vanderlei *et al*., 2009). Inter Canine Distance should be used only as reference value in estimations of central incisor width. Final tooth selection for edentulous subjects should be made in accordance with facial form (Abdullah, 2002). The use of the right hamular notch to left hamular notch measurement plus 10 mm provides a useful method for determining the width of the 6 maxillary anterior teeth for complete denture patients with medium and large cast sizes (Philip *et al*., 2010). In the current investigation, relationship between maxillary teeth width to length of index finger and mandibular teeth width to length of little fingers in males and females were analyzed, the measurements obtained showed that there is positive relationship between these measurements and relationship for the same can be formulated.

Therefore, the suggested hypothesis regarding the significant relationship between the mesiodistal width of maxillary and mandibular anterior teeth and length of index and little finger in males and females was found correct and the following relationship can be formulated. For males, Maxillary anterior teeth width = 31.202 + (average length of index finger X 0.361).For females, Maxillary anterior teeth width = -5.396 + (average length of index finger X 0.982). For males, Mandibular anterior teeth width = 16.608 + (average length of little finger X 0.496). For females, Mandibular anterior teeth width = 19.662 + (average length of little finger X 0.484). The limitation of the study was that it was restricted to the subjects belonging to Indian population. Further the subjects were not categorized based on nutritional status. The number of participants studied were less and over a small geographical area. To authenticate these findings further studies should be carried out comprising of a broad clinical research program that would include the similar analysis for dentulous population in other ethnic groups.

Conclusion

Within the limitations of the study it can be concluded that there is significant correlation between the maxillary and mandibular anterior teeth width with the index and little finger length in males and females. For males, Maxillary anterior teeth width = 31.202 + (average length of index finger X 0.361).For females, Maxillary anterior teeth width = -5.396 + (average length of index finger X 0.982). For males, Mandibular anterior teeth width = 16.608 + (average length of little finger X 0.496). For females, Mandibular anterior teeth width = 19.662 + (average length of little finger X 0.484) This method is attractive and practical because it is simple, economic, non-invasive, reliable, requires no radiographs or sophisticated measuring devices and provides reproducible values for future reference. Besides it does not require a great amount of time and experience to master which is another advantage it enjoys over previous methods. Hence, it can be concluded from the study that the anthropometric measurements like finger lengths can serve as a basic guide in estimating the size of anterior teeth in males and females when no pre-extraction records are available.

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