

A Study to Correlation between Distal Maxillary Arch Width and Mesio-Distal Width of Maxillary Anterior Teeth among Dakshina Kannada Population

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ABSTRACT

Introduction: In the absence of pre-extraction records, the selection of maxillary anterior teeth for the edentulous patient is mostly subjective. Several techniques using anatomic landmarks have been suggested for determining the size of maxillary anterior teeth, but there is no universally accepted method that can be used reliably. Hence the objective of this in vivo study was to find correlation between distal maxillary arch width and mesio-distal width of six maxillary anterior teeth.

Material and methods: One hundred maxillary dentulous impressions were made (19 to 23 years old) using stock tray and irreversible hydrocolloid impression material. The mesiodistal width of the six maxillary anterior teeth and distal maxillary arch width were measured by digital caliper on stone casts (on two separate occasions by two independent observers). The results were statistically analyzed using Karl Pearson correlation test.

Results: The mean mesiodistal width of the six maxillary anterior teeth was 46.22 (± 2.508) mm, and the mean distal maxillary arch width was 46.41 (± 2.749). A highly significant correlation was found between mesiodistal width of the maxillary anterior teeth and the Distal maxillary arch width ($p < 0.0001$; $r=0.454$).

Conclusion: A correlation between total mesio-distal width of maxillary six anterior teeth and distal maxillary arch width was found, which can be used as one of the reliable anatomical landmarks for selecting maxillary anterior teeth among Dakshina Kannada, Karnataka population.

Keywords: distal maxillary arch width; maxillary anterior teeth; complete denture prosthodontics

Young reviewed 21 techniques spanning between 1700 to 19051 relating to this issue and concluded none as satisfactory and recommended the development of operator esthetic sense as most effective.¹⁰ But for inexperienced clinician this approach may be impractical. Furthermore, if a simple measurements made over the cast could be used to determine the size of the teeth leading to optimal esthetics; edentulous patients would be greatly benefited.

Actual tooth size and morphology are addressed in dental literature. But as racial variation has its effect over the tooth size, knowledge of racial norms may help specify certain aesthetic and functional modifications in treatment plans and apply them scientifically.⁶

However, there is no universally accepted anatomical landmarks currently exists for selecting maxillary anterior teeth. So this study was conducted to find correlation between distal maxillary arch width and mesiodistal width of six maxillary anterior teeth in Dakshina Kannada population.

MATERIAL AND METHODS

The present study was carried out in the Department of Prosthodontics including Crown and Bridge and Implantology, K.V.G. Dental College and Hospital, Sullia. A total of 100 individuals who were native of Dakshina Kannada region with an age ranging from 19 - 23 years old were selected for this study according to the designed inclusion and exclusion criteria. Individuals with intact teeth, Angle class I skeletal and occlusal relationship with minimal tooth rotation or compression were included in the study. Patients with marginal periodontitis or gingival recession and who had undergone any orthodontic treatment were excluded from the study. Following the written approval of the ethical committee of the institute, the population of Dakshina Kannada region were screened randomly according to the defined inclusion and exclusion criteria and the procedures to be carried out were explained to selected subjects. All selected candidate signed a written consent confirming their

INTRODUCTION

Teeth selection is a critical step in the complete dentures fabrication, which can be disappointing if they do not meet up to the patient's expectation. Pound E¹ stated that in restoring facial appearance and function for edentulous patients, five qualities must work together in harmony: the size, form, color, arrangement, and framing of the teeth. Selection of ideal anterior teeth for edentulous patient becomes a difficult task in the absence of pre-extraction records. For anterior teeth selection number of ideal facial landmark has been proposed,²⁻⁹ however; none of the facial landmark is reliable enough to be regarded as universally accepted single method for reliable artificial tooth selection. The main problem of biometric measurements that use the soft structures for artificial tooth selection is the absence of a static relationship of soft structures, as the width of soft tissues may change according to several factors such as aging and the weight and built of the person. Therefore, a relationship between dimensions of the anterior teeth with anatomical landmarks can be drawn reliably only when landmarks independent of such factors are used.

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participation in the study. The candidate was seated on a dental chair in an upright position and after the brief oral examination, proper size perforated rim lock stock tray (S S WHITE) was selected. T burnisher was used to locate hamular notch distal to tuberosity behind the ridge crest on either sides and the hamular notches were marked with an indelible pencil prior to impression procedure. Alginate impression powder (Plastalgin) was mixed with water according to manufacturer instructions with 1:2.6 (proportion by weight) water / powder ratio in flexible rubber bowl with curved stainless steel spatula by spatulating it in figure of eight motion then swiping and stropping it against the walls of the rubber bowl then impression tray was loaded and maxillary impression was made. The cast was poured immediately with hard setting dental stone (GYPROCK) by mixing dental stone using proper water powder ratio (according to manufacturer) in rubber bowl with wide blade straight stainless steel spatula. After one hour, casts was retrieved, the damaged cast was discarded and impression was remade. Then base was formed. Same procedures were followed for all the 100 subjects.

The measurements were made on dentulous cast by dial vernier caliper (with 0.05mm accuracy) (Mitutoyo Ltd. 505-633-50). Distal maxillary arch width was measured from mesial fossa of first right maxillary molar to mesial fossa of first left molar through vernier caliper by keeping arms of caliper in contact with mesial fossa (figure 1). Mesio-distal width of each maxillary anterior tooth was measured with caliper by drawing a line perpendicular to long axis of the tooth at the maximum coronal width of the tooth. Each individual maxillary anterior tooth width measurements were added to give a total width for the six maxillary anterior teeth (figure 2).

The mesiodistal width of the six maxillary anterior teeth and distal maxillary arch width were measured on two separate occasions by two independent observers.

STATISTICAL ANALYSIS

The results were statistically analyzed using Karl Pearson correlation test using SPSS version 21.

RESULT

Table 1 shows mean and standard deviation of total mesiodistal

width of six maxillary anterior teeth (TOTAL₁ and TOTAL₂) as recorded by observer 1 and 2 for 100 samples and inter-class correlation coefficient test for this value. Mean for the total mesio-distal width of six maxillary anterior teeth as recorded by observer 1 (TOTAL₁) was 46.22mm. Standard Deviation for the



Figure-1: Distal maxillary arch width measurement



Figure-2: Mesio-distal width of each maxillary anterior tooth measurement

	Inter class Correlation	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	p value
Single Measures	.979	.969	.986	96.196	99	99	.000
Any value above .8 is excellent agreement							
Table-2: Inter class Correlation Coefficient test for total mesiodistal width							

	Mean	Std. Deviation	N
DMxW ₁	46.412500	2.7490161	100
DMxW ₂	46.391500	2.7899898	100
DMxW ₁ : Distal maxillary arch width recorded by observer 1; HN ₂ : Distal maxillary arch width recorded by observer 2; N: Total number of sample.			
Table-3: For Distal maxillary arch width by observer 1 and 2			

	Inter class Correlation	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	p value
Single Measures	.989	.984	.993	181.590	99	99	.000
Table-4: Inter class Correlation Coefficient test for Distal maxillary arch width							

data of total mesio-distal width of six maxillary anterior teeth as recorded by observer 1 (TOTAL₁) was 2.508. Mean for the total mesio-distal width of six maxillary anterior teeth as recorded by observer 2 (TOTAL₂) was 46.14 mm. Standard Deviation for the data of total mesio-distal width of six maxillary anterior teeth as recorded by observer 2 (TOTAL₂) was 2.48.

Inter-class correlation coefficient obtained was 0.979 with Lower Bound 0.969 and Upper Bound 0.986, which shows strong agreement between the Data recorded by observer 1 and observer 2 (table 2).

Table 3 shows mean and standard deviation of distal maxillary arch width (DMxW₁ and DMxW₂) as recorded by observer 1 and 2 for 100 samples and inter-class correlation coefficient test for this value. Mean for the distal maxillary arch Width as recorded by observer 1 (DMxW₁) was 46.41 mm. Standard deviation for the data of distal maxillary arch width as recorded by observer 1 (DMxW₁) was 2.749. Mean for the distal maxillary arch width as recorded by observer 2 (DMxW₂) was 46.39 mm. Standard deviation for the data of distal maxillary arch width as recorded by observer 2 (DMxW₂) was 2.789. Inter-class correlation coefficient obtained was 0.989 with lower bound 0.984 and upper bound 0.993, which shows strong agreement between the data recorded by observer 1 and observer 2 (table 4).

DISCUSSION

Every sane individual likes to be presentable irrespective of sex and age. When an individual becomes edentulous, he/she seeks dental treatment to restore esthetics. It is the primary concern for the individual. Even when the complete denture prosthesis is functionally suitable, the individual will not accept it if esthetic requirements are not fulfilled. Tooth size is one of the important factors that must be considered to add life like appearance to the patient denture. Since the time of Leonardo da Vinci, dentists are in search for the objective method that can be used for determination of tooth size.¹¹

Scandrett Forrest et al¹² designed a study to find the relationship between width of the maxillary anterior teeth and the central incisor to that of inter commissural width, bizygomatic width, sagittal cranial diameter, inter buccal frenum distance and philtrum width. The investigators hypothesized that two or more of these predictor variables would provide a better prediction of maxillary tooth width than any of them individually. This research clearly stated that biometric ratio of 16:1 is not significant magnitude for individual edentulous patient. However they suggested that more than one anthropometric parameter is required to determine the width of central incisor and maxillary anterior teeth. They also cautioned the difficulty encountered in studying the width of natural teeth in older age group as there would be interproximal wear and loss of tooth structure.

Sears WH⁵ stated that the total width of the maxillary anterior teeth can be determined by dividing the bizygomatic width by 3.3. In another study, Hasanreisoglu U et al⁶ also showed that bizygomatic width and interalar width may serve as references for establishing the width of the maxillary anterior teeth, particularly in women; however, other authors have demonstrated inconsistencies in relating biometric measurements to artificial teeth selection.³

With the review of literature it is clear that, in the absence of

	Mean	Std. Deviation	N
TOTAL ₁	46.221500	2.5083422	100
TOTAL ₂	46.140200	2.4801592	100
TOTAL ₁ : Total mesio-distal width of maxillary six anterior teeth by observer 1; TOTAL ₂ : Total mesio-distal width of maxillary six anterior teeth by observer 2; N: Total number of sample.			
Table-1: For total mesiodistal width of teeth by observer 1 and 2			

pre-extraction records, there is however, no accurate objective method in order to select the anterior teeth for edentulous patients. Although, many methods have been utilized, none of these methods are absolutely reliable for tooth selection^{3,8,13-16} The anatomical landmark as a guide for selection of anterior teeth will vary from population to population. Modern anthropology on studies of genetic admixtures and biological relationship among the various groups of human races, has found that teeth and dental arches have a high genetic component. Furthermore, studies of the etiological factors of malocclusion have shown that growth of the jaws is strongly influenced by genetic, as well as by environmental factors such as nutrition, health, physical status.¹⁷ Most studies done do not include Asian and Indian population, even though they form largest population as compared to other ethnic groups. So the aim of this study was to find a relationship between the mesio-distal width of six maxillary anterior teeth and distal maxillary arch width among Dakshina Kannada population. In present study in order to carry out the required measurements of the anatomical landmarks, the dental stone casts were used.

In present study, a highly significant correlation was found between mesiodistal width of six maxillary anterior teeth and distomaxillary arch width among the Dakshina Kannada population. This finding is partially supportive with the result obtained by N. Petricevic et al.¹⁸

Dubey S et al¹⁹ assessed the correlation between combined mesiodistal width of six maxillary anterior teeth and curved distance from distal surface of one canine to the other among Indian and Malaysian population and found a statistically significant correlation and that these parameters can be used in the clinical practice. Gomes VL et al⁴ reported a significant correlation between all facial elements and the combined mesiodistal width of the six teeth. Anatomical landmarks which is reliable for selecting maxillary anterior teeth varies between different ethnic groups, as shown by different studies done on tooth and arch dimensions for different ethnic groups worldwide, but still new studies for certain ethnic groups have to be implemented before considering any anatomical landmark is a reliable guide for selecting maxillary anterior teeth for that particular population.^{20,21} Development of a more scientific or objective method of teeth selection would greatly assist dentist in delivering their service for patient care and satisfaction confidently and will also enable lab technician to accurately pick the teeth without seeing the patient on dental chair, computer would also be used to scan and measure casts to give image of patient teeth in the proper size relationship. To check reliability of the recorded data, all the measurements were performed independently at two separate occasions by two observers, observer 1 (prime observer) and observer 2 separately. The data were tabulated and subjected to inter-class correlation test. After getting strong agreement between the data recorded by observer

1 and observer 2, the data documented by observer 1 (prime observer) was subjected to statistical analysis.

Karl Pearson correlation coefficient test was applied to know if correlation exists between Total mesio-distal width of maxillary anterior teeth and distal Maxillary arch width among Dakshina Kannada population.

Limitations of this study includes age of the patient, as age advances the proximity of teeth undergoes attrition, gender differences influencing the tooth size and difference in tooth size for the right and left side.

CONCLUSION

Thus, within the limitations of this study, it can be concluded that there is correlation between total mesio-distal width of maxillary six anterior teeth and distal maxillary arch width, thus distal maxillary arch width can be considered as one of the reliable anatomical landmark to select maxillary anterior teeth among Dakshina Kannada population group.

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