Evaluate the Association between the Interpterygomaxillary Notch and the Width of Maxillary Anterior Teeth

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Abstract

Aim: Among the most challenging aspect of complete denture construction is the proper selection of maxillary anterior teeth. The main objective of this study was to examine the relationship between the total mesiodistal width of the six maxillary anterior teeth and the interpterygomaxillary notch distance.

Materials and Methods: One hundred maxillary impressions were taken on subjects using irreversible hydrocolloid impression material and stock trays. The distance between two pterygomaxillary notches was measured on a straight line using a digital caliper with a 0.01-mm precision level. For each cast, the maximum coronal widths of each of the maxillary anterior six teeth were measured with a caliper. The results were analyzed using correlation regression tests.

Results: The mean mesiodistal width of the six maxillary anterior teeth was 52.97 (+2.29) mm, and the mean distance of the interpterygomaxillary notch was 44.28 (+ 3.29) mm. The corelation and regression tests showed that there was a stastically significant positive corelation (p=0.001), Pearson coefficient = 0.498 between the interpterygomaxillary notch distance and total mesiodistal width of the six maxillary anterior teeth.

Conclusion: The majority of cases showed a significant relationship between the interpterygomaxillary notch distance and total mesiodistal width of the six maxillary anterior teeth. Though other parameters should also be considered to analyze and compare other morphological structures to improve the aesthetic requirement for the conventional denture wearer.

Key Words: *W.M.A.T= width of maxillary anterior teeth, I.P.N.D= interpterygomaxillary notch distance*

Introduction

Art is the imposing of a pattern on experience, and our aesthetic enjoyment is recognition of the pattern. The face holds a mark in the beauty in comparison to other features of human beings.

Esthetic in dentistry is defined as the cosmetic effect produced by a dental prosthesis which affects the desirable beauty, attractiveness, character and the dignity of an individual, the ultimate challenge for the restorative dentist [1].

Poetry and literature for centuries have hinted on the importance of teeth with its own role in contributing to the facial beauty. The face being the most noticeable part of human anatomy holding a key to determining one's social acceptance. The loss of teeth with such a high effect on facial appearance associated with it often attributes to tremendous psychological and psychosocial trauma for the patient [2]. The dental prosthesis which plays a pivotal role in either enhancing or distracting the patient's personal image and attractiveness of the appearance. Frush stated, the acceptance of the treatment by the patients is made considerably easier on prosthesis accomplishing the two basic esthetics needs, the portrayal of physiological form and an actual improvement in the attractiveness of the smile" [3]. Further justifying the other definition of esthetics "the natural setting of the teeth in the arch plus natural ridge and contours of gingiva" [4]. Yet, Hardy concurred as

esthetic is not easily reduced to a formula, additionally complimenting Martones statement "the key to esthetics lie in asymmetry".

Esthetic in complete denture fabrication is the bug bear of dentistry with a majority of the practitioners. When an edentulous patient hopes for a satisfying treatment, the prosthodontist is compelled to use certain amount of ingenuity. Among the most challenging aspect of complete denture construction is the proper selection of maxillary anterior teeth [5]. The central incisor forms the spearhead of the anterior teeth, where the teeth width is more fundamental than the length [6]. It is the prosthodontist who comes into play and the only one to correlate and evaluate the biomechanical information so that the selection of artificial teeth will meet the individual needs. For the most part, the measurements employed to guide the selection of anterior teeth primarily focusses on the soft tissue landmarks, which may be misleading due to dynamic changes over time [7]. Using a landmark less affected by these factors may therefore be a better and a reliable method for the selection of anterior teeth. The pterygomaxillary notch is the palpable notch formed by the junction of the maxilla and the pterygoid hamulus of the sphenoid bone and does not appear to change with factors such as weight changes, aging, and extraction of teeth [8]. Pterygomaxillary notches can readily be identified on dental casts and may be used as an alternative anatomical landmark for anterior teeth selection [8] The aim of this study was to examine the existence of any relationship between the interpterygomaxillary notch and the total mesiodistal width of the six maxillary anterior teeth in the Indian population.

Materials and Methods

Dental student volunteers from the JSS DENTAL COLLEGE AND HOSPITAL, JSS University and were solicited by a written announcement to participate in the study. The study protocol was approved by the local Ethics Committee. Informed consent was obtained from all subjects prior to their participation. The inclusion criteria of the subjects limited to those with Angle class I maxillomandibular relationship, natural maxillary teeth in good alignment, no restoration or tooth loss in the maxilla, and no history of orthodontic treatment. The exclusion criteria of the subjects included interdental spacing or crowding and apparent loss of tooth structure. The volunteers were examined by one of the investigators of the study. One hundred were chosen by drawing from the students who met the inclusion criteria. The ages of the subjects ranged between 19 and 22 years.

Maxillary impressions were taken on subjects using irreversible hydrocolloid impression material and stock trays. To correctly register the pterygomaxillary notch and reduce soft tissue distortion, the impression was made under minimal pressure. The stone casts were obtained using ADA type III dental stone. Damaged stone casts were also excluded from the study.

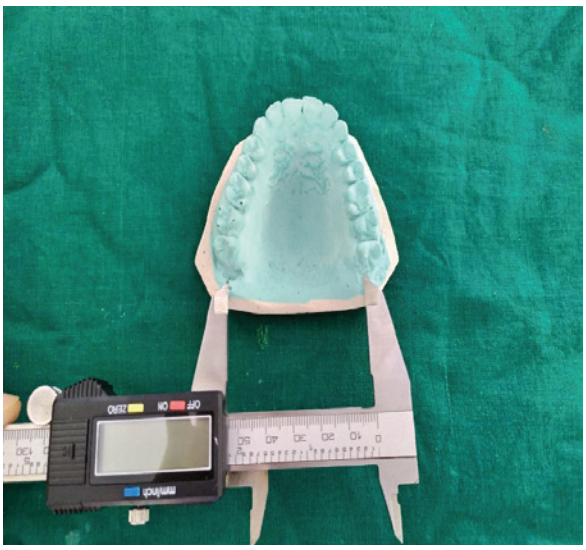


Figure 1

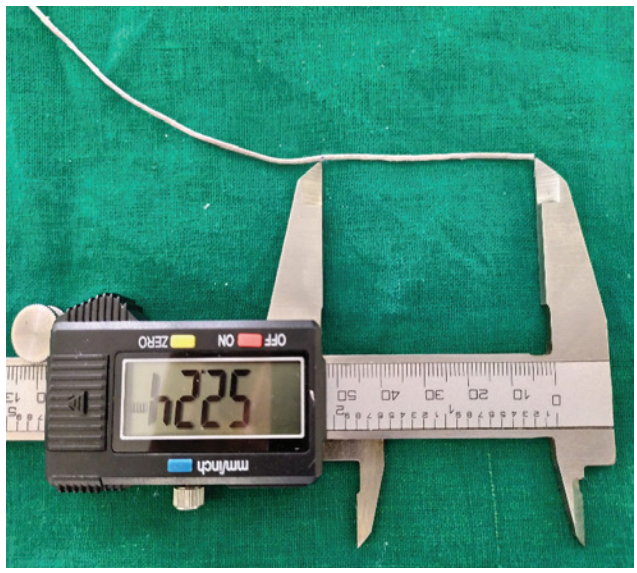


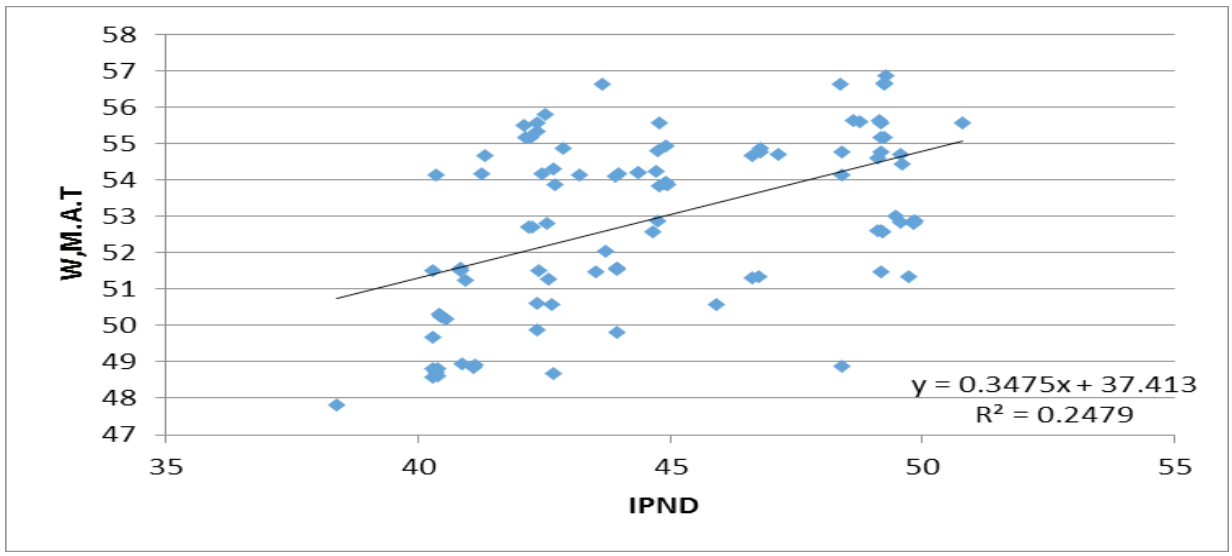
Figure 2

The buccolingual center of the pterygomaxillary notches was identified on each stone cast and marked with graphite. The distance between two pterygomaxillary notches was measured on a straight line using a digital caliper with a 0.01-mm precision level. The arms of the caliper were adjusted so they were in contact with the graphite marks. For each cast, the maximum coronal widths of each of the maxillary anterior six teeth were measured with a caliper. The six individual anterior tooth width measurements from each cast were added to give a total width for the six anterior teeth on each cast. All measurements were performed at two separate occasions by two independent observers. The accuracy of the caliper was tested with the use of a 3.5-mm steel plate and digital micrometer before each measurement. All measurements were recorded in mm. The data were analyzed.

Results

The sample size of the study was taken to be (n= 100). With a variation of 42 female population and 58 male population.

The distribution of the data was not different from the normal distribution, as revealed by Kolmogorv-Smirnov (p>0.5). The mean mesiodistal width of the six maxillary anterior teeth was 52.97 (+2.29) mm, and the mean distance of the interpterygomaxillary notch was 44.28 (+ 3.29) mm. The corelation and regression tests showed that there was a stastically significant positive corelation (p=0.001), Pearson coefficient = 0.498 between the interpterygomaxillary notch distance and total mesiodistal width of the six maxillary anterior teeth. Figure 1 shows the distances between pterygomaxillary notches (A), which correspond to the mesiodistal width of the maxillary anteriors (B) for each subject. There was a linear relationship between the two measurements according to the linear regression (p=0.001), F=31.98 analysis; however standardized coefficients (beta) were found as 49% (r=0.498



Graph 1 Relation between IPND and WMAT

Table 1 :

Correlations

Correlations			
		IPND	**WMAT**
IPND	Pearson Correlation	1	.498**
	Sig. (2-tailed)		.000
	N	100	99
WMAT	Pearson Correlation	.498**	1
	Sig. (2-tailed)	.000	
	N	99	99
**. Correlation is significant at the 0.01 level (2 tailed).			

Table 2

Curve Fit

Model Summary and Parameter Estimates							
Dependent Variable: WMAT							
Equation	Model Summary					Parameter Estimates	
	R Square	F	df1	df2	Sig.	Constant	b1
Linear	.248	31.980	1	97	.000	37.413	.347
The independent variable is IPND.							

Discussion

Esthetics is the primary consideration for patients leading to characteristic appearance. The size, color, shape, and overall arrangement of the teeth in the anterior maxillary region are a prime determinant not only to dental esthetics but also to facial esthetics. The ultimate object is to rehabilitate the teeth in consonance with the facial appearance [7].

Since, the evolution of dentistry, multitudinous approaches have been taken for determination of the size of the maxillary anterior teeth. Initially when teeth were selected, mostly by dimensional measurements, with slight consideration given to face form or other qualities [9]. Later, starting from 1815, for the very first time when the geometric classification of face form and profile, by Madame Schimmelpeinik for artists use was considered in dentistry for esthetic teeth selection

[10]. Further leading to different techniques like The "correspondence and harmony" concept by J.W. White in 1872, The "Temperamental technic" [11], The "Typal form concept" by W.R. Hall in 1887, "Berry's biometric ratio method", in 1906 [11]. Clapp's "Tabular Dimension Table Method," around 1910 [12]. "Molar Tooth Basis," by Valderrama in 1913 [13]. According to this method, the tooth size was measured on a one-fourth increment of the size of a Bonwill triangle, and is determined by measuring the edentulous mandible. Cigrande in 1913 [14] used the outline form of the fingernail to select the outline form of the upper central incisor tooth.1920 Nelson projected a technique for selecting a tooth mould and he called it as "Maxillary Arch Outline Form," [15-16]. In 1936 "Wright's Photometric Method" based on using a photograph of the patient with natural teeth. The "Multiple Choice Method," by Myerson in 1937 [17]. The "House Instrumental Method" of projecting typal outline and profile silhouettes onto the face by means of a telescopic projector instrument and silhouette form plates [18] by House in 1939.

"Stein's coordinated size technic," in 1940 [18]. "Anthropometric Cephalic Index Method," by Sears in 1941 [19]. "Frame Harmony Method," by the Justi Company in 1949 [20]. The "Bioform technic" in 1950 based on the House classification [21]. The "Selection Indicator Instrument method," correlated with Williams' and Houses' typal tooth form theory and the tabular table technic [21,24]. The "Automatic Instant Selector Guide" projected in 1951..

With such techniques, came a variety of concepts, including White's concept, H. Pound's concept, Winkler concept, Dentogenic concept and Leon William's concept.[22,23]

Anatomical landmarks which have been established as a guide for selecting maxillary anterior teeth in edentulous individuals but with a variance of different ethnic groups worldwide.

Multiple efforts have been made to unambiguously quantify the selection of the anterior teeth using the anatomical landmarks. BW, IPD, ICD, IAD, and ICOW, and some newer anatomical measurements, such as philtral width, circumference of skull (COS), maxillary arch length (MAL), and maxillary arch width (MAW) have also been studied [22,23]. However, there is no consensus of data with respect to a single esthetic factor that can be used reliably to facilitate for artificial tooth selection [25]. Hence, this study was carried out to try and identify a single, reliable anthropometric measurement that can be used to determine the size of the anterior teeth in various population groups of India.

Pterygomaxillary notch: It is a narrow cleft of loose connective tissue which is approximately 2mm in extent anteroposteriorly formed by the junction of the maxilla and pterygoid Hamulus of the sphenoid bone. Located by using T- burnisher. Significance: Constitutes the lateral boundary of posterior palatine seal area in maxillary foundation. The pterygomandibular raphe attaches to Hamulus [24].

The position of the pterygomaxillary notches do not appear to change with factors such as weight changes, aging, and extraction of teeth. Pterygomaxillary notches are easily localized on the casts as well [8,24,26].

The use of biometric guidelines typifies a way of matching the width of anterior teeth in complete dentures in as much detail as possible to the original. Therewith, anthropometric parametres obtained from one's own population indubitably constitute a substantial role as there are abundant studies on the human face proving the existence of significant variations in parameters among different races, population, nation as well as individuals.

Petricevic N et al. asserted that sum of width of maxillary anterior teeth is equal to hamular notch distance as well as distomaxillary arch width. Baker PS et al. concluded that adding 10 mm to the hamular notch distance showed strong correlation with the maxillary anterior teeth [27,28]. Johnson and Stratton in their study stated that pterygomaxillary notch plus 5 mm equals the width of maxillary six anterior teeth [29]. Though, Guldag in his study concluded that inter-pterygomaxillary notch cannot be used as a predictive factor for anterior teeth selection. But, significant co-relation was identified to be used as method to assess the size of the maxillary anterior teeth [30].

In this study, the mean mesiodistal width of the six maxillary anterior teeth was 52.97 (+2.29) mm, and the mean distance of the interpterygomaxillary notch was 44.28 (+ 3.29) mm. The difference between the results could be due to the difference in the observer's

respective interpretation. The corelation and regression tests showed that there was a stastically significant positive corelation (p=0.001), Pearson coefficient = 0.498 between the interpterygomaxillary notch distance and total mesiodistal width of the six maxillary anterior teeth thus, concurring the relationship between the interpterygomaxillary notch distance and size of the maxillary anterior teeth.

Conclusion

This brings to a conclusion that better studies for certain ethnic groups have to be executed before considering any anatomical landmark being a reliable guide for selecting maxillary anterior teeth for that particular population [31]. Parameters like gender variations in tooth size, ethnic variations, differences in size of dentition on the left and right sides and a specific sample size can limit the areas of this study. Although the application of anterior teeth measurements using anthropometric measurements has been documented extensively, future endeavors are needed to establish a common national or global database to assist in the ultimate selection of anterior maxillary teeth for enhanced aesthetics.

Conflict of Interest: No conflict of interest was found.

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References

1) Vadavadagi, Suneel V., et al. "Prevalence of tooth shade and its correlation with skin colour-A cross-sectional study." *Journal of clinical and diagnostic research: JCDR* 10.2 (2016): ZC72.-ZC74
2) Arhakis, Aristidis, Eirini Athanasiadou, and Christina Vlachou. "Social and psychological aspects of dental trauma, behavior management of young patients who have suffered dental trauma." *The open dentistry journal* 11 (2017). 41-47
3) Donitza A Creating the perfect smile: prosthetic considerations and procedures for optimal dentofacial esthetics.. J Calif Dent Assoc. 2008 May;36(5):335-40, 342
4) Principles, concepts, and practices in prosthodontics—1989 Academy of Denture Prosthetics JPDent. January 1989Volume 61, Issue 1, Pages 88–109.
5) Neda, AL-Kaisy, and Balkees Taha Garib. "Selecting maxillary anterior tooth width by measuring certain facial dimensions in the Kurdish population." *The Journal of prosthetic dentistry* 115.3 (2016): 329-334.
6) Grawish, Mohammed E., Lamyaa M. Grawish, and Hala M. Grawish. "Permanent Maxillary and Mandibular Incisors." *Dental Anatomy*. IntechOpen, 2017.
7) Kumar, M. Vasantha, S. C. Ahila, and S. Suganya Devi. "The science of anterior teeth selection for a completely edentulous patient: a literature review." *The Journal of Indian Prosthodontic Society* 11.1 (2011): 7-13.
8) Shivaji, Jadhav M. "An Innovative Method to Determine the Width of Maxillary Anterior Teeth with the Help of Measurements Obtained from the Master Cast." *Dent Pract* 19.12 (2018): 1488-1493.
9) Gomes, Vanderlei Luiz, et al. "Correlation between facial measurements and the mesiodistal width of the maxillary anterior teeth." *Journal of Esthetic and Restorative Dentistry* 18.4 (2006): 196-205.
10) Berry, F. H. "Is the theory of temperaments the foundation of the study of prosthetic art." *Dent Mag* 1.405 (1905): 6.
11) Clapp, George Wood. "Twentieth century mold book." *Dentist's Supply co, New York* (1922).
12) Valderrama, José. "Fundamental errors in anatomic articulators." *Dent Cosmos* 55 (1913): 1205-1215.
13) Graber, Lee W., and G. William Lucker. "Dental esthetic self-evaluation and satisfaction." *American journal of orthodontics* 77.2 (1980): 163-173.
14) Williams, J. Leon. "A new classification of natural and artificial teeth." *Dentists supply Co, New York City* (1914).
15) Kern, Byron E. "Anthropometric parameters of tooth selection." *The Journal of prosthetic dentistry* 17.5 (1967): 431-437.
16) Wright, Walter H. "Selection and arrangement of artificial teeth for complete prosthetic dentures." *The Journal of the American Dental Association (1922)* 23.12 (1936): 2291-2307.
17) Nelson, A. A. "The selection of mold and hue of teeth for artificial restoration." *Dent Items Interest* 5 (1925): 775.

18) Mycrson, S. "A new system for tooth selection. Cambridge: Ideal tooth." (1935).

19) House, M. M. "Form and color in denture art." *House and Loop, Whittier* 17 (1939).

20) Stein, M. F. "Williams classification of artificial tooth forms." *J Am Dent Assoc* 23 (1936): 512.

21) Sears, Victor H. "Selection of anterior teeth for artificial dentures." *The Journal of the American Dental Association* 28.6 (1941): 928-935.

22) Saffir, Jacob A. "Artificial tooth." U.S. Patent No. 2,380,468. 31 Jul. 1945.

23) Kristek, Ela, and Asja Čelebić. "Analysis of width/length ratios of normal clinical crowns of the maxillary anterior dentition: correlation between dental proportions and facial measurements." *International journal of prosthodontics* 20.3 (2007).

24) Sellen, Philip N., Daryll C. Jagger, and Alan Harrison. "Methods used to select artificial anterior teeth for the edentulous patient: a historical overview." *International Journal of Prosthodontics* 12.1 (1999).

25) Johnson, P. F. "Racial norms: Esthetic and prosthodontic implications." *The Journal of prosthetic dentistry* 67.4 (1992): 502-508.

26) Ranjan, Madhu, et al. "Correlation between mesiodistal width of maxillary anterior teeth and interhamular notch distance amongst dakshin kannada population." *International Journal of Contemporary Medical Research* 4.7 (2017): 1471-1474.

27) Jain, Ashish R. "Determination of correlation of width of maxillary anterior teeth using extraoral and intraoral factors in Indian population: A systematic review." *World* 9.1 (2018): 68-75.

28) Guldag, M. Ustun, et al. "Relationship between pterygomaxillary notches and maxillary anterior teeth." *Journal of Prosthodontics: Implant, Esthetic and Reconstructive Dentistry* 19.3 (2010): 231-234.

29) Johnson DL, Stratton RJ. Fundamentals of Removable Prosthodontics. Chicago: Quintessence Publishing Co, Inc.; 1980. p. 389.

30) Ayoub, W., and Raisa Rashid. "Evaluation of the current techniques and introduction of a novel approach for estimating maxillary anterior teeth dimensions in Kashmiri population." *Int J Appl Dent Sci* 3 (2017): 26-31.

31) Ellakwa, Ayman, et al. "Quantifying the selection of maxillary anterior teeth using intraoral and extraoral anatomical landmarks." *J Contemp Dent Pract* 12.6 (2011): 414-421.