Original Research Article

Anterior teeth selection in edentulous patients and its relationship with interhamular distance, maxillary arch width and maxillary central incisors: A study in North East Indian Population

Nilotpol Kashyap[1], Brij Kumar[1,*], Khushnud Alam[2], Pabitra Mandal[2], Swargajyoti Das[3], Dharmen Bhansali[4]

[1]Dept. of Pedodontics and Preventive Dentistry, Rungta College of Dental Sciences and Research, Bhilai, Chhattisgarh, India
[2]Rungta College of Dental Sciences and Research, Bhilai, Chhattisgarh, India
[3]Silchar Dental College, Silchar, Assam, India
[4]Dept. of Oral Medicine and Radiology, Rungta College of Dental Sciences and Research, Bhilai, Chhattisgarh, India

A R T I C L E   I N F O

A B S T R A C T

Introduction: In prosthodontics, esthetics a combination of the art and science. Patients requiring complete dentures usually expect comfort first, followed by harmonious appearance, and lastly efficiency. Therefore, the correct selection of the artificial teeth is essential for achieving a pleasant esthetic outcome. A number of soft tissue landmarks have been purported as useful for anterior tooth selection; but these are easily affected by several factors such as aging and the weight and build of the person. In the present study hard tissue landmarks like pterygomaxillary notches and maxillary arch width was presented as alternative anatomical landmark for anterior teeth selection. The aim of the study was to evaluate the hamular width and inter maxillary arch width which could be the guide for the selection of artificial teeth for complete maxillary denture in the North-East Indian population.

Materials and Methods: The study was conducted on 100 dentate individuals from the North Eastern Indian population, between the age group of 18- 30 years. All measurements were done with digital calliper on cast obtained after impression with irreversible hydrocolloid impression material.

Result : Pearson correlation analysis showed, statistically significant correlation between maxillary archwidth and central incisor width. The result was significant at p<0.05 but not high enough to be practically used. Correlation between hamular width and central incisor width was found to be insignificant. The value of R was 0.05435. The result was significant at p < 0.05.

Conclusion: The maxillary arch width was in direct proportion to the maxillary central incisor width which meant that the increase of maxillary arch width,there was a corresponding increase of maxillary central incisor width. Significant correlation was found between maxillary arch width and central incisor width with p value=0132. The result was significant at p<0.05 but not high enough to be practically used. But In this study statistically insignificant correlation was found between hamular width and central incisor width.

1. Introduction

The esthetic restoration of the edentulous condition, has profound potential to affect psychology of a patient.[1–3] Denture esthetics is defined as the cosmetic effect produced by a dental prosthesis which affects the desirable beauty,

* Corresponding author.
    E-mail address: brij220787@gmail.com (B. Kumar).

attractiveness, character and dignity of the individual.[4] The subject of esthetics is not a totally scientific and objective discipline nor is it 100% an art form. According to Young "it is apparent that beauty, harmony, naturalness, and individuality are major qualities of esthetics".[5] In prosthodontics, it is a combination of the art and the science. Optimal outcome of any prosthesis treatment depends on the successful integration of the prosthesis with the patient's oral functions plus psychological acceptance of the dentures by the patient. Patients requiring complete dentures usually expect comfort first, followed by harmonious appearance, and lastly, efficiency.[6] Therefore, the correct selection of the artificial teeth is crucial step to achieving a pleasant treatment outcome. In a situation where preextraction records are not available, selection and arrangement of artificial teeth for edentulous patients in natural and aesthetically pleasing position becomes a cumbersome procedure even for an experienced prosthodontist. Attempts have been made to find a method to choose the size of anterior teeth, but no single method has been accepted universally so far. The size and form of the maxillary anterior teeth affects dental esthetics as well as facial esthetics. The goal of esthetic restoration in edentulous patient can be achieved when maxillary anterior teeth are restored in harmony with the facial appearance. However, little scientific data are mentioned in dental literature regarding this.

Few of these methods described in literature are based on soft tissue landmarks, but problems associated with these biometric soft tissue landmarks is dynamic with changes occuring with age, weight and health of the patient.[5]

Few studies indicated the use of hard tissue landmark for measurement of size of anterior teeth in an edentulous patient. Some of them stated that there is a significant relationship between hamular distance and maxillary anterior width. Hard tissue landmarks such as interhamular width, intermaxillary width, palatal length all are used as guide for selection of anterior teeth for an edentulous patient. This is based on the fact that the size of anterior teeth is in harmony with anatomical landmarks. The aim of this study was whether hamular notch can be used as a reliable guide for selection of anterior tooth size universally or whether it varies according to races or factors like age and extraction on dental cast. The term race has been defined as "a group or population characterized by some concentrations, relatives as to frequency and distribution of hereditary genes or physical characters,which appears to fluctuate and often disappear in the course of time by the reason ofgeographical and cultural isolation".[6] In the opinion of UNESCO it is better to use the term ethnic group instead of race.[7] The study was carried out on 100 dental casts of North Eastern Indian population. North East India, also known as, land of seven sisters covers political units namely– Assam, Arunanchal Pradesh,

Mizoram, Meghalaya, Nagaland and Tripura.[7] It is located between latitude $20^0$and 22^0 north and longitude 89^046'and 97^05' east. The North East India is the homeland of large number of races /ethnic groups and shows variation in physical features.[7] Therefore the knowledge of racial norms for facial appearance might aid the dental practitioner understand some empirical prosthodontic decisions and may indicate some esthetic and functional alterations that need to be made in treatment plans to accommodate and be in harmony with the esthetic requirement of racial groups in this part of Indian population.

2. Materials and Methods

The study was conducted on dental cast collected from individuals (male and female), within the age group of 18-30 years. A total of 100 casts were selected from the North Eastern Indian population.

The inclusion criteria for selecting dental casts included, presence of all Natural permanent maxillary and mandibular teeth (except 3rd molar), Angle class I caliper- mandibular relationship, natural maxillary permanent teeth in good alignment without drifting, spacing or attrition, no frontal tooth restoration or prosthetic appliance, no history of orthodontic treatment, no congenital or surgical facial defect and no gingival recession or hypertrophy. All the subjects were from North East Indian population.

Casts with interdental spacing or crowding and apparent loss of tooth structure by attrition in frontal teeth, with artificial crown or partial denture prostheses either on maxillary or mandibular arch, with asymmetries and abnormalities in tooth size or shape as well as showing marginal periodontitis and gingival recession or damaged casts were excluded.

2.1. Measurements

All measurements were made on the maxillary dental casts directly using a precise caliper of a 0.01-mm precision level.

Mesiodistal width of each maxillary central incisor tooth was measured at their widest part. The points were identified on each cast and marked with graphite. The distance was measured in a straight line using a digital caliper at the level of interdental contact points. (Figure 1). The most mesial demarcation point of the pterygomaxillary notches was identified on each stone cast and marked with graphite (Figure 2). The distance between two pterygomaxillary notches was measured. Central pit of central fossa was identified on cast and marked with graphite. Maxillary arch width was measured between central pit of central fossa of the right and left maxillary first molar tooth (Figure 3).

3. Results

Kolmogorov Smirnov test found the data to be consistent with a normal distribution: P= 0.92. Descriptive statistics
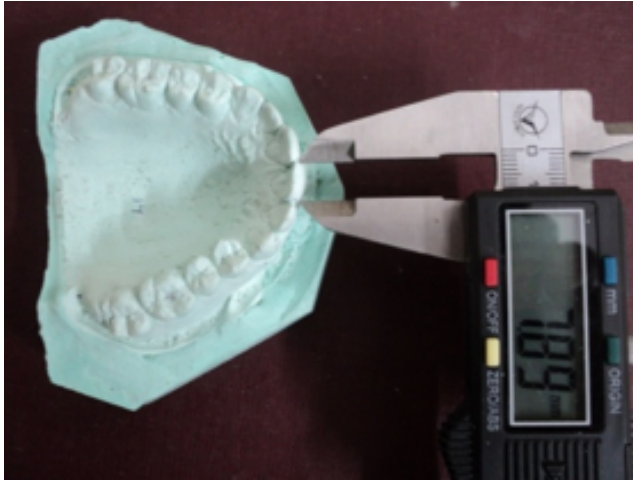
Fig. 1: Measuring incisor width
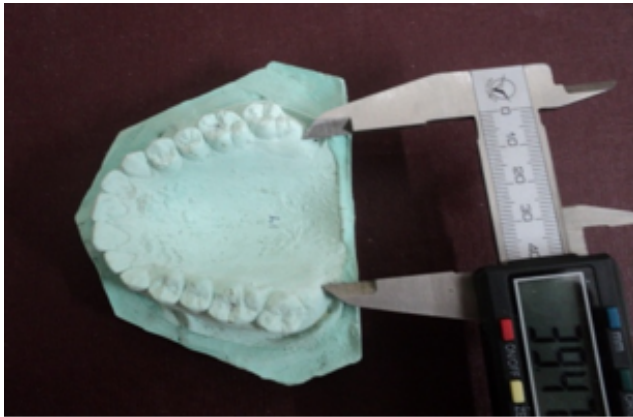
Fig. 2: Measuring interhamular width

Fig. 3: Measuring Maxillary width

for each was tabulated and no significant difference between the dimensions of the left and the right maxillary central incisors ($p>0.05$) were observed. Therefore, mean values between the left and the right maxillary central incisors dimensionswere used.

Pearson coefficient was calculated. Statistically significant correlation was found between maxillary arch width and central incisor width with value0.25110. The result was significant at $p<0.05$ but not high enough to be used practically. Correlation between hamular width and central incisor width was found to be insignificant. The value of R was 0.05435. The result was significant at $p < 0.05$.

Between maxillary arch width and maxillary central incisor width regression coefficient was 12.46 and 0.09 with f value equal to 6.59 and standardized coefficient was 25.There was a linear relationship between the two measurements according to linear regression analysis, however standardized coefficient was found to be as low as 25%(0.25).

Between inter hamular width and maxillary central incisor width linear regression coefficient was 16.277 and 0.01796 with f value equal to 0.29.There was no linear relationship found between the two measurements according to linear regression (standardized coefficient 0.054).

4. Discussion

Despite a number of studies on selection of artificial teeth, controversies remain. Despite the recent advanced methods, we still come across the difficulties in selection of artificial teeth. Selecting the ideal artificial anterior teeth for edentulous patients can be difficult when pre-extraction records are not available. As often no preextraction records are available to serve as a guide, it is necessary to make decisions based upon other informations or techniques. Numerous methods have been devised for the evaluation of artificial tooth size however none of these methods have been used alone for tooth selection reliably and their advantages and disadvantages put the dentist into a dilemma as to which method is best to use.In majority, soft tissue landmarks were suggested for determination of anterior tooth selection such as inter canthal distance, interalar nasal width, as a useful methodfor establishing the width of the maxillary anterior teeth. However, Varjao[8] and Kern[9] have pointed out the existence of inconsistent relationship between biometric measurements and artificial tooth selection.

The pterygomaxillary notches is a hard tissue landmark and do not tend to change with some inevitable factors such as weight changes, aging, and extraction of teeth.[10] Hence, measurements of interpterygomaxillary notch distance could be a practical method for clinical application in tooth size selection in an edentulous and partially edentulous

patient as these can be easily localized on the dental casts. Johnson and Stratton[11] stated that the width of the six anterior teeth equals the distance between the buccolingual centers of the pterygomaxillary notches plus 5 mm. Ustun Guldag[12] confirmed about the significant correlation between pterygomaxillary notches and maxillary anterior teeth (p=0.003), but he also mentioned that correlation coefficient is low for practical use. In this study statistically insignificant correlation was found between hamular width and central incisor width r=0.05435p.The result was significant at p<0.05 but not high enough to be practically used. Correlation between maxillary arch width and central incisor width was found to be significant withr = 0.25110. Although technically a positive correlation, the relationship between variables was weak. The result is significant at p < 0.05.

Nikola P[13] stated that the width of central incisor can be calculated at their contact point by dividing hamular width by 5.51, but in this study statistically insignificant correlation was found between hamular width and central incisor width. This could be the result of an influence of genetic, cultural, environmental and food habits on anatomical landmarks. Further studies in other racial populations are required to make a definite conclusion that whether there is any relationship between maxillary anterior tooth size and interpterygomaxillary notch.

5. Conclusion

According to the observations taken from regression lines, the distance between the maxillary arch width was in direct proportion to the maxillary central incisor width which meant that the increase of maxillary arch width, there is corresponding increase of maxillary central incisor width. Significant correlation was found between maxillary arch width and central incisor width with p value= 0.0132. The result was significant at p<0.05 but not high enough to be practically used. But In this study statistically insignificant correlation was found between hamular width and central incisor width r=0.05435p. Influence of genetics, culture, environment and food habits cannot be denied. Further research in other races is required to reach a definitive conclusion. Selection of anterior tooth size may be more appropriate using multiple facial measurements to achieve ideal esthetic outcome.

6. Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

7. Source of Funding

None.

References

1. Frush JP, Fisher DR. Introduction to dentogenic restorations. *J Prosthet Dent*. 1955;5(5):586–95. doi:10.1016/0022-3913(55)90084-6.
2. Sellen PN, Phil B, Jagger DC, Harrison A. Methods used to select artificial anterior teeth for the edentulous patient: a historical overview. *Int J Prosthodont*. 1999;12(1):51–8.
3. Wazzan A, A K. The relationship between intercanthal dimension and the widths of maxillary anterior teeth. *J Prosthet Dent*. 2001;86(6):608–12. doi:10.1067/mpr.2001.119682.
4. The Glossary of Prosthodontic Terms Seventh Edition (GPT-7). *J Prosthetic Dent*. 1999;81(1):48–110. doi:10.1016/S0022-3913(99)70234-9.
5. Gomes VL, Gonclaves LC, Prado CJD. Correlation between facial measurements and mesiodistal width of the anterior teeth. *J Esthet Restor Dent*. 2006;18(4):196–205. doi:10.1111/j.1708-8240.2006.00019_1.x.
6. Dunbar KD. Natural appearance for the individual denture patient. *J Pros Dent*. 1960;10(2):205–14. doi:10.1016/0022-3913(60)90041-X.
7. Das BN. The people of Assam-Origin & Composition. vol. 27. India: Gyan Publishing House;. p. 186.
8. Varjao FM, Nogueira SS. Intercommisural width in 4 racial groups as a guide for the selection of maxillary anterior teeth in complete dentures. *IntJ Prosthodont*. 2005;18(6):513–5.
9. Kern BE. Anthropometric parameters of tooth selection. *J Prosthet Dent*. 1967;17(5):431–7. doi:10.1016/0022-3913(67)90140-0.
10. Ferrario VF, Sforza C, Dellavia C. Three-dimensional hard tissue palatal size and shape: a 10-year longitudinal evaluation in healthy adults. *Int J Adult Orthodon Orthognath Surg*. 2002;17(1):51–8.
11. Johnson DL, Stratton RJ. Fundamentals of removable prosthodontics. Quintessence Publishing Co. Inc; 1980. p. 389.
12. Guldag MU, Buyukkaplan US, Sentut F, Ceylan G. Relationship between pterygomaxillary notches and maxillary anterior teeth. *J Prosthet Dent*. 2010;19(3):231–4.
13. Petricevic N, Celebic A, Robert A, Baveic M. Importance of hamular distance for calculation of the width of maxillary anterior teeth. *Acta Stomatologica*. 2005;39(3):291–4.

Author biography

Nilotpol Kashyap, Professor

Brij Kumar, Reader

Khushnud Alam, Dental Surgeon

Pabitra Mandal, Dental Surgeon

Swargajyoti Das, Professor

Dharmen Bhansali, Senior Lecturer