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An auto - cad based study to evaluate correlation between maxillary central incisor tooth form, face form and arch form.

Dental Science

Kattamuri Vijay kanth	pg trainee, department of prosthodontics, Gitam dental college, rushikonda, vishakapatnam, andhrapradesh, India.
Sumeet kumar sharma	Reader, department of prosthodontics, gitam dental college, rushikonda, vishakapatnam, andhrapradesh, India.
Ravi shankar yalavarthy	Professor and head of the department, Department of prosthodontics gitam dental college, Vishakapatnam, andhrapradesh, India.
Lavanya pentapati	Pg trainee, department of prosthodontics, gitam dental college, vishakapatnam, andhrapradesh, India.
P Shameen kumar	Senior lecturer, department of prosthodontics, gitam dental college, Visakhapatnam

ABSTRACT

Background: Edentulism whether partial or total has a profound impact on life of individual in terms of social well being and general health of the individual. As teeth form an integral part of facial esthetics, their placement should be compatible with facial features and at the same time should be functional and esthetically pleasing. To fulfill the patient esthetic criteria and to give the patient a pleasing smile, selection of anterior teeth is very important.

Aims and objectives: To determine the relationship of tooth form, arch form with the face form.

Materials and methods: A total of 500 subjects of age group 18 to 25 years were selected for the present study. Impressions of the maxillary arch were made and models were generated. Standardized photographic procedure was used to record the patients face and central incisor form. Similarly photographic procedures were used to capture the arch form from the model and these images were transferred to a computer and were superimposed using an Auto - cad software to evaluate the correlation among each. The results were tabulated and SPSS -20.0 was used for statistical analysis. The statistical test used were Mean, Standard deviation (SD), p-value, and chi square test.

Results: The results obtained showed that, the arch form to face form showed more similarity of 36% when compared to the face form with tooth form with similarity of 32%.

Conclusion: As per the results obtained, it can be concluded that the face form cannot be taken as sole guideline in selecting the artificial teeth.

Background:

Dentofacial morphology is closely related to facial esthetics.[18] Esthetics is a primary consideration for patients seeking prosthodontic treatment and esthetics when applied to complete denture prosthesis, may be defined as combination of science and art. Anterior teeth are one of the key elements when making an aesthetic analysis of the face. The goal is to have the maxillary anterior teeth to restore optimal dentolabial relations in harmony with the overall facial appearance.[7] For edentulous patients with no available pre-extraction records, the choice of tooth mold and arrangement becomes far more difficult, resulting in disappointment if the selection and expectations of the patient do not match those of the dentist. There have been many efforts to find the most suitable method that would allow dentists to make restorations look as natural as possible, avoiding the appearance of artificial dentures.[11,15] However, there is little scientific data in the dental literature to use as a guide for defining the proper size and shape of anterior teeth or determining normal relationships for them.[7] The temperamental theory was the first widely accepted method for selecting anterior teeth. It is based on the temperament theory proposed by Hippocrates in the fifth century BC, which tries to relate the personality of people with their body shape and size, thus allowing to deduce the shape of their teeth.[11] The dentogenic theory of Frush and Fisher[2] represents a variation of the temperament theory and proposes a method of selection of anterior teeth based primarily on sex, age and personality. They thought that women's dentition reflected smooth, rounded surfaces and men's dentition reflected force and toughness. In 1914, William [1] rejected the theory of temperaments and proposed a new method for the election of anterior teeth based on the shape of the patient's face, which reflected the reverse contour of the upper central incisor. By

analyzing the area between the eyebrows and the tip of the chin, he identified and classified three typical shapes of faces: square, tapering and ovoid. Williams also suggested that there are three kinds of teeth: Class I: square tooth (parallel proximal surfaces), Class II: tapering tooth (converging proximal surfaces), Class III: ovoid tooth (rounded proximal surfaces). "Williams's law of harmony" [1] proposes that a square face should have square teeth, a tapering face should have tapering teeth, and an oval face should have ovoid teeth. Only in this way harmony between the teeth and the face of a patient could be achieved. Recent studies such as those by Mahmoud [14] and Rodriguez et al [17] confirmed Williams's law concerning the presence of harmony between the shape of the face and the shape of the upper central incisor. However, many other studies [4,6,8,10,12] have shown that there is not a real relationship between the shape of the face and the shape of the upper central incisor as stated by "The law of harmony" proposed by Williams.[1] The literature is based mostly on study populations outside India, and there is an apparent lack of information about the selection of maxillary central incisor forms in subjects of Indian ethnicity.

This study aimed to determine the correlation between the face form with tooth form and arch form according to the "Law of harmony" proposed by Williams. [1] It was anticipated that any correlation obtained would be helpful for selection of artificial teeth for edentulous patients of Indian ethnicity. The main objective of this study is to decide the face form, tooth and arch form and find the correlation between them.

Materials and methods:

A Total of 500 Undergraduate Students With Age Group 18-25 Years Of Indian Origin participated in the study.

The inclusion criteria were
(1) No missing maxillary or mandibular anterior teeth;
(2) No gingival or periodontal conditions or therapy that would undermine a healthy tissue-to-tooth relationship;
(3) No interdental spacing or crowding;
(4) No anterior restoration; and
(5) No history of orthodontic treatment

Exclusion criteria eliminated subjects with
(1) Evidence of gingival alteration or dental irregularities;
(2) Apparent loss of tooth structure due to attrition, fracture, caries, or restorations; and
(3) Obvious problems that could disfigure or otherwise affect the face and dentition.

Procedure:
Each subject was seated upright with the head supported by a head rest on a chair with the occlusal plane of the maxillary teeth parallel to the floor. An impression of maxillary dentition of each subject was made with irreversible hydrocolloid material (plastalgin, septodont) using stock trays and study casts (type 3 dental stone) were prepared. Two standardized photographs were taken for each subject one for facial portrait and the other for maxillary incisors. For each photograph, standardized distances (portrait 100 cm, teeth 12 cm) were used. The height of the Nikon D5300 digital camera (full-featured DX-format DSLR with 24.2-megapixel and CMOS sensor) mounted on a tripod was adjusted individually according to the position of the subject's face and teeth. A full-face photograph with the closed lips was obtained, with the lens positioned parallel to the subject's face. An intraoral photograph of the maxillary central incisors was obtained with the lens parallel to the labial surface of the teeth. The images of the teeth and the face were then transferred to a computer. Using Auto cad software 2015 the facial outline form (face form) was determined by marking certain anatomic landmark i.e. upper border of eyebrows, zygomas, angles of mandible and chin. Outline on tooth (FIG:1) was followed the curvature of cervical margin, mesial margin, incisal edge and distal margin. Outline of arch was drawn over the incisal edges of anterior teeth and buccal cusps of posterior teeth as far as second molars from the photographs obtained. Outlined images (FIG:2) of face, tooth and arch were set at proper pixel size.[14] Outlined image of tooth was first inverted or rotated at 180 degrees and then superimposed on the subject's face image, to coincide the chin with the cervical margin of the tooth. Superimposition of arch image on face image: - outlined arch image was rotated at 180 degree and outlined arch image then placed on subject's face image, until the anterior arch curvature aligned with chin.

Then an assessment of correlation between face, tooth and arch form superimposed outlined images was done by same observers. Findings were grouped under following categories.
• Correspond: very close match between images.
• Similar: some resemblance between images.
• Dissimilar: images differed significantly.

The observations were tabulated using Microsoft Excel data sheet. The statistical analysis done using SPSS 20.0. Mean, Standard deviation (SD), p-value, and chi square statistical tests were performed.

Results:
The results showed that arch form to face form showed a similarity of 36%, dissimilarity of 42% and corresponds of 22% while tooth form to face form showed similarity of 32%, dissimilarity of 52% and corresponds of 16%. The results reveals p value insignificance.

Discussion:
One of the essential factors in satisfying a patient with complete denture is that denture should be pleasing and natural in appearance. In a developing country like India, problems such as non-availability of pre-extraction records often hinder fabrication of

dentures. Several esthetic guides have been proposed as aids for artificial tooth selection. To date, no reliable method has been found, but William's method [1] is that most widely and universally accepted. Many studies had been done previously, to evaluate correlation of esthetic factors i.e. tooth form, face form and arch form. From those, some authors had given their own theories; some had done studies on validity of those theories, and some had done computer based studies for evaluation of correlation between tooth form, face form and arch form. The purpose of this study was to identify face, central incisor and arch shapes and to investigate the possible resemblances using an Auto – Cad software (AutoCAD is a commercial software application for 2D and 3D computer-aided design (CAD) and drafting). The computer based auto cad programme used for this study provided the opportunity for convenient electronic evaluation or tooth, arch and face form of the subjects and correlation among these forms is done. The method of making images was more practical directly into the database software and evaluation was made on basis of obvious images of anterior tooth, full arch as well as face images. An assessment of the correlation between face, tooth and arch forms was made with the superimposed outline tracings produced in the auto cad programme. These findings invalidate William's 'law of harmony' because nearly two thirds of the population showed no correlation. These methods are therefore not reliable for selecting artificial maxillary central incisor tooth forms for edentulous patients of Indian origin. William in his original work disproved his own theory by stating "subjectively similar teeth existed in dissimilar skulls.[16]

Bell, Broadbelt, Mavroskoufis et al also carried out study on correlation of face form to tooth form and found insignificant correlation between these factors and their results support the present study.[4] F.A.P. Silva, N.L.F. de Almeida et al done digitalized study of the correlation between the face and tooth shapes in young adults. [9] Sellen had also done computerized study and showed 22% correspondence which is somewhat higher than the present study [5]. It may be because of different subjective visual perception. Vivianne et al observed that association between the shapes of the face and maxillary central incisor was significant with greater prevalence with oval shape [13]. 'Dentogenic theory' given by Frush and Fisher [2] is based on SPA factors which can be taken as more physiological than the geometric theory of William so it can be considered for anterior tooth selection.

Before concluding, it is suggested that a probe into improvement in the field of facial aesthetics still remains incompletely explored and further such studies and researches can be very beneficial for the clinicians to provide the patient with the best possible facial aesthetics through the media of replacing with artificial dentition, the valuable treasure which the patient has lost. But still it is worthwhile to maintain the slogan of Horn – "Architects deal in symmetry. Nature rarely creates perfect symmetry. Dentist should not." [3]

Limitations of the study:
Although the current method is sophisticated, complexity of the method of measurement may make it impractical for common application.

Conclusion:
From this study, following conclusions were made:
The face form to tooth form showed more dissimilarity. According to result of this study, William's geometric theory is insignificant. The arch form to face form found more similarity and showed only 42% dissimilarity. So, from this, it can be concluded that when pre-extraction records are not available, we cannot take face form as a guideline in selection of teeth particularly of anteriors in complete dentures. Various other measurements such as bizygomatic width, intercanine distance are to be used in selection of anterior teeth. Correspondence of outline forms through superimposition shows an insignificant correlation between face, tooth, and arch forms.

Legends for tables and Figures:
Figure 1: Outlining the tooth form using auto cad software

Figure 2: outlined face form, arch form, tooth form and correlating by superimposing the tooth form on arch and face form.
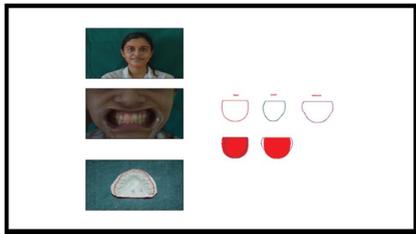

Table 1:
**Showing correlation of face form to tooth form, arch form to face form along with percentage**

			GROUP		
			TOOTH TO FACE FORM	ARCH TO FACE FORM	Total
SAMPLE	DISSIMILAR	Count	260	210	470
		% within GROUP	52.0%	42.0%	47.0%
	SIMILAR	Count	160	180	340
		% within GROUP	32.0%	36.0%	34.0%
	CORRESPOND	Count	80	110	190
		% within GROUP	16.0%	22.0%	19.0%
	Total	Count	500	500	1000
		% within GROUP	100.0%	100.0%	100.0%

Table 2: chi square test results

		arch to face form
tooth to face form	Correlation Coefficient	0.224
	p-value	0.118
	N	500

NOT SIGNIFICANT.

Table 3: Showing correlation of face form to tooth form, arch form to face form (BAR DIAGRAM)
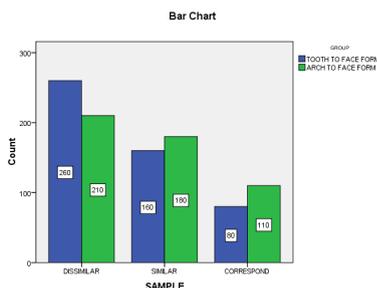
References:
1. Williams J L. A new classification of human tooth forms with a special reference to a new system of artificial teeth. Dent Cosmos. 1914;56: 627.
2. Frush J, Fisher R. How dentogenic restorations interpret the sex factor. J Prosthet Dent. 1956;6:160-72.
3. Horn HR. Forward on symposium on esthetics. Dent Clin North Am 1967: 1-7.
4. Mavroskoufis F, Ritchie G M. The face-form as a guide for the selection of maxillary central incisors. J Prosthet Dent 1980;43(5):501-5.
5. Sellen PN, Jagger DC, Harrison A. Computer-generated study of the correlation between tooth, face, arch forms and palatal contour. J Prosthet Dent 1998; 80: 163-78.
6. Ibrahimagi L, Jerolimov V, Celebic A, Carek V, Baucic I, Knezovi D. Relationship Between the Face and the Tooth Form. Coll Antropol. 2001;25(2):619–26.
7. Ufuk Hasanreisoglu, Semih Berksun, Kerema anand, Ilker Arslan, An analysis of maxillary anterior teeth: Facial and dental proportions, J Prosthet Dent 2005;94:530-8.
8. Varjâo M, Sualdini S, Russi S, Neudenir J. Correlation between maxillary central incisor form and face form in 4 racial groups. Qintessence Int. 2006;31(10):767-71.
9. Silva FAP, de Almeida NLF, Ferreira DF, Mesquita MF, de Negreiros WA. Digitized study of the correlation between the face and tooth shapes in young adult individuals. Braz J Oral Sci 2007; 6 : 1383-86.
10. Peixoto F, Freitas N, Filgueiras D, Ferraz M, Araújo W. Digitized study of the correlation between the face and tooth shapes in young adult individuals. Braz J Oral Sci. 2007;22(6):1383-86.
11. Fonollosa J. Integración y estética en rehabilitaciones completas acrílicas. Gac Dent. 2010;215:152-71
12. Rodríguez P, Martínez J, Celemín A. Estudio entre las formas y proporciones del contorno facial y del incisivo central. Gac Dent. 2011;90(11):228
13. Pedrosa VO, Franca FMG, Florio FM, Basting RT. Study of the morpho-dimensional relationship between the maxillary central incisor and the face. Braz Oral Res 2011.
14. RON Goodlin. Photographic assisted diagnosis and treatment planning: Dent clin N Am, Apr 2011, vol55, no 2.
15. Mariano R, Marggiorini M, Koichiro A, Kairalla S, Torres F, Paranhos L. A forma do incisivo central superior na visão da literatura. Rev Fac Odontol Univ Passo Fundo. 2011;16(3):337-41..
16. Pavankumar R, Dhanyakumar H. A clinical study to evaluate the correlation between maxillary central incisor tooth form and face form in an Indian population. J Oral Sci. 2012; 54(3):273-78..
17. Mahmoud L. Face central incisor form matching in selected south Asian population. Sci Res Essays. 2012;7(5):616-20.
18. Weber B, Fuentes R, García N, Cantín M. Relaciones de Forma y Proporción del Incisivo Central Maxilar con Medidas Faciales, Línea Mediana Dentaria y Facial en Adultos. Int J Morphol .2014;32(3):1101-7.