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A clinical study to evaluate the correlation between maxillary central incisor tooth form and face form in an Indian population

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(Received 9 March and accepted 13 August 2012)

Abstract: A study was performed to examine the correlation between maxillary central incisor tooth form and face form in males and females in an Indian population. The selection of prosthetic teeth for edentulous patients is a primary issue in denture esthetics, especially in the case of maxillary central incisors, which are the most prominent teeth in the arch. Two hundred dental students of Indian origin comprising 79 males and 121 females aged 18-28 years studying at Bapuji Dental College and Hospital were randomly selected as the study subjects. A standardized photographic procedure was used to obtain images of the face and the maxillary central incisors. The outline forms of the face and the maxillary right central incisor tooth were determined using a standardized method. The outline forms obtained were used to classify both face form and tooth form on the basis of visual and William's methods. The means were considered after evaluation by five prosthodontists, and the results were tabulated. Statistical analysis was performed using the chi-squared test for association and Z-test for equality of proportions. A correlation greater than 50% was observed between tooth form and face form by the visual method, compared with one of 31.5% by William's method. There was no highly defined correlation between maxillary central incisor tooth form and face form among the male

and female Indian subjects studied. (J Oral Sci 54, 273-278, 2012)

Keywords: tooth form; face form; maxillary central incisor; edentulous; William's classification.

Introduction

The term esthetics is derived from the Greek word *aisthetikos*, meaning perceptive (1). Esthetics, as applied to a complete denture prosthesis, may be defined as a combination of science and art. Art is in itself a science - the appreciation of the beautiful in both form and color. By skillful application of this science, it is possible to produce beautiful restorations that are almost completely natural in appearance (2).

If some teeth remain, it is a relatively straightforward procedure to select artificial teeth that blend with the natural dentition. However, 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 (3).

The size and form of the maxillary anterior teeth are important to not only dental, but also facial esthetics. The most influential factors contributing to a harmonious anterior dentition are the size, shape, and arrangement of the maxillary anterior teeth, particularly the maxillary central incisors as viewed from the front (4).

Facial dimensions have been obtained by measuring the distance between zygomas for face width and the distance from the hairline to the gnathion for face length. The measurements obtained are divided by 16 to determine the length and width of the maxillary central

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incisor. Also, measuring devices such as the Trubyte Tooth Indicator, Trubite Teleform gauge, and Tooth selector have been used for determining the form of an artificial tooth (4-6). To date, William's (7) classification is the most universally accepted method of determining maxillary central incisor tooth form.

Based on William's theory, many studies have attempted to evaluate the correlation between the upside down facial form and the form of the maxillary central incisor (5,7-9). The prosthodontics 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.

In the present study, therefore, we attempted to clinically examine the correlation between maxillary central incisor tooth form and face form in males and females in an Indian population. It was anticipated that any correlation obtained would be helpful for selection of artificial teeth for both male and female edentulous patients of Indian ethnicity.

Materials and Methods

As study subjects, a total of 200 dental student subjects (79 males and 121 females) of Indian origin belonging to different states and different age groups, who were studying at Bapuji Dental College and Hospital, Davangere, Karnataka, India, were randomly selected. Inclusion criteria for the subjects were:

- Dentulous and aged 18-28 years.
- Completely dentate arch with presence or absence of third molars.
- Natural maxillary anterior teeth in good alignment. Exclusion criteria for the subjects were:
 - Restoration of maxillary anterior teeth by a complete or partial veneer crown.
 - Extensive carious lesions, incisal wear, tooth fracture and gingival hyperplasia of the maxillary anterior teeth.
 - Previous orthognathic surgery or orthodontic treatment.
 - Congenital or surgical facial defects and any anomalies of the teeth.

The purpose and nature of the intended research procedure was explained adequately to all subjects in their own language, who were then asked to sign an informed consent form. It was approved by the institutional ethics committee.

Procedure

Each subject was seated upright with the head



Fig. 1 Outline tracing of the face (face form)



Fig. 2 Outline tracing of the right maxillary central incisor (tooth form).

supported by a head rest on a chair with the occlusal plane of the maxillary teeth parallel to the floor. Two standardized photographs were taken for each subject: facial portrait (closed lips) and the maxillary incisors (without lips). For each photograph, standardized distances (portrait 100 cm, teeth 12 cm) were used. The height of the Olympus FE-200 digital camera (Olympus Corp., Tokyo, Japan) mounted on a tripod was adjusted individually according to the position of the subject's face and teeth (9). A full-face photograph with the closed lips was obtained, with the lens positioned parallel to the subject's face. The subject's hair did not cover any part of the face, and the teeth were in contact (9,10).

An intraoral photograph of the maxillary central incisors was obtained using cheek retractors, 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 (Windows PC, Microsoft) running image-editing software (Photoshop 6.0, Adobe). The facial outline form (face form) was determined from the outline of the temporal bone at the height of the hairline, the temporal process of the zygomatic arch, and the gonion (Fig. 1). The right maxillary central incisor tooth outline form (tooth form)



Fig. 3 Face form classified by the visual and William's methods.



Fig. 4 Tooth form classified by the visual method.



Fig. 5 Tooth form classified by William's method.

was determined using an outline tracing made around the buccal surface of the tooth, which corresponded to the mesial and distal contours, the incisal edge, and the cervical margin (Fig. 2). The photographic print-outs of the outline tracings were taken separately (7,10).

Photographic evaluation using the outline tracing prints for classifying face form and tooth form by both the visual method and William's method was performed by five prosthodontists each having 8 years of experience.

During the first session, the visual method of classifying face form and tooth form was explained, and the prosthodontists were asked to classify the cases by visually analyzing the print-outs of the outline tracings. After 3 months, a second session was conducted and William's method of classifying face form and tooth form was explained to the same prosthodontists, who were then asked to classify face form and tooth form based on William's method.

Visual method

The face form (Fig. 3) and the tooth form (Fig. 4) were classified first into square, tapering, ovoid or combination forms by visual analysis of the outline tracings (7,10,11)

William's method

The face form (Fig. 3) was classified based on William's (7) method as follows:

- a) Square face outline of the face between reference points showed no deviation from vertical.
- b) Tapering face the outline converged from the temporal bone to the gonion.
- c) Ovoid face the outline diverged from the temporal bone to the gonion.

The tooth form was classified by placing a diagram of perpendicular lines on the outline tracing print of the tooth form (Fig. 5), and the tooth in each quadrant was classified by William's (10) method as follows:

- a) Square incisor tooth mesial and distal proximal surfaces are parallel for at least half of the cervico-incisal length of the crown.
- b) Tapering incisor tooth mesial and distal proximal surfaces converge from incisal to cervical.
- c) Ovoid incisor tooth mesial and distal proximal surfaces are biconvex.

One of the three basic forms (square, ovoid or tapering) was attributed to a tooth only if that form predominated in at least 75% of the outline tracing (3 quadrants). If one basic form predominated in 50% of the outline tracing (2 quadrants), the tooth form was classified as a combination tooth form.

The mean values were taken, and the respective percentages were calculated by statistical analysis using the chi-squared test for association and the Z-test for equality of proportions.



Fig. 6 Correlation between tooth form and face form by the visual method and William's method.



Fig. 7 Correlation between tooth form and face form in males and females by the visual method.



Fig. 8 Correlation between tooth form and face form in males and females by William's method.

Results

According to the prosthodontists' evaluations, a correlation greater that 50% occurred between tooth form and face form by the visual method, compared with one of 31.5% by William's method (Fig. 6). The chi-squared test and Z test values of 13.41 and 3.66, respectively, were Table 1 Descriptive statistics for the correlation between maxillary central incisor tooth form and face form by the visual method, and correlation between maxillary central incisor tooth form and face form by William's method

Method	Correlated	Not correlated
Visual method	100 (50)	100 (50)
William's method	63 (31.5)	137 (68.5)

Figures in the parenthesis indicate percentage

 χ^2 = Chi-square test = 13.41, *P* (Probability factor) < 0.001 HS, *Z* (Test for equality of proportions) = 3.66

Table 2 Descriptive statistics for males and females regarding
the correlation between maxillary central incisor
tooth form and face form by the visual method

Male 42 (53) 37 (47)	79 (100)
Female 58 (48) 63 (52)	121 (100)

Figures in the parenthesis indicate percentage, χ^2 = Chi-square test = 1.01, *P* (Probability factor) > 0.05 NS, *Z* (Test for equality of proportions) = 0.54

Table 3 Descriptive statistics for males and females regarding
the correlation between maxillary central incisor
tooth form and face form by William's method

Gender	Correlated	Not correlated	Total
Male	29 (37)	50 (63)	79 (100)
Female	34 (28)	87 (72)	121 (100)

Figures in the parenthesis indicate percentage, χ^2 = Chi-square test = 1.26, *P* (Probability factor) > 0.05 NS, Z (Test for equality of proportions) = 1.18

found to be highly significant with a *P* value of < 0.001.

Among male and female subjects, a correlation greater that 53% and 48%, respectively, was obtained by the visual method (Fig. 7); the chi-squared test and Z test values of 1.01 and 0.54, respectively, were found to be non-significant with a *P* value of > 0.05. For William's method, the correlation was 37% and 28%, respectively (Fig. 8), having chi-squared test and Z test values of 1.26 and 1.18, respectively, which were non-significant with a *P* value of > 0.05.

Discussion

The Indian population is polygenetic and is a mixed amalgamation of various races, cultures and ethnic groups. 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. There are also numerous methods and techniques for establishing the relationship between face form and tooth form when determining the form of artificial teeth. To date, no reliable method has been found, but William's method is that most widely and universally accepted.

The correlation of 50% between tooth form and face form obtained using the visual method in the present study was concordant with a previous study that found a 51% correlation (11). The value was higher than in previous studies showing correlations of 39.3% and 30.6%, respectively (5,10), but less than in a study showing a 56% correlation (3).

The present correlation of 53% between tooth form and face form in males by the visual method was higher than in a study showing a 35.8% correlation (3). On the other hand, the present correlation of 48% between tooth form and face form in females by the visual method was less than in a study showing a 64% correlation (3).

The present correlation of 31.5% between tooth form and face form by William's method corresponded to a previous study done by the authors that found a 31.3%and 31% correlation, respectively (8,11). The value was higher than in a previous study showing a 24.4% correlation (10), but less than in a previous study showing a 35%correlation (9).

The present correlation of 37% between tooth form and face form in males by William's method was higher than in a previous study showing a 20% correlation (12). On the other hand, the present correlation of 28% between tooth form and face form in females by William's method was less than in a previous study showing a 30% correlation (12).

The limitations of the present study were that the prosthodontists, while classifying face form and tooth form first by the visual analysis method, were not given any specifically defined characteristics to classify. Later, after specific instructions on classifying face form and tooth form according to William's method, the evaluators failed to categorize the same forms for the maxillary central incisors. This may have been attributable to the infinite variety of tooth forms in nature. Also, the principles and application criteria for dental esthetic vary among individuals.

From the present findings it was concluded that there is no highly defined correlation between maxillary central incisor form and face form in males and females of Indian ethnicity. These results indicate that the maxillary central incisor tooth shows considerable asymmetry, whereas the face is basically symmetric. These findings invalidate William's 'law of harmony' because nearly two thirds of the population showed no correlation by William's method, and half of the population showed no correlation by the visual method. 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". So neither an inverted face shape nor gender should be used as a guideline for selection of anterior teeth, especially maxillary central incisors, for complete denture fabrication or complex anterior restorations, because this might lead to unsatisfactory results. Instead, the opinions and desires of the patient should be considered, to ensure optimal dental esthetics for each individual.

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