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A geometrical method to classify face forms

V. Ashok*, Dhanraj Ganapathy

Department of Prosthodontics, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India

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ABSTRACT

Introduction: Face form is a useful reference in numerous clinical prosthodontic procedures for nearly ten decades since the postulation of Leon Williams typal form theory. Hitherto, face forms has been studied by clinical and photographic assessment methods and classified it as square, tapering, square tapering and ovoid forms. The existing method of classifying face form is subjective as it is derived on visual perception and hence alternative methods have to be studied further.

Aim: The aim of the study was to analyze the existing classification of face form and to classify face forms based on geometrical method to eliminate the errors in classifying the face form by visual judgment.

Methods: 200 subjects of age group 18 to 25 were investigated with the clinical method using face form indicator and photographic method. Reference points were marked on the face form indicator and the photographs to classify face form. A geometrical method was used to classify face form based on the angle of convergence in the photograph. Based on the angle of convergence between the widest part of the face to the lower, middle and the upper third of the face, face form was classified. This method of classification widens the existing classification of face form with three additional types of face forms.

Results: A Comparison was done between the face forms obtained by clinical and photographic methods. Face forms obtained by clinical and photographic method showed no significant differences ($p > .05$) between them.

Conclusion: A geometrical method on photograph can be an effective method to analyze the various face forms to overcome the errors in visual judgment in the commonly used clinical method with face form indicator.

1. Introduction

Face form is a useful reference in numerous clinical prosthodontic procedures for nearly ten decades since the postulation of Leon Williams typal form theory.[1] Several authors have related the harmony of face form with central incisor tooth,[2–4] a few have related face form to upper edentulous arch form and classified edentulous arch form as square, tapering, ovoid.[5] Face form has also been related to an individual's smile pattern.[6]

Hitherto, face forms has been studied by clinical and photographic assessment methods and classified it as square, tapering, square tapering and ovoid forms. Sometimes it is difficult to define an individual's face to any one of these four divisions of face form. It has been observed that among the classical square, tapering, square tapering and ovoid face forms there are deviations which cannot be confined to anyone of these face form. The existing method of classifying face form is subjective as it is derived on visual perception. A geometrical method was therefore devised to analyze the face form which eliminates the errors in classification of face form based on visual judgment. The aim of the study was to analyze the existing classification of face form and to classify face forms based on geometrical method to eliminate the errors in classifying the face form by visual judgment.

2. Method

A preliminary investigation of face form was done by the clinical and photographic method to ascertain the accuracy between the two methods. 200 South Indian subjects in the age group ranging from 18 to 25 years of both sexes with good facial contour, without scars, wrinkles, pigmentation, moles, swelling, asymmetry of the face and other facial deformities were investigated using the face form indicator and photographs.

3. Device used to analyse the facial form

A face form indicator of 30 × 30 was fabricated indigenously from a flat 2 mm thick plexi glass plate. A triangular relief was given to the

* Corresponding author. Department of Prosthodontics Saveetha Dental College Saveetha Institute of Medical and Technical Sciences, Saveetha University, 162, Poonamallee High Road, Chennai, 600077, Tamil Nadu, India.
E-mail address: ashokprostho@gmail.com (V. Ashok).

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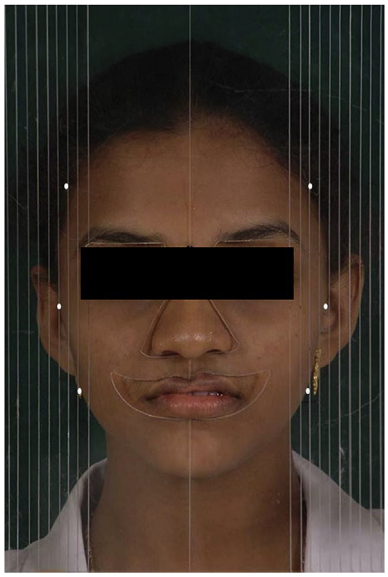

Fig. 1. Reference points marked on the face form indicator.

Fig. 3. Lines joining reference points ABC and A1B1C1 on the photograph.

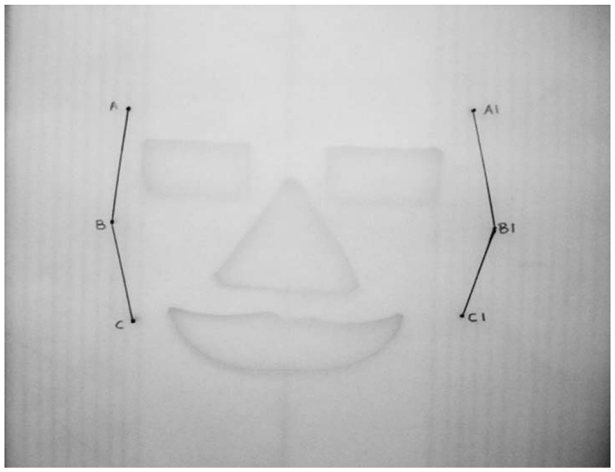

Fig. 2. Lines joining reference points A,B,C and A1,B1, C1 on the transparent paper.

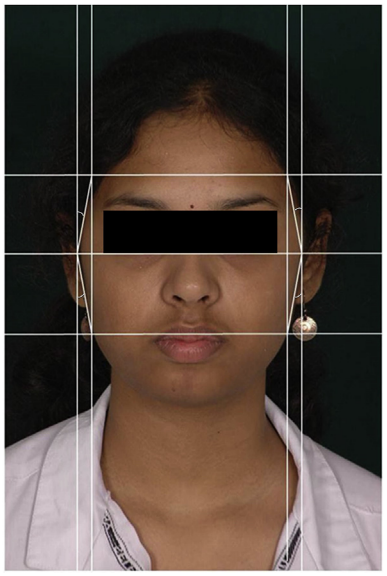

Fig. 4. Angle of convergence shown in the photograph.

nose to project from the plate when the indicator was placed on the subjects face. Relief was given in the upper and lower lip. These reliefs permitted the plexi glass plate to be kept close to the face, parallel to the coronal plane without any interference from the nose and lips. In addition to this, two eye slots were made for the eyes. In order to center the sagittal plane,a central line was marked on the middle of the plate, so that parallelism could be verified. Parallel lines on both sides with a distance of 5 mm gap were also marked in the plexi glass plate. By comparing these vertical lines with the side of the patients face, individual face form was determined.

1. Clinical method with face form indicator

Patient was seated in an upright position and the face form indicator was placed over the patient face, in such a manner that it fitted closely to the face, and it was in a perpendicular position to the horizontal plane, so that the midline of the face form indicator was parallel to the midline of the face and made parallel to the coronal and horizontal planes.

3.1. Marking of reference points

With the face form indicator in place six reference points A, A_1, B, B_1, C, C_1 were marked on the left and right sides of the face form indicator to represent the greatest width at the upper one third (forehead) middle one third (between zygoma) and lower one third (between angle of mandible) respectively [Fig. 1]. The face form indicator was then removed and the reference points were traced on a transparent paper placed over the face form indicator. Reference points ABC was connected with a line. In the same manner $A_1B_1C_1$ were also joined to each other to obtain the outline form of face in each of the subject [Fig. 2].

2. Photographic method

A portrait of the patients face was obtained with a standardized photographic method (Canon EOS 650D). Reference points (A A_1, B B_1, C C_1) were marked on the photograph similar to the clinical method to obtain the subjects face outline form [Fig. 3].

The clinical and photographic methods were compared in the 200

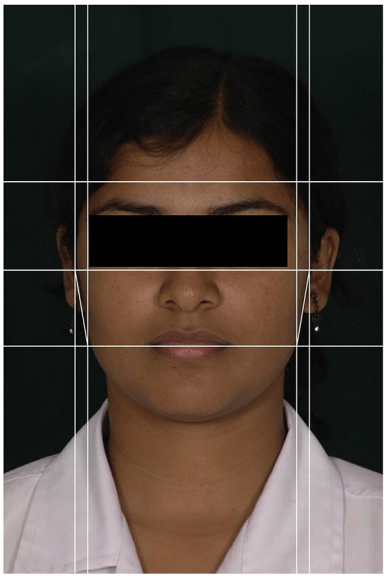

Fig. 5. Recommended angle of convergence for square face form.

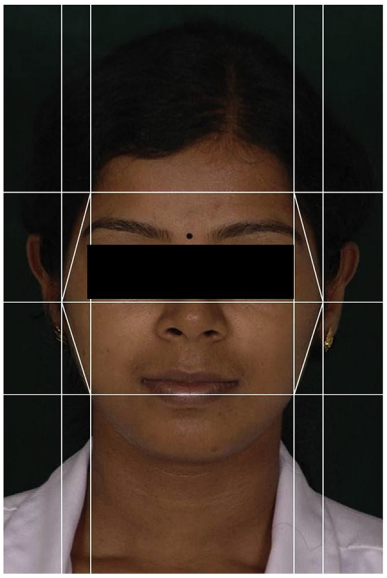

Fig. 6. Recommended angle of convergence for ovoid face form.

subjects to verify the accuracy between the two methods.

3.2. Geometrical method of classifying face forms on the photograph

A photograph of the patient was obtained and the reference points ABC and $A_1B_1C_1$ were marked on the photograph. Reference points ABC was connected with a line. Likewise $A_1B_1C_1$ were also joined to each other to obtain the outline form of face in each of the subject. A vertical line was then drawn at the widest part of the face on the photograph and the angle formed between vertical line and the line connecting ABC and $A_1B_1C_1$ was recorded.

3.2.1. Angle of convergence

The angle formed between vertical line representing the widest part of the face to the middle, upper or lower third of the face was designated as the angle of convergence [Fig. 4]. Based on artists perception and harmony of proportion the following equation is suggested to arrive at the face form of the subjects.

Angle of convergence range for square face form [Fig. 5] $< 5^\circ$ angle
Angle of convergence range for ovoid face form [Fig. 6] 5–12° angle
Angle of convergence range for tapering face form [Fig. 7] $> 13^\circ$
Angle of convergence range for square tapering form [Fig. 8]
From middle one third to upper one third $< 5^\circ$ angle
From middle one third to lower one third $> 13^\circ$ angle

4. Result

Table 1 shows the incidence of face forms in 200 subjects using the face form indicator and photographic method. It was seen that a majority of subjects (77%) had ovoid face forms. The second most common face form was the tapering (15.5%). Only 4.5% of the subjects had Square face. Square tapering was the least in the occurrence between all the four face forms with a percentage of 3%. While comparing both the face forms, tapering face form was seen in 15% and 16% between the clinical and photographic method. Similarly there was no significance difference in the incidence of square face form4% and 5%. Square tapering and ovoid face forms showed identical values. Chi square test showed no significant difference between clinical and photographic method ($p > .05$). So the photographic method can be used to classify face forms by analyzing the angle of convergence for each of the subject.

5. Discussion

Extensive research is being carried out regarding facial form and tooth form in designing a perfect smile as a standard protocol while restoring the structure, morphology and function of a maxillary anterior segment.[7,8] In patients whose anterior teeth are missing and for whom no records are available, choosing the form of anterior prosthetic teeth becomes more difficult.[9] The best artificial teeth are the ones that reflect the patient's sex and age, which render the prostheses more natural. Several criteria were presented to aid artificial tooth selection, and several methods were introduced to assess the best esthetic outcome of the definitive prosthesis after anterior tooth loss.[10] Among the most well-established criteria is the form of the face or maxillary arch for predicting the form of maxillary incisors.[11] Qualitative classification by Williams, first proposed in 1914, remains the most commonly accepted method for determining anterior tooth form1 and has been supported by studies that link the form of the face or the maxillary arch with that of the maxillary incisors.[12–14] Standardization is not possible in the existing methods of classification of face form as it is dependent on operator's perception. The geometrical method of classifying face form eliminates such errors.

Generally face forms are ascertained by the reference points marked in the face form indicator and photographs, which are then connected linearly to visually arrive at the face form of an individual. Observation by the visual judgment may not always be a dependable criterion to ascertain the face form, as it is subjective.[15,16] For example in an ideal square face form all the reference points should be in a straight line. However in a few subjects all the reference points may not fall in the same line, yet is included in the square face form. A square face form can merge with the square tapering face form. There are no criteria for the deciding limit between these two face forms, likewise also between the square tapering face form and ovoid face form. A criterion is therefore required to standardize and demarcate the boundary between the groups.

The geometrical analysis method based on angle of convergence used in this study, consisted in observing the angle formed between vertical line representing the widest part of the face and the line drawn connecting the widest part of the face to the middle, upper and lower third of the face as described in the methodology. In this manner standardization was possible to obtain the various face forms. From the computation made by the geometrical method in 200 subjects three new types of face forms namely ovoid tapering, tapering ovoid, tapering

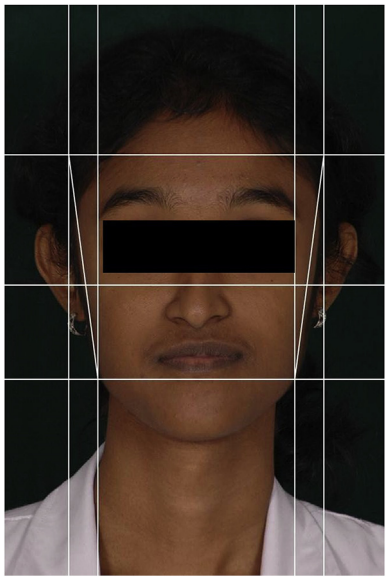

Fig. 7. Recommended angle of convergence for tapering face form.

Fig. 8. Recommended angle of convergence for square tapering face form.

Table 1
Face forms in 200 subjects between the clinical and photographic method.

Type of face form	Method of recording face form		Chi^2 test
	Clinical method (n = 200)	Photographic method (n = 200)	P value
Square	11 (5%)	8 (4%)	> 0.05
Tapering	30 (15%)	33 (16%)	> 0.05
Square tapering	5 (3%)	5 (3%)	> 0.05
Ovoid	154 (77%)	154 (77%)	> 0.05

ovoid tapering were observed.

A geometrical method on photograph can be used to analyze the various face forms to overcome the errors in visual judgment in the commonly used clinical method with face form indicator and the photographic method. The geometrical method based on angle of convergence is recommended as a basis to classify face forms as it is dependable and not subjected to variation differences among investigators observation. Geometrical analysis method reduced the errors in visual assessment which are observations based on individual perception. It permitted to broaden the classification of face form according to mathematical proportions to three additional types of face forms.

6. Conclusion

Standardization is not possible in the existing methods of classification of face form as it is dependent on operator's perception. The geometrical method of classifying face form eliminates such errors. A geometrical method on photograph can be an effective method to analyze the various face forms to overcome the errors in visual judgment in the commonly used clinical method with face form indicator.

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