Study of the morpho-dimensional relationship between the maxillary central incisors and the face

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Abstract: The aim of this study was to evaluate the frequency of agreement between the shape of the maxillary central incisor (MCI) and that of the face; verify which is the most pleasing MCI shape for the two genders; whether there is coincidence in the preference for tooth shape; and measure the most pleasant proportion of tooth and facial width for the esthetics of the smile. One hundred patients were selected from among front view photographs of the face and smile. The photographs were evaluated to determine the shape of the face and the type of dental contour, the pleasant appearance of the set consisting of the teeth and facial features. The widths of the MCIs and the face were measured and the proportional values were associated with the evaluators' opinions with regard to the pleasant appearance of the set of facial features. There was a significant association between the shape of the face and the MCI (Bowker's test, p = 0.0015). There is a relationship between the shape of the MCI and the shape of the face, with a greater prevalence of the oval shape of the teeth and face; it was not possible to associate the pleasant appearance of the shape of teeth with gender; there was no agreement on the pleasant appearance of the shape of teeth in the photographs of the patient smiling and in the images of the smile; and there was no relationship between the pleasant appearance of the face and the dentofacial proportion and bizygomatic width.

Descriptors: Incisor; Esthetics; Smiling.

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Introduction

When a person is smiling, the center of visual attraction is the basic contour of the anterior maxillary teeth. Because of their position, the maxillary central incisors provide the illusion of being the lightest and largest teeth in the mouth, making them the dominant teeth in the smile.[1,2]

A balanced proportion in the appearance of the teeth when the patient smiles is fundamental to compose an esthetically pleasant smile.[3] The Golden Proportion, that establishes the value of 1:1.6181,[4,5] is considered the ideal and is the most commonly used proportion. Nevertheless, the golden proportion is a reference, thus the professional must not be limited by it and forget the individual aspects.[6]

Although the teeth must be in proportion to one another, they must also be in proportion to the face. A great variation in the size of the

tooth in relation to the face may affect the ability to obtain a good esthetic appearance.[7,8] It is important to know the mean widths and heights of the crowns of anterior teeth, because these provide the dimensions of the basic geometric shapes that will enable the dentist to detect features that are not esthetically pleasant, and reach a final result that allows qualitative disharmonies to be eliminated.[9]

The shape of teeth can be classified as square, triangular and oval, and in the majority of cases there is some similarity between dental morphology and facial morphology, as well as a great deal of similarity in terms of shape and size among the teeth present in the same mouth.[7]

Moreover, the face can be classified as square-, triangular- or oval-shaped.[10,11] In 1914, Williams[12] suggested that there is a relationship between the shape of the face and the shape of the teeth.[13] However, Sellen *et al*.[14] mentioned that there is not necessarily any relationship between the shapes of the face and teeth, and other aspects that compose an esthetic analysis must be considered in order to establish the final shape of the teeth to be restored.[15] Moreover, it is considered that women should have rounded, smooth teeth with delicate angles (small and ovoid), and men should have square teeth with angled shapes.[14,16,17]

Nevertheless, it is difficult to affirm definitely which aspects give the teeth an attractive appearance as the potential of the different characteristics of teeth is unknown; or to determine a hierarchy of the factors that contribute to attractive dentition, and no one has considered all the esthetic factors of teeth when evaluating their significance in the attractiveness of the teeth in general.[18,19] Moreover, when restoring anterior teeth, dentists may be guided by the reliaiship between shape of the face and teeth. Therefore, the objectives of this study were:

- to analyze the frequency of agreement between the shapes of the face and teeth;
- observe whether there were preferences for stereotypes in the photographs of the smile and the smiling face with regard to the shape of the MCIs;
- verify whether there is any coincidence between the images of the smile and images of the smiling face with regard to preference for the shape of

teeth;
- verify the most pleasant shape of the maxillary central incisors for both genders, and
- measure the proportion of the most pleasant dental and facial width for the esthetics of the smile.

Materials and Methods

After approval by the Ethics Committee (No. 07/238), 100 patient record charts were selected (65 women and 35 men), without considering the ethnicity of the selected population. After this, the consent and approval of the patients concerned were obtained. The selected patients were in the age-range between 16 and 35 years-old, had natural teeth, irrespective of whether or not they had received orthodontic treatment. Patients with a high gingival smile, periodontal alterations that were visible in the photographs, those with large restorations or anterior dental prostheses, worn or fractured central incisors, malocclusion that harmed esthetics, patients under orthodontic treatment, those that underwent changes in dental shape due to wear or esthetic recontouring were not included in the study.

Three digital photographs of each patient were chosen:
- 1 front view of the face with the patient at rest,
- 1 intra-oral front view photograph, and
- 1 photograph of the patient smiling.

Additionally, 1 photograph of the smile only was obtained (Figures 1 through 4).

The photographs were evaluated by 5 professionals in the dentistry field (two men and three women) and they were previously submitted to two calibrations, with an interval of 30 days, immediately preceding each sample evaluation with regard to the criteria for determining the shape of the face and type of dental contour. A presentation was prepared to show Williams' dental and facial shape classification[12] as square-, triangular- or oval-shaped face and as square-, triangular- or oval-shaped tooth. To analyze the shape of the tooth contour, the evaluators were asked to consider only the maxillary right central incisor of each patient.

Photographs grouped from 1 to 100 according to the type of evaluation to be made (front view of the

Figure 1 - Front view of the face with the patient at rest.

Figure 3 - Patient smiling.

Figure 2 - Intraoral front view.

Figure 4 - Smile of the patient.

face at rest, front view of the face smiling, intraoral front view and photograph of the smile) were projected by means of a multimedia projector with 800 x 600 pixels (Sony VPL-ES7, Park Ridge, USA), following the sequence of the 4 questions (which evaluated the shape of the tooth, face and the pleasant appearance of the smile and face).

The measurements of the dentofacial proportions were obtained by the computer program AutoCAD (Autodesk, San Rafael, USA), using the front view photographs of the individuals smiling. With the method used by Lavelle,[20] the mesio-distal diameter of the crown was considered the longest distance between the areas of contact on the proximal surfaces of the crowns of teeth, and the bizygomatic width as being the maximum distance between the zygomas.

The AutoCAD program was also used to determine the proportion by means of a numerical value obtained by dividing the apparent length of the in-

ter-zygomatic distances and the apparent length of the mesio-distal distances of the two maxillary central incisors. The proportion between the dental and facial distances was obtained by a variation of the methods of Cesário and Latta,[13] Lavelle,[20] La Vere et al.[21], which found mean intervals ranging from 1/18 to 1/16. In this study, an interval of variation for the mesio-distal width was considered, based on the studies of Mavroskoufis and Ritchie,[15] who observed a variation in 63% of the maxillary central incisors of individuals, and this variation in width could be up to 1 mm.[21]

The intra- and inter-examiner agreement was evaluated by means of the Kappa statistical test that presented a Kappa index higher than 0.7. The modal value was considered as the standard for the analyses of the shapes of faces, maxillary central incisors and the evaluation as regards the pleasant appearance of the face and smile.

Bowker's test was used to assess the association between the shapes of the face and teeth. McNemar's test was applied to assess the association between:

a. pleasant smiles / pleasant faces and agreement between the shapes of the face and teeth;
b. pleasant faces and dental and bizygomatic proportions (1:7.5 to 1:8.5).[13,20,21]

Pearson's correlation was used to assess the relationship between the width of the tooth and the bizygomatic width. The Chi-square and Fisher's Exact tests were used to assess the association between gender and the study variables.

Results

The association between the shapes of the face and maxillary central incisor was shown to be significant (p = 0.0015) (Table 1), with predominance of the oval shape of the central incisor in persons with oval- and square-shaped faces. For individuals with triangular faces, the predominant tooth shape was square. The tooth-face agreement was verified, with higher prevalence of the oval shape (56.8%).

No association was observed between the pleasant appearance of the face and agreement between the shapes of the tooth and face (p > 0.05) (Table 2).

The association between the pleasant appearance of the face and the proportion between the tooth and bizygomatic width was not significant (p < 0.2432) (Table 3).

There was positive correlation between the tooth width and facial width in the study group (Pearson's Correlation, r = 0.9731; p < 0.001), with a concomitant increase in the mean values for both variables being assessed.

An agreement between the pleasant appearance of the smile and face was observed, and it was noted that when the classification of the face was pleasant, there was a greater chance that the smile would be classified in the same way (Table 4).

No association was observed between the pleasant appearance of the smile as a function of the tooth shape (Table 5).

With regard to the shape of the face (Fisher's test, p = 0.1786), central incisors (Chi-square test, p = 0.7840) and pleasant appearance and shape of the maxillary central incisor (Fisher's Exact test, p > 0.05), no significant association was observed. There was no significant agreement between the shapes of the maxillary central incisors and face for

Table 1 - Relationship of agreement between the shapes of the face and maxillary central incisors.

| Shape of the face | Shape of the maxillary central incisors | | | | | | General total | |
| | Oval | | Square | | Triangular | | | |
	n	%	n	%	n	%	n	%
Oval	46	56.8	24	29.6	11	13.6	81	100.0
Square	9	64.3	3	21.4	2	14.3	14	100.0
Triangular	1	20.0	3	60.0	1	20.0	5	100.0
General total	56	56.0	30	30.0	14	14.0	100	100.0

(Bowker's test, p = 0.0015)

Table 2 - Frequency of responses about pleasant face with regard to agreement between shape of the face and maxillary central incisor.

| Face | Agreement of shapes | | Total |
	No	Yes	
Not pleasant	22 (59.5%)	15 (40.5%)	37
Pleasant	28 (44.4%)	35 (55.6%)	63
Total	50 (50.0%)	50 (50.0%)	100

(McNemar's test, p = 0.0673)

Table 3 - Frequency of responses about pleasant face with regard to the proportion between tooth width and bizygomatic distance.

| Pleasant face | Proportion between tooth width and bizygomatic width | | | | General total |
	1:7.5 to 1:8.5		< 1:7.5 and > 1:8.5		
No	28	75.7%	9	24.3%	37
Yes	44	69.8%	19	30.2%	63
General total	72	72.0%	28	28.0%	100

(McNemar's test, p = 0.2432)

Table 4 - Frequency of responses about face and pleasant smile.

Pleasant face	Pleasant smile				General total
	No		Yes		
No	29	78.4%	8	21.6%	37
Yes	29	46.0%	34	54.0%	63
General total	58	58.0%	42	42.0%	100

(McNemar's test, p = 0.0016)

Table 5 - Frequency of the association between the pleasant appearance of the smile and shape of the maxillary central incisors.

Shape of the maxillary central incisors	Pleasant smile				General total
	No		Yes		
Oval	32	57.1%	24	42.9%	56
Square	17	56.7%	13	43.3%	30
Triangular	9	64.3%	5	35.7%	14
General total	58	58.0%	42	42.0%	100

(Chi-square test, p = 0.8755)

both genders (Chi-square test, p = 0.8339).

Discussion

As far back as 1914, Williams observed a possible relationship between the shapes of the face and tooth,[12] and although some authors have confirmed the existence of some relationship between certain anatomic details of the face and the tooth,[13,21] this evidence has remained weak for strictly correlating the shape of a maxillary central incisor to a point of reference of the face.[10]

In the present study, it was observed that the association between the shapes of the face and maxillary central incisor was shown to be significant (Table 1). A relationship between the shapes of the tooth and face differing from this were obtained in the studies of Wolfart *et al.*,[22] in which the square shape was the one that generated the greatest similarities. In the studies of Seluk *et al.*,[10] Varjão *et al.*,[11] Sellen *et al.*,[14] Mavroskoufis and Ritchie[15] and Sears,[23] no associations were observed between the shapes of the tooth and face.

No significant relationship between the shapes of the face and tooth, or the association of these with gender was observed. The oval shape, both for men and women, was the most prevalent, and the triangular shape was the least common for both genders, as shown by Wolfart *et al.*[22] Sellen[14] showed that women had predominantly oval-shaped faces and men had predominantly triangular-shaped faces. Such variations could be attributed to racial and ethnic differences in the chosen groups, as observed for this group in the present study, in which the population was miscegenetic.

Various alternative methods are used to define

an individual's ideal tooth contour,[19] and although the Geometric Theory or its variations are widely used for selecting teeth used in dental prostheses, as a basis in dental recontouring in esthetic dentistry, or even as a parameter in the reconstitution of the tooth shape in a fixed denture, satisfactory results for all cases have still not been obtained.[15]

Mavroskoufis and Ritchie[15] and Marunick *et al.*[24] observed that in the small percentages of coincidence of the two shapes, these produced no improvements as regards the pleasant appearance of the smile, and the best esthetic results were obtained when there were differences between the shapes of the face and tooth. In the present study, no association was observed between the pleasant appearance of the face and agreement between shapes (Table 2).

In the analysis of the pleasant appearance of the tooth shape in the photograph of the smile, and photograph of the smiling face (Table 5), irrespective of gender, it was not possible to determine an association between tooth shape and pleasant appearance of the smile. The results of this study are in disagreement with the findings of Marunick *et al.*,[24] in which the square and oval shapes generated the largest number of positive results with regard to the pleasant appearance of the smile. The largest number of negative replies was given for the triangular contoured shape, and this was in agreement with the studies of Seluk *et al.*[10] in which there was a certain rejection of the triangular-shaped teeth.

The preference for stereotypes, based on the theory of Frush and Fisher,[16,17] was also not confirmed in the present study, since no statistical relevance and no preference for tooth shape was observed for

both genders. Carlsson *et al.*[25] obtained different results as regards the pleasant appearance of the shape of teeth: the triangular shape was the least popular in the images of men and women, whereas the oval shape for women and square shape for men were the most popular, and so was the preference for masculine forms (square shape) instead of feminine forms (ovoid shape) for men and women.[23]

It was also not possible to make any statistical association between the tooth shape, gender and the pleasant appearance of the images of the smile. This may suggest that, in some way, the arrangement and composition of the anterior teeth have a greater influence on esthetics, and this would justify the size of the tooth and its disposition being more important than its shape.[24]

The real size of the tooth has been evaluated in the literature and has been seen positively in studies of the "Golden Proportion".[3,4,26] In other studies, these references, based on this "Golden Proportion", would be inconsistent, or valid only for a specific population.[6,8,11] In the present study, no relationship could be observed between the width of the tooth and the distance between the zygomas. In the analysis of the proportion between the bizygomatic width and the diameter of the two central incisors (Table 3), the data obtained demonstrated that 72% of individuals present a dentofacial proportion ranging between 1:7.5 and 1:8.5. When these findings were compared with those in the literature, one observed that the population under study was located in the range of values found in other studies.[20,21] With regard to the subjective analysis of the proportion most pleasing to the evaluators, a proportionally higher percentage of pleasant appearance was observed for the individuals whose tooth to face ratio was located in the range between 1:7.5 and 1:8.5.

When planning treatment for esthetic cases, the shape of the maxillary central incisor cannot be isolated from a detailed approach to the patient's treatment.[18,26] General characteristics, such as culture, biotype and personality can and must be taken into consideration for a better esthetic result.[10,25] Perhaps the key to understanding this definition of a pleasant smile would be the awareness that dentition is only part of a larger figure, and must be seen within a set of features.[18,19]

Conclusion

1. There is a relationship between the shapes of the teeth and face, with greater prevalence of the oval shape.
2. No preference for stereotypes in the shape of the dental contour was observed.
3. A relationship was found between the shape of the maxillary central incisor and pleasant appearance of the images of the smile and smiling faces.
4. No relationship was observed between the pleasant appearance of the shape of teeth and gender.
5. There is no relationship between a pleasant facial appearance and dentofacial proportion and bizygomatic width.

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