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Relationship between the shape of the upper central incisors and the facial contour in dental students. Lima. Peru.

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Abstract: Determine the relationship between the shape of the face and the shape of the upper right central incisor according to "The law of harmony" proposed by Williams. Materials and methods: This was an observational, analytic and cross-sectional study. A sample of 124 subjects, male and female students between 17 and 28 years old, was selected for the research. Their facial biotype and the shape of their upper right central incisor were determined by means of direct and photographic methods. Height and facial width were clinically evaluated using the direct method, and the proximal contours of the incisors were evaluated using a Vernier digital caliper. Images were downloaded to a computer and analyzed by means of the photographic method using Adobe Photoshop 5.0. Results: The relationship between the shape of the face and the shape of the incisor was positive in 43.5% of the sample (p=0.006) in the direct method. In the photographic method, the relationship between the shape of the face and the shape of the incisor was positive in 41.1% of the sample (p=0.037). The most frequent facial biotype in the direct and photographic methods was the dolichofacial with 61.3% and 71% respectively. The most frequent shape of the tooth with the direct and photographic methods was the ovoid with 55.6% and 51.6% respectively. Conclusion: Results do not confirm "The law of harmony" proposed by Williams, therefore when choosing the most suitable anterior tooth, experience and criteria of the dentist as well as the opinion of the patient should be taken in account in order to achieve a good aesthetic result.

Keywords: *Esthetics; tooth shape; facial index; upper central incisor; dental aesthetics.*

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INTRODUCTION.

In recent years, dentists have used aesthetic references in the selection of anterior teeth in research conducted in populations with different races and biotypes[1,2]. Although these references have not been adjusted to the Latin- population, they have been used as the standard for dental procedures.

Dentofacial morphology is closely related to facial aesthetics[3]. Anterior teeth are one of the key elements when making an aesthetic analysis of the face. Facial harmony should always be taken into account in oral restorations[3]. Anterior teeth, especially the upper central incisors, are prominent in a smile, so their size, shape and arrangement should be pleasing to the eye and in harmony with the rest of the face[3-5]. There are some methods for the selection of anterior teeth in oral rehabilitation, but they have always been controversial. 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[6,7].

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[7].

The odontogenic theory of Frush and Fisher[8] 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[8].

In 1914, Williams[9] 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[7]. 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)[7]. "Williams's law of harmony"[9] 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[7] could be achieved. Recent studies such as those by Mahmoud[10] and Rodriguez *et al.*[11] 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[12-16] 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[9].

This study aimed to determine the relationship between the shape of the face and the shape of the upper right central incisor according to the "Law of harmony" proposed by Williams[9] in undergraduate mestizo (mixed-race) students at the Faculty of Dentistry at Universidad Mayor de San Marcos, Peru.

MATERIALS AND METHODS.

Study design

An analytical observational cross-sectional study was conducted and designed according to STROBE statement[17].

Population

124 undergraduate students (68 male and 56 female), aged between 17 and 28 years, in their first five years as students at the Faculty of Dentistry at Universidad Nacional Mayor de San Marcos (UNMSM), Peru, during August and September 2013.

Sample size

To determine the size of the sample, a universe of 334 students was considered, with a confidence level of 95%, an error of 5% and a value of 50% for the occurrence of the main variable "shape of incisive tooth" in relation to "shape of the face". A sample of 124 students was selected. Then the number of students per each year was determined using a stratified probabilistic sample. Once this value was obtained students on the list for each year of study were selected using a table of random numbers.

Inclusion criteria

Subjects included in the study should not have their upper central incisors rotated or severely worn, broken or restored. They should not have fractures, facial asymmetry or have undergone any type of facial surgery. All selected students had the upper central incisors in good condition, and presented facial symmetry. If someone did not meet the selection criteria for inclusion, the next student on the list (for each year of study) was selected.

Exclusion criteria

Subjects with missing upper central incisors; subjects who had undergone conservative treatment or prosthetic replacement in their anterior-upper teeth; patients who had orthodontic treatment in the anterior-superior area; and subjects who were undergoing orthognathic surgery were excluded from the study.

Bioethical considerations

Participants in the study were explained all aspects

Figure 1. Equipment.

Head positioning device.

concerning this research. They were informed that it did not involve any type of physical or moral harm; that personal data collected would be confidential and that they were allowed to abandon the study at any time. Subjects were asked to sign an informed consent form. Ethical principles for medical research involving human subjects set forth in the Declaration of Helsinki of the World Medical Association[18] were respected.

Determining facial biotype and shape of the upper right central incisor: Direct method

The morphological facial index described by Mayoral[19] was used to determine the facial biotype of participating students. This facial index is calculated by a formula that relates the facial height from ofrion point (intersection of the midsagittal plane and the plane tangent to the upper edge of the eyebrows) to gnathion point (the lowest and highest point of the chin contour) with respect to the facial or bizygomatic width multiplied by 100. For the direct method each student placed the base of their jaw on one device at a 1 meter high, keeping their heads in a stable position[20] (Figure 1).

Ofrion and gnathion points were marked on subjects' faces with a fine tip marker (Faber-Castell, Germany). Facial height was measured in millimeters using a digital Vernier caliper (Truper, Mexico) and data were registered in the first data sheet. Then the most extreme points of the face (bizygomatic distance) were marked again with indelible marker (Faber-Castell, Germany) and facial width was measured with a digital Vernier caliper (Truper, Mexico). These measurements were also registered in the same data sheet. The Vernier caliper was modified attaching on its bars thin wooden sticks measuring 10cm long, 1.5cm wide and 0.2mm thick. This modification was necessary because a standard Vernier caliper was used in this pilot study, and its short bars did not measure facial width correctly and caused discomfort in the base of the nasal region of participating students. Later, variable facial biotype was determined following Mayoral[19], using the facial index formula described above. When the value was lower than 97, students were considered brachyfacial, with values between 97 and 104, mesofacial, and if they were above 104, dolichofacial.

Then impressions with Tropicalgin alginate (Zhermack, Italy) using metal impression perforated trays (Zhermack, Italy) were taken from the maxilary arch. Special care was taken to imprint the anterior-superior area perfectly. Then the printing was put in Elite Rock Fast plaster (Zhermack, Italy).

Subsequently, the shape of the upper central incisor in the study models was determined using the method proposed by Williams[9]. Proximal contours (mesial and distal) of the incisor were qualitatively evaluated with a digital Vernier caliper (Truper, Mexico), so the shape of incisor variable was determined and registered in the first data sheet (Figure 2).

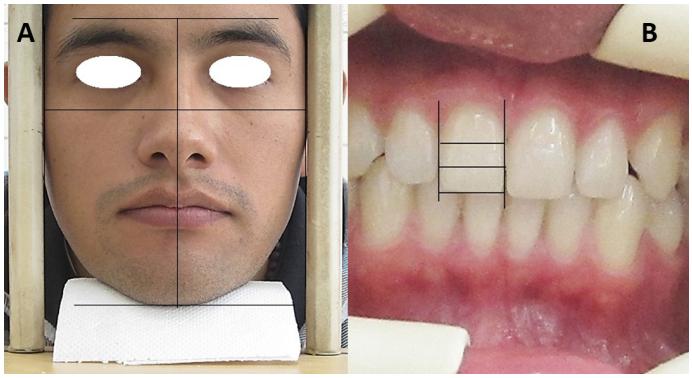
Determining facial biotype and shape of the upper right central incisor: Photographic Method

A digital camera (Canon Inc., Japan) mounted on a tripod (Canon Inc., Japan) and placed at a distance of 50cm from the face of the student and at a height of 1 meter from the floor was used for the photo shoot. Each student was instructed to sit on a stool (KaVo, Germany) and asked to put the bottom of their jaw with their teeth in maximum intercuspation on a head positioning device

Figure 2. Determining facial biotype and shape of the upper right central incisor: Direct method.

A: Marking the ofrion point on the subject's face with a fine-tip indelible marker. B: Measuring facial height from ofrion point to gnathion with a digital Vernier caliper. C: Measuring facial width with a specially-modified digital Vernier caliper. D: Measuring the mesial and distal proximal contours to determine the shape of the upper right central incisor.

Figure 3. Determining facial biotype and shape of the upper right central incisor: Photographic method



A: Determining facial height and width of a brachyfacial biotype. B: Determining the shape of the upper right central incisor by drawing vertical lines at the level of mesial, distal and proximal contour lines and horizontal lines of a square-shaped tooth.

specifically developed for this study. Then a pair of bars running vertically at each side of the student's face were carefully closed until they made contact with the sides of his/her face, thus a real and natural position of the head[20] was achieved before taking each picture. For the second picture the subject was asked to remain in the same position and using a lip retractor (Morelli, Brazil) the upper right central incisor was visualized. The same procedure was performed with the other students. A total of 248 photographs were taken.

Later, an analysis of the photographs was performed. All the images were downloaded to a computer (Hewlett-Packard, USA) and analyzed with Adobe Photoshop 5.0 (Adobe Systems Incorporated, USA). Two horizontal lines were drawn on the facial photograph: one tangential to the upper edge of the eyebrows and the other tangential to the lower margin of the jaw. Then the two lines were joined at the ofrion and gnathion points by drawing a vertical line that matched facial midline in order to determine facial height. Similarly, two tangent vertical lines at the sides of the face were made, being later joined at the level of the most external points of the face using a horizontal line to determine facial width. Results were recorded in a second data sheet. Then data were set in the formula proposed by Mayoral[19] to determine facial index and variable facial biotype. In the photograph taken with the lip retractor (Morelli, Brazil) the upper right central incisor was visualized, following the method proposed by Williams[9]. The mesial and distal proximal contours of the incisor were qualitatively evaluated by drawing vertical lines. The mesiodistal width was also evaluated drawing horizontal lines. The shape of incisor variable was determined as described above and results were registered in the same data sheet. Facial and incisor pictures were analyzed independently at the same level. Both methods, direct and photographic, were carried out by only one of the researchers to avoid bias and differences in criteria (Figure 3).

Data analysis

Data were processed with SPSS 21 (IBM Company, USA), for the descriptive analysis (frequency tables) of the variables and correlation analysis using statistical tests. The analysis was performed using statistical Chi-square

Table 1. Relationship between the shape of the upper central incisor and the shape of the face by the direct method.

Shape of the face	Shape of tooth					
	Square		Ovoid		Tapering	
	n	%	n	%	n	%
Brachyfacial	6	24.0	2	2.9	2	6.7
Mesofacial	4	16.0	27	39.1	7	23.3
Dolichofacial	15	60.0	40	58.0	21	70.0
Total	25	100.0	69	100.0	30	100.0

Table 2. Relationship between the shape of the upper central incisor and the shape of the face by the photographic method.

Shape of the face	Shape of the tooth					
	Square		Ovoid		Tapering	
	n	%	n	%	n	%
Brachyfacial	3	14.3	0	0.0	3	7.7
Mesofacial	6	28.6	18	28.1	6	15.4
Dolichofacial	12	57.1	46	71.9	30	76.9
Total	21	100.0	64	100.0	39	100.0

test to determine the relationship between the shape of the face and shape of the upper right central incisor.

RESULTS.

The direct method showed a positive relationship between the shape of the face and shape of the upper right central incisor in 43.5% of the sample (p=0.006). An incisor with a tapering shape was predominant in the dolichofacial biotype in 70.1%, square and ovoid incisors were the most frequent in the dolichofacial biotype with 60% and 58% respectively (Table 1).

The photographic method showed a positive relationship between the shape of the face and the shape of the incisor in 41.1% of the sample (p=0.037). An incisor with a tapering shape was predominant in the dolichofacial biotype in 76.9% of the sample, and incisors with a square and ovoid shape were also the most frequent in the dolichofacial biotype with 71.9% and 57.1% respectively (Table 2).

The most common facial biotype obtained with both methods, direct and photographic, was dolichofacial, found in 76 (61.3%) and 88 (71.0%) of the participating students respectively. The most common shape of tooth obtained with both methods, direct and photographic, was ovoid, found in 69 (55.6%) and 64 (51.6%) of the students respectively.

DISCUSSION.

Many studies have tried to figure out whether or not there really is a relationship between the shape of the face and shape of the upper central incisors based on the "Law of harmony" proposed by Williams[9], with the aim of facilitating the selection of anterior teeth for patients.

The present study found that there is a close relationship between the dolichofacial biotype and the shape of the tapering incisor using direct and photographic methods to relate the shape of the upper right central incisor with the shape of the face. In the rest of the facial biotypes no dental predominant shape was found based on the "Law of harmony"[9]. Posada *et al.*[22] found a significant relationship between the shape of the upper right central incisor and the shape of the face using a photographic method.

They found that the shape of the square and tapering incisors was more frequent in the mesofacial type and that an ovoid incisor was more predominant in the dolichofacial type. In the present study, the photographic method established a significant relationship for oval and square incisors, which were more frequent in the dolichofacial biotype, while tapering incisor was also predominant in the dolichofacial biotype. The results of this study as well as the findings of Posada *et al.*[22] do not agree with "The law of harmony". Different combinations between incisors and face shape were obtained, these variations may be explained by the fact that subjects belonged to different ethnic groups.

In the papers of Peixoto *et al.*[14], Ibrahimagi *et al.*[15], Pavankumar *et al.*[16], the relationship between the shape of the right central incisor and the shape of the face using a photographic method was 41.7%, 30% and 31.5% respectively. Their results are similar to the ones obtained in this study, in which the relationship between both methods, direct and photographic, was slightly higher 43.5% and 41.1% respectively. The studies of Ibrahimagi *et al.*[15] and Pavankumar *et al.*[16] did not agree with "The law of harmony" either.

Mavroskoufis *et al.*[12] and Varjão et al.13 likewise conducted a study using the photographic method. They compared the relationship between the shape of the face and shape of the upper right central incisor and did not get an agreement with "The law of harmony" either. They even obtained lower relationship values with 17.2% and 23.7% respectively. Both, in the present study and in the studies conducted by other researchers[12,13,15,16,22], different percentages regarding the relationship between the shape of incisor and the shape of the face were obtained. These variations may be due to differences among the groups studied.

Dolichofacial was the most frequent facial biotype using both methods, direct and photographic. Other authors[21,23,24] found that the most frequent biotype was brachyfacial followed by mesofacial, and finally dolichofacial. These variations may have occurred because participating subjects belonged to different ethnic groups.

The most frequent tooth shape was ovoid. This finding is similar to the results obtained by other authors[11,25,26]. Only one of the two central incisors was studied because it has been shown that they do not have the same measure[12].

In conclusion, results do not confirm "The law of harmony" proposed by Williams. Consequently, dentists must take into consideration their own clinical experience and criteria, and listen to the opinions and needs of their patients in order to achieve an aesthetically satisfying and pleasant smile. We suggest to conduct comparative studies on more specific communities (ethnic and racial groups) to find out if this theory really meets clinical requirements. We also recommend to continue this type of research to achieve the best diagnosis and treatment for a specific population.

Relación entre la forma de los incisivos centrales superiores y el contorno facial en estudiantes de odontología. Lima. Perú.

Resumen: Determinar la relación entre la forma de la cara y la forma del incisivo central superior derecho según la "ley de la armonía" propuesta por Williams. Materiales y métodos: Este estudio fue observacional analítico de tipo transversal, se seleccionó una muestra de 124 estudiantes de ambos sexos entre 17 y 28 años de edad, a los cuales se determinó el biotipo facial y la forma del incisivo central superior derecho, por medio de un método directo y otro fotográfico. Por el método directo se evaluó clínicamente la altura y el ancho facial así como también los contornos proximales del incisivo utilizando un Vernier digital y por el método fotográfico se realizaron trazos en las imágenes tomadas utilizando el software de Adobe Photoshop 5.0 Resultados: Por el método directo la relación entre la forma de la cara y la forma del incisivo fue positiva en un 43.5% de la muestra (p= 0.006). Por el método fotográfico la relación entre la forma de la cara y

la forma del incisivo fue positiva en un 41.1% de la muestra (p=0.037). El biotipo facial con mayor frecuencia por el método directo y fotográfico fue el dolicofacial en un 61.3% y 71 % respectivamente. La forma del diente con mayor frecuencia por el método directo y fotográfico fue el ovoide en un 55.6% y 51.6% respectivamente. Conclusión: Los resultados no confirman la "ley de la armonía" propuesta por Williams, por lo tanto al momento de seleccionar el diente anterior más adecuado, se debe tener en cuenta la experiencia y el sentido crítico del profesional así como los deseos del propio paciente con el fin de alcanzar un buen resultado estético.

Palabras clave: *Estética; forma del diente; índice facial; incisivo central superior; estética dental.*

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