

Photographic analysis of esthetic dental proportions

Análise fotográfica da proporção estética dentária

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ABSTRACT

Objective

The aim of this study was to analyze smiles considered to be harmonious, by observing the patterns of proportion between the width and length of the central incisor and its shape.

Methods

A total of 85 people with harmonious smiles were used for the sample, divided by sex and age. Two photographs were produced for each patient: smile and occlusion, using a lip retractor. The photographs were scanned and transferred to the software application Corel Draw 10, where the esthetic dental factors were measured.

Results

It was shown that harmonious smiles usually have a height/width ratio of between 65% and 85% and a predominance of the triangular shape, followed by the square shape.

Conclusion

Despite differences in tooth size and shape, they have, both individually and in conjunction, a certain proportion, as does the face and more specifically, the mouth.

Indexing terms: Dental esthetics. Incisor. Smile.

RESUMO

Objetivo

Analisar sorrisos considerados harmônicos, observando os padrões de proporção entre a largura e comprimento do incisivo central e forma do incisivo central, já que a importância de se analisar as relações e proporções entre os dentes anteriores e os tecidos circunvizinhos está fundamentada na necessidade de se estabelecer tratamentos restauradores satisfatórios e estéticos, uma vez que a confiança e auto-estima das pessoas dependem em grande parte do sorriso.

Métodos

A amostra utilizada foi de 85 pessoas com sorrisos harmônicos, divididas por sexo e faixa etária. Em cada paciente, foram confeccionadas 2 fotografias, do sorriso e da oclusão, com afastador de lábios. As fotos foram escaneadas e transferidas para o programa Corel Draw 10, onde se mediram os fatores estéticos dentários.

Resultados

Os sorrisos harmônicos apresentam-se, geralmente, com proporção altura/largura de 65 a 85% e predominância da forma triangular, seguida pela quadrada.

Conclusão

Apesar das diferenças de forma e tamanho dos dentes, eles mantêm individualmente e entre si certa proporção, assim como com a face e mais especificamente com a boca.

Termos de indexação: Estética dentária. Incisivo. Sorriso.

INTRODUCTION

Proportion can be understood as a quantitative ratio of size or dimension between 2 elements of the same kind, with the esthetic proportion between teeth being defined as the division of their width by their

length, it being considered that the ideal proportion for upper incisors is between 70% and 80%¹. The lack of esthetic proportion in teeth may result in an uneven, inharmonious smile².

The composition of teeth as a whole presents esthetic quality when their elements exhibit both real and apparent sizes that are proportional to the other parts of

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the whole. Proportion involves the width/length ratio for a single tooth and for the arrangement of the anterior teeth, i.e. there must be proportion in the appearance of the teeth, actual size and esthetic proportion of each tooth as well as its position and alignment in the arch. The proper esthetic proportion of each tooth is related to its shape and position and that of neighboring teeth in the dental composition of the whole mouth, reflecting in the harmony of the whole².

Francischone & Mondelli³ performed a biometric study to evaluate the accuracy of this method for calculating the width of the upper central incisors, by comparing it to the actual incisor width measured in patients. They also assessed the actual esthetic proportion (width/height ratio) of the anterior upper teeth and lastly the percentage of arches and hemi-arches that the anterior upper teeth present in golden ratio with the width of the smile. The results showed that the actual esthetic proportion of the anterior teeth supports the values contained in the literature, and also 63.3% of right and left tooth segments present in golden ratio with the width of the smile.

One concept of proportionality which is widely accepted supports the theory that the maxillary central incisor has a length/width proportion of 10:8. In other words, they argue that the width of the maxillary central incisor should never exceed 80% of its length. However, it can be seen that when this proportion of length to width is slightly altered, in the order of 10:7 or 10:6, the result is an esthetically more agreeable arrangement⁴.

Dental proportions are calculated by dividing the width of the clinical crown by its length. As a general rule, the most agreeable width/length proportions for maxillary central incisors are between 75% and 85%. Below 65%, the central incisor may appear very narrow and above 85%, very short⁵.

Observing the surfaces close to the vestibular surface of the maxillary central incisor, Williams⁶, in 1914, defined three basic shapes, classifying them into triangular, oval and square. He ascertained that when these surfaces are arranged in parallel, the shape is square; when they are arranged converging on the root, the shape is triangular, and when they converge on the incisor edge, the shape is oval. In addition to the three basic shapes mentioned, it should be stressed that, seven other atypical or combined shapes⁷ were also described by Williams.

In similar vein, Nelson⁷, when studying the alignment of the teeth in the dental arches, found the same three basic shapes, square, triangular and ovoid. He also studied the existing relationship between the shape of the face, teeth and dental arch, by observing the existing correlation between these three elements, a finding that came to be known as "Nelson's Aesthetic Triangle".

Souza et al.⁸ performed a comparative analysis of the shape of the vestibular contour of the maxillary central incisor with the format of the face and accordingly selected 37 Caucasian patients in the 20 to 25 age range and employed the photographic analysis method. They ascertained that the triangular shape of the maxillary central incisor is the one most frequently encountered, followed by the square shape and lastly, with the lowest frequency, the ovoid shape.

According to Baratiere⁹, in square-shaped teeth, the vertical crests are well developed and evenly distributed across the vestibular surface. As for triangular teeth, there is a depression in the vestibular surface, and while the central crest is not prominent or well developed, the marginal crests are very pronounced. With oval shaped teeth, the central crest is well developed and thick while the marginal crests are almost non-existent.

Despite the differences in shape and size between teeth, they maintain an individual width/height ratio and relative to each other a certain proportion of actual and apparent width from the front view. Some authors relate the width of the smile to the actual and apparent width of the teeth³.

The aim of the present study is to analyze smiles considered to be harmonious, by observing the patterns of proportion between the width and the length of the central incisor and its shape, as well as the esthetic alterations that these may present.

METHODS

Sample selection

For the present study, a sample of 85 individuals was chosen with ages ranging from 15 to 40 who had harmonious smiles, and excluding from the sample those who had prosthetics on the anterior teeth.

The sample was divided into four groups, arranged as follows: a) men between 15 and 25 years of age; b) women between 15 and 25 years of age; c) men between

26 and 40 years of age; d) women between 26 and 40 years of age.

For the delimitation of sample size, based on a statistical study, a significant number of patients were considered, which was capable of permitting the expected results of this study to be achieved.

The abovementioned sample was chosen from an initial number of photographs taken by the researcher in charge of smile pre-selection. This initial batch of photographs went before a board of judges comprising 3 dentists who, in mutual agreement, selected 85 patients with harmonious smiles.

In order to calibrate the board of judges (consisting of the three aforementioned dental surgeons), 10 photographs were handed to the members who individually selected harmonious and non-harmonious smiles.

Once the calibration test was complete, the Kappa method was used to evaluate the capacity of agreement amongst these professionals, a Kappa coefficient of 0.9 being obtained, interpreted as excellent¹⁰. If the agreement was not satisfactory at the first try, the test would be repeated using different professionals until satisfaction was obtained.

Instruments used

The following set of tools were used: a) Dental Eye photographic camera; b) Professional FujiFilm ASA 200 photographic film; c) scanner; d) Corel Draw 10 software.

Photographic technique

The patients were placed with their heads resting on a rigid frame, facing forward in a position perpendicular to the camera lens. The photographs, all taken by the same operator, were standardized using the same focal length for all patients and were always developed in the same location.

Two photographs were taken per patient, as follows: a) with the patient smiling; b) with the patient in occlusion and using a tissue retractor.

Smile examination

The photographs were scanned and transferred to the Corel Draw 10 software application.

Proportion between the width and length of the central incisor

The length of the central incisor was measured

from the gingival zenith to the incisal, while the width was measured from the mesial contact to the distal contact, these measurements being used to calculate proportion. Measurements were carried out in the resulting photographs using a lip retractor, as shown in Figure 1.

A comparison was conducted of the width and length of the central incisor in order to observe the following proportions: a) above 85 % - very short tooth; b) below 65% - very long tooth; c) between 65% and 85% - acceptable proportion; d) between 75% and 80% - ideal proportion.



Figure 1. X corresponds to the length of the tooth and Y to the mesio-distal width.

Shape of central incisor

The dominant shape of the vestibular contour of the central incisor was analyzed via lines traced in the proximal areas of these teeth. If these were arranged in parallel, then the tooth would present a square shape, if they converged on the root the tooth would present a triangular shape while if they converged on the incisal, the shape would be ovoid.

The ethical principles contained in the Helsinki Declaration (2000) were duly observed, as well as compliance with specific legislation of the country where the study was performed.

RESULTS

Height/ width proportion

When analyzing the variable height/width proportion of the maxillary central incisor, we observed through descriptive statistics a mean value of 79.252 with a standard deviation of 6.18 for the respective proportion, the minimum and maximum values found being 64.61

and 95.62 respectively. The percentage found for the height/width proportion was between 75% and 80% in 34.1% of cases, while the height/width proportion above 85% was 17.65% and less than 65% was 1.2%. The remainder of the sample was in the 65% to 75% band (22.35%) and 80% a 85% rate band (24.7%), as shown in Figure 2.

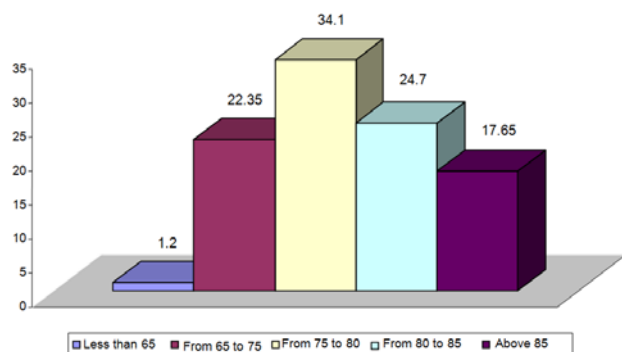


Figure 2. Graph of the distribution of the height/width proportion according to age range.

Shape

With regard to the descriptive variable “shape”, it was observed that the triangular shape was the most frequent (50.59%), followed by the square shape (37.6%) and lastly the oval shape (11.76%). The shape measurement is shown in Figure 3. Percentages are shown in Figure 4. The predominance of the triangular shape and the smallest concentration with the ovoid shape were observed for both sexes, therefore there was no association between shape and sex, $p = 0.664$.



Figure 3. Measurements A) square shape; B) triangular shape; C) oval shape.

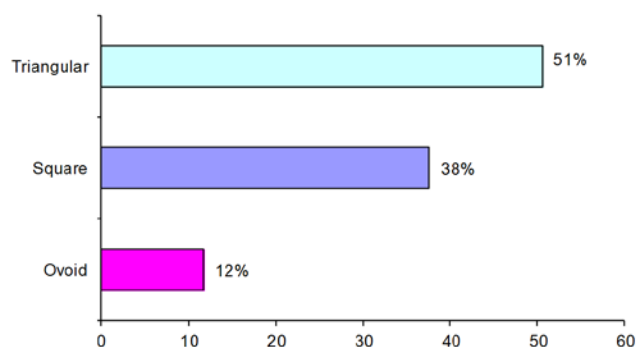


Figure 4. Graph of percentages relating to tooth shape.

Statistical analysis

The statistical packages used were SPSS 8.0 and Excel and the techniques employed were descriptive Statistics and Inference. The statistical tests performed were chi-square and paired t-Test.

DISCUSSION

The average value of 79.252%, with a standard deviation of 6.18, was found for the height/width ratio, when carrying out measurements of the height and width of the clinical crown of the upper central incisor. This outcome was similar to results obtained in other studies. The study performed by Sterret et al.¹¹ obtained a mean value of 81% for the height/width ratio of clinical crowns in normal teeth. As for Magne et al.¹², analyzing the crowns of unworn extracted upper central incisors attained a mean value of 78% for the aforementioned population.

Chiche & Pinault¹³ reported that the ideal height/width ratio for the central incisor should lie between 75% and 80%, where a ratio below 65% presents an appearance of very narrow teeth, while those above 85% presented very short teeth. However, the ratio which allows an esthetically acceptable appearance is in the 65% to 85% range⁹.

According to Seixas et al.¹⁴ the highest width/length (W/L) ratio is found in squarer teeth while the lowest ratio is related to a more elongated appearance.

In accordance with this classification it was noted that 81.15% of the sample analyzed falls within the acceptable values (65% to 85%), while only 34.1% are found within the ideal range of values (75% to 80%). The sample items below 65%, relating to very narrow teeth, was represented by 1.2%, and those above 85%, with very short teeth, was represented by 17.65%.

The sex-specific mean width of the upper incisor crown is greater in men than in women; as far as race is concerned, it is greater in negroes than in whites. Wider, more rectangular-shaped teeth produce a sensation of strength and masculinity, while narrow, rounded teeth accord a sensation of daintiness and femininity¹⁵.

The analyzed sample showed that the triangular shape was the most frequent (50.59%), followed by the square shape (37.6%), with the oval shape being the least common (11.76%). This predominance of shapes is supported by a study conducted by Souza et

al.⁸, in which the triangular shape of the upper central incisor was the one occurring most frequently (45.9%), followed by the square shape (40.5%), and ovoid being the least common (13.55%). Despite the fact that the triangular shape of the upper central incisor was the most frequently found, the results of a study conducted by França et al.¹⁶ showed that the tooth shape preferred by the students was ovoid (46.7%), followed by triangular (35%) and square (18.3%). The patients also maintained a preference for the ovoid shape (51.7%), followed by triangular (30%), square being the least preferred shape (18.3%).

CONCLUSION

In spite of the differences in tooth shape and size, they do, both individually and in conjunction with each

other, maintain a certain proportion, as does the face and more particularly the mouth. Harmonious smiles usually have a height/width proportion of 65% to 85% and are predominantly triangular in shape, followed by square.

Collaborators

LM PEIXOTO carried out the bibliographical survey, the experiments and the composition of the article. RL LOURO conducted the bibliographical survey, the composition, correction and final editing of the article. AA GOMES and APC NASCIMENTO provided guidance on the research and took part in the composition of the article.

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