Original Article

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Prevalence of the different maxillary central incisor shapes in individuals with natural normal occlusion

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Abstract

Aim: To investigate the prevalence of crown shape in maxillary central incisors of individuals with natural normal occlusion. **Methods:** The sample consisted of 51 Caucasian individuals with natural normal occlusion, no history of previous orthodontic treatment, and at least four of Andrews' six keys to normal occlusion. The images of the maxillary incisors generated from model scans were evaluated by 12 orthodontists. The Kappa test was applied to verify inter-examiner agreement with regard to classification of the central incisor shape. **Results:** The results of the Kappa test showed significant agreement for tooth shape. The following prevalences were observed: ovoid (47.06%), square (31.37%) and triangular (21.57%). **Conclusions:** The choice and use of one of these three shapes when selecting teeth for prosthetic rehabilitation (total and partial dentures) can contribute significantly to obtaining an improved facial harmony and balance. Ovoid-shaped teeth should be "stocked" in greater quantities than other tooth shapes.

Keywords: perception of shape, tooth, shape.

Introduction

The concern with facial esthetics has followed the rise of civilizations, and faces representing the ideal of beauty have always been used as references. In orthodontics, it is not different. In the 20th century, this concern was already taken into consideration for a successful orthodontic treatment, as well as to promote healthy tissues, occlusion and treatment stability. The versatility in beauty standards developed over the years, eventually accepting, for example, profiles with soft labial biprotrusion[1-3].

Considering that even laypeople are able to identify characteristics of facial beauty, it is believed that lateral cephalometric radiographs are not necessary to visualize some important features of facial harmony. In this context, facial shape analyses were developed with the objective of helping dental surgeons perform sensible evaluations of subclinical asymmetries[3-4], such as smile harmony, which is strongly related with the maxillary central incisors.

The smile is part of this beauty standard, which is measured subjectively[5-6]. A harmonious smile depends on the balance that involves several factors, from its width to its ratio with facial outlines, tooth color and shape, as well as gingival exposure and contour.

It is important to have an adequate ratio between the teeth and face[7], in

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order to achieve balanced and harmonious features and facilitate anatomic reconstructions[6], prosthetic treatments, and precise prescriptions of tooth increase or selective grinding, in cases of size discrepancy.

There is a debate in literature with regard to the shape of incisors. Some authors believe it does not follow any rule[8] or that there is no statistically significant correlation between tooth sizes and facial pattern[9]. It has also been suggested that teeth have the same shape as the face, but inverted[10]. Several authors have stated that the basic shape of the maxillary central incisor could be classified as triangular, square or ovoid[6-7,11-18].

A few methods have been suggested to analyze incisor shape, including superimpositions[15], software-aided measurements[19], and photographs with questionnaires[17]. The use of tooth photographs with questionnaires proved to be the most reliable.

Based on the importance of the maxillary central incisors for facial harmony, balance and esthetics, the aim of this work was to verify the prevalence of the different shapes of the maxillary central incisor crown in Caucasian individuals with natural normal occlusion.

Material and methods

Sample

Fifty-one plaster models were made of the maxillary arch of Caucasian individuals, with natural normal occlusion, being 21 (41.2%) males and 30 (58.8%) females, with ages between 15 years and 2 months and 19 years and 4 months (mean age = 16 years and 6 months). The sample was originated from a meticulous selection among 13,618 students at private, municipal and state schools in the Greater São Paulo metropolitan area.

All models should be intact and bubble-free, with at least four of Andrews' six keys to normal occlusion[20], and necessarily including the first key (Angle Class I molar relationship). Additionally, they should have no history of orthodontic treatment, craniofacial malformations or asymmetries, or odontogenic anomalies. The presence of all permanent teeth in occlusion (except for the third molars), as well as intact and healthy upper and lower incisor, was essential.

Model scanning

Each model was individually digitized using a dw5-140 3D (three-dimensional) scanner (*Dental Wings*[â], Montreal, Canada), previously set according to manufacturer instructions.

The non-destructive scan captured the models in all three Cartesian axes (x, y, z) using a laser beam and cameras placed inside the scanner. In this procedure, the models move in a platform while the laser beam and the cameras remain fixed. The STL (Standard Template Library) image was generated by computer software (*Dental Wings*[â]) so that 3D images featured 0.2 mm resolution and accuracy of 20 to 50 µm. The images were read using 3Shape 3D Viewer software.

Image gathering

After the 3D images were obtained from the models, print screens were taken, transforming the image obtained from the maxillary incisor (Figure 1) into a figure with good resolution. The figures were transferred to CorelDRAW[â] *X3* software, in which they were cut and prepared for the study.

The image of the right maxillary central incisor was magnified up to 10 cm for standardization, for greater accuracy in indentifying the different shapes. The image negative was prepared with a dark background in order to improve viewing (Figure 2).

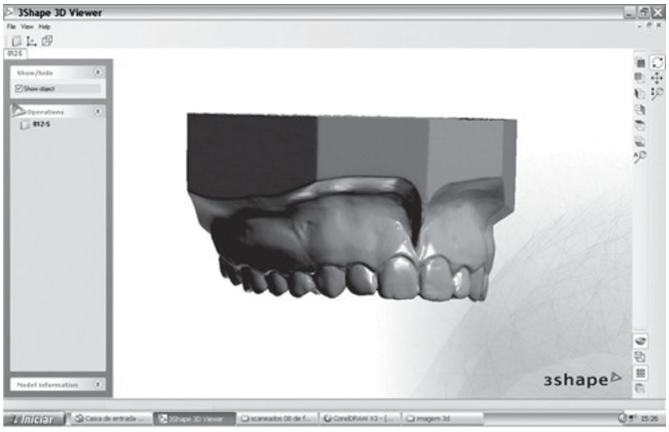

Fig. 1. Print screen of the right maxillary central incisor.

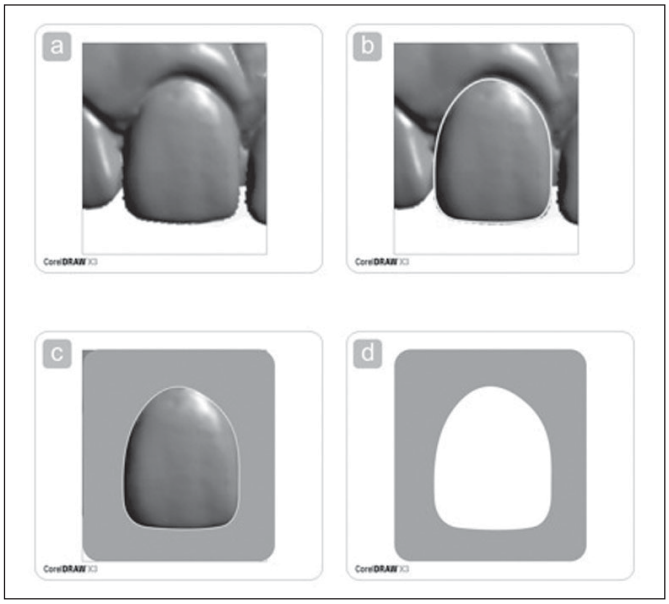

Fig. 2. a) Image of the right maxillary central incisor imported into CorelDRAW[â] X3; b) delimitation of dental shape; c) isolated image of the incisor crown; d) negative image of the crown.

Subjective classification of maxillary central incisor

Each obtained image was placed in the center of a sheet of 90 g/m^2 white paper, below pre-established models of tooth crowns (crib), composing an album with the 51 sheets. On each album sheet were the tooth models, classified according to Kina and Bruguera[18] as square, ovoid and triangular (Figure 3).

Twelve dental surgeons received the album containing all crown images (Figure 4). They were asked to mark the shape that best matched the crown models presented. The material was then collected one week later the by researcher in charge.

All dental surgeons evaluating the models had at least a Master's degree in Orthodontics. Seven evaluators were female (58.33%) and five were male (41.67%).

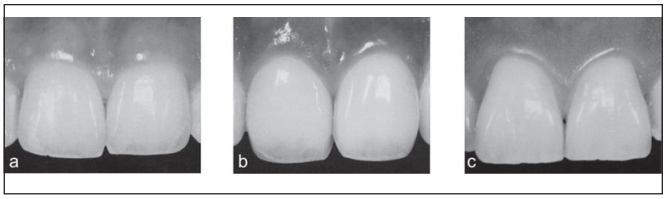

Fig. 3. Dental morphology according to the classification by Kina & Bruguera (2008): a) square tooth; b) ovoid tooth; and c) triangular tooth.

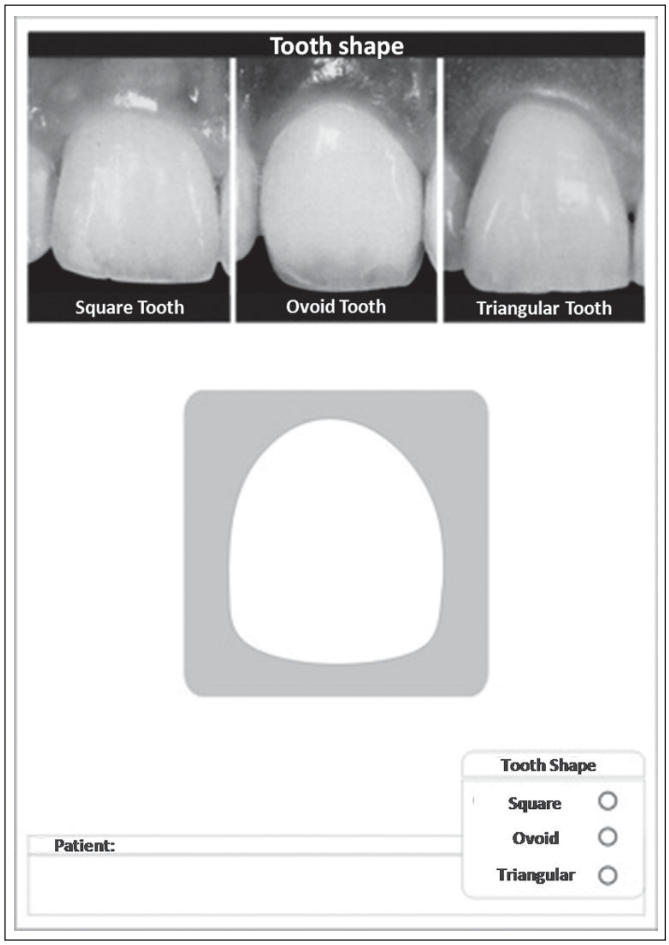

Fig. 4. A sheet from the album containing images of right maxillary dental incisor crowns.

Data analysis

In order to check inter-examiner agreement of the classification of central incisor morphology, the modified[21] Kappa[22] test was used, with a 5% significance level[23]. The results of the Kappa test can range from -1 to +1, with +1 representing a perfect agreement; 0 (zero) occurs when the agreement is the same as would be expected at random. In the cases of negative values, the result obtained is even lower than would be expected at random.

Results

A Kappa value of 0.52 (CL95% 0.49-0.55; $p < 0.001$) was obtained for the inter-examiner agreement for the analysis of maxillary central incisor shape, which indicates statistically significant moderate agreement among the 12 examiners[22].

Figure 5 shows the prevalence of the different shapes of the crown of the right maxillary central incisor, according to the judgment of the evaluators.

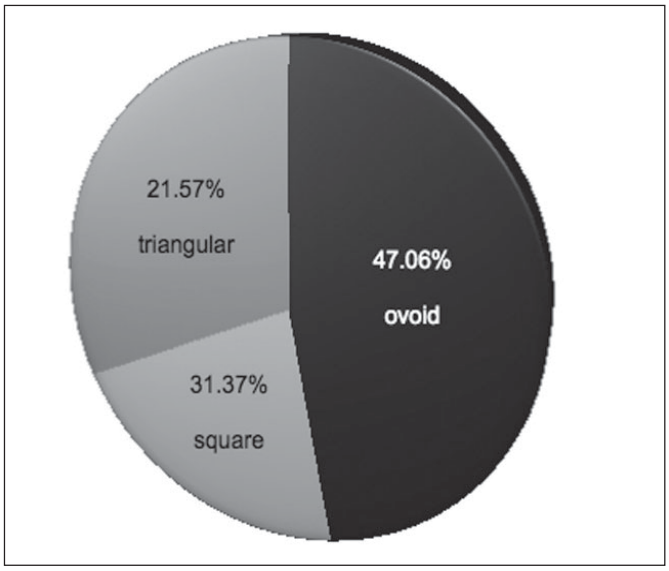

Fig. 5. Prevalence of maxillary central incisor shape.

Discussion

The idea of beauty has followed human development since the first records of its existence. The ancient Greeks treated it as supernatural, while others revered it as a sign of the grace of God, as man had supposedly been made in His image and likeness. Indeed, the cult of beauty is natural to humans, and today more is spent worldwide on beauty than on education[6].

The concept of beauty comprises symmetry, balance and harmony. The endless search to define harmonious features resulted in the golden or divine ratio[6,18]. This proportionality relationship was the origin of beautiful works of art made not only to please the senses, but also as attempts to reach the pinnacle of natural beauty.

The principle that every human being has proportional relationships is expressed in the face, especially in teeth. The maxillary central incisors are the most dominant and visible, as distally positioned teeth are seen less during smiling. Currently, there is a tendency to restore teeth by reestablishing their geometric relationships in the dentofacial context[6].

Orthodontists are admirers of shapes, preferably symmetrical and regular. So, it is only natural that they should be responsible for the subjective analysis of the variable of

this study – tooth shape. The methodology employed in this study was based on literature, starting with digital scanning of the models to generate 3D images, whose accuracy has already been proved by several authors[24-30]. With regard to image management, a similar method had already been reported by other authors[17].

Kappa statistics was used to verify inter-examiner agreement. It is a relatively recent method that is more rigorous than others because it excludes the possibility of zero (or randomness). This results in values between -1 and +1, with +1 establishing a perfect agreement. "0" (zero) demonstrates that the agreement is the same as would have been obtained at random; and negative values indicate the value is lower than would be expected at random[22]. Agreement was statistically set as "moderate" at a significance level of 5%, which validated the methods employed.

Tooth morphology has always been studied with the objective of standardizing shapes and obtaining a more harmonious face. In 1914, it was suggested that the basic shape of the maxillary central incisor corresponded to the geometric shape of the facial contour, classified as either square, ovoid or triangular[11]; this nomenclature has also been used by other authors[6-7,10,12-17].

Recently, teeth have been grouped morphologically, according to contours and external angles of the anterior segment, into a similar terminology: square, ovoid and triangular[18]. The square tooth is close to the geometric figure that gave its name, with practically parallel external lines, usually straight or slightly rounded mesial and distal angles, straight incisal contour, and mesiodistal length comparatively longer than ovoid and triangular shapes. The ovoid tooth has rounded external lines, angles and incisal contour, with mesiodistal length comparatively shorter than the other shapes, which characterizes a cervical line slightly narrower than the incisal line. The triangular tooth also features contour lines that resemble the geometric form that gives its name, with cervical line significantly shorter than the incisal line. The mesial and distal angles are smaller with a straight incisal contour.

In the present study, the prevailing shape of the maxillary central incisor was ovoid (47.06%), followed by square (31.37%) and triangular (21.57%). In a different study[14], the triangular shape was the most common (45.9%), followed by square (40.5%) and ovoid (13.6%).

The choice and use of a given incisor shape when developing prosthetics contribute significantly to better facial harmony and balance. Ovoid-shaped teeth should be "stocked" in greater quantities than other tooth shapes. In esthetic and cosmetic dentistry, it is essential to incorporate the concepts of camouflage[6], as tooth morphology is unique and individual. In orthodontics, knowledge of the different shapes and the most common shapes makes the clinician's practice routine easier, contributing to more precise prescriptions of tooth increase or selective grinding in cases of size discrepancy.

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