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Assessment of the Ability to Relate Anterior Tooth Form and Arrangement to Gender

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Abstract

Purpose: This study evaluated the assumption that there are morphological differences between the natural anterior dentition of men and women. The goal of the study was to determine the gender of patients based on the appearance of the anterior teeth in photographs.

Materials and Methods: Laymen and observers from different specialties were asked to determine the gender of individuals based on the shape and arrangement of anterior teeth. Forty anterior dentition photographs of dental students of both genders (20 women, 20 men) between 18 and 26 years old were selected, coded, and randomly arranged in an album. The albums were delivered to five groups of observers: general practitioners (recently graduated dentists), prosthodontists, orthodontists, restorative dentists (specialists in cosmetic and restorative dentistry), and laymen (control group). The observers evaluated the photographs twice at 1-week intervals.

Results: The average correctly identified values in women and men were 57.6% and 58.8%, respectively. There was no statistical difference between observers and between each group of professionals and the laymen group ($p > 0.05$). An intraobserver agreement was not observed between the evaluations (kappa $= -0.01$).

Conclusion: The results of this limited study indicated that it was not possible to differentiate gender by viewing photographs of anterior teeth.

Esthetic dentistry is an issue of importance for dentists and patients.[1-6] From economic, social, and sexual points of view, the desire to look attractive is no longer considered a sign of vanity. In a competitive world, an esthetic appearance is a necessity.[7,8] Given that the face is the most exposed part of the body, and the mouth is one of its most prominent features, teeth have become perhaps even more important.[7,9]

Currently, dentistry is widely practiced on patients with preserved natural dentitions,[10] despite the need for partial or total replacement of missing teeth. With advancements in techniques, materials, and knowledge, such as adhesive procedures, dental whitening, microabrasion, and cosmetic remodeling, dentists are able to modify the shape, color, size, and position of teeth predictably and efficiently.[7] Current restorative techniques enable clinicians to perform dental alterations previously possible only with dentures.[4]

When anterior teeth need to be restored, secondary to neglect, trauma, or esthetics, features inherent in the natural dentition may be of great value to achieve individualized and attractive restorations.[3,11] However, if all teeth are missing, and records relative to the original dentition are not available, other criteria will have to be used. These criteria may have been previously used for complete dentures and are now found to be useful for anterior dental restorations as well.[4] In this context, the maxillary central incisors are generally considered to be the most dominant teeth in the human dentition, and therefore the most important in terms of esthetics.[11]

Concerning the tooth shape, a century ago, Williams[12] suggested that a correlation existed between the shape of the inverted face and the shape of maxillary central incisors, a theory that became known as the "law of facial harmony." The contours of maxillary incisors were classified into three categories: triangular, ovoid, and square. In 1955, Frush and Fisher[13] proposed the so-called "dentogenic theory," which stated that gender, personality, and age could be used as guidelines for tooth selection, arrangement, and characterization to "enhance the

natural appearance of the individual."[14] These authors believed that delicacy, smoothness, and softness, described as female characteristics, could be reflected in prostheses for women, and that vigor and courage should be reflected in prostheses for men.[15] According to this theory, femininity was characterized by teeth with oval shapes and rounded edges, while masculinity was expressed with more square-shaped teeth.[16] Besides the shape, arrangement of teeth could also influence perceptions of femininity or masculinity, so that positioning lateral incisors in certain positions either softened or produced ruggedness depending on a patient's gender. The same occurred with positioning the long axis of canines: for women, the necks of canines would be more prominent than the incisal edges, and anteriorly, only the mesial half would be visible.[17] The dentogenic theory has been taught in dental schools for decades and has been adopted by generations of dentists as a major esthetic principle.[2,4]

The purpose of this article was to evaluate the assumption that there are morphological differences between the natural anterior dentition of men and women. The null hypothesis was that there would be no significant difference in dental professionals' abilities to correctly identify the gender of individuals by viewing intraoral photographs. To this aim, judges from different specialties, as well as laymen, attempted to determine gender, based on overall morphology and arrangement of anterior teeth.

Materials and methods

Forty dental students (20 men, 20 women) were selected from consenting persons in the College of Dentistry of Pará Federal University. The criteria used for selection were ages between 18 and 26 years, no missing teeth or any type of anterior tooth restorations, and no history of prior orthodontic treatment. The study was approved by the Research Bioethics Committee of the School of Dentistry of Pará Federal University (process no. 050/2006).

An intraoral photograph was taken of each student with a Dimage Z6 digital camera (Konica Minolta Photo Imaging, Mahwah, NJ). Plastic lip retractors (Expandex; Indusbello, Londrina, Brazil) were used to retract the lips. Images exposed only the labial surfaces of the occluded anterior teeth; lips were not visible in the photographs. For standardization of the images, the camera was attached to a tripod positioned at a 90° angle relative to the ground, 1 m between the middle of the chair where students sat and the middle of the tripod. The camera height was adjusted to the student's mouth level. The anterior teeth were framed in the camera display. The natural head position was adopted by asking students to sit in an upright position, looking into their own eyes through a mirror positioned behind the camera. Photographs were printed in color (size 10 × 15 cm^2), coded, and organized randomly in an album.

Photographs were analyzed by 15 judges: three orthodontists (Ortho), three restorative dentists (Res—specialists in cosmetic and restorative dentistry), three prosthodontists (Pro), three recently graduated general practitioners (Gen), and three laymen (not graduated in dentistry—control group). Each judge was directed to evaluate the photographs and identify the gender of patients and to describe the criteria used in the choice. These data were logged in a table with numbers corresponding to those in the album. After this initial evaluation, the process was repeated a week later, with the images in a different order to test reproducibility of the results of the first identifications.

All data were stored in a databank using the software program Microsoft Excel, version 2002 (Microsoft Co., Redmond, WA). Since nonparametric data were obtained, kappa and chi-squared tests were used for statistical analysis. This was complemented by the use of the odds ratio (OR). A 5% level of significance was adopted.

Table 1 Reliability and validity of the method

Judge	Kappa	% of correct responses in phase 1	% of correct responses in phase 2	% of correct and consistent responses between phases
Ortho 1	0.02	62.5	60.0	65.5
Ortho 2	−0.02	52.5	55.0	54.5
Ortho 3	−0.05	52.5	57.5	57.0
Res 1	−0.07	47.5	55.0	52.0
Res 2	0.07	72.5	65.0	76.0
Res 3	0.10	60.0	50.0	57.0
Pro 1	−0.10	57.5	67.5	66.0
Pro 2	0.05	52.5	47.5	50.0
Pro 3	−0.05	55.0	60.0	62.5
Gen 1	0.02	60.0	57.5	61.0
Gen 2	−0.15	55.0	70.0	68.0
Gen 3	0.02	62.5	60.0	67.0
Layman 1	0.02	57.5	55.0	62.0
Layman 2	−0.05	52.5	57.5	57.5
Layman 3	−0.10	60.0	70.0	82.6
Average%	−0.01	57.3	59.1	62.5

Results

Reliability and validity

Table 1 identifies kappa values, the proportion of correct responses in the two phases, and the proportion of correct responses in agreement between phases for each judge. Kappa values were estimated to measure agreement between the first and second phases. These values measured the degree of agreement beyond what would be expected solely by chance. The overall kappa value was −0.01, which suggested nonexistent agreement or disagreement (i.e., less than chance concordance). There were no statistically significant differences between judges ($p > 0.05$). On analyzing the correct and coincident responses for the same judge in the two phases, a minimum percentage of 50% was observed for Pro 2 and maximum of 82.6% for layman 3, with an average of 62.5%. On comparing the rate of correct and erroneous responses between groups of professionals through the chi-squared test, no statistically significant differences were found ($p > 0.05$). The same occurred when the layman group (control group) was compared with each group of professionals.

Figure 1 A majority of the judges correctly identified this person as female.

Photographic evaluation

In the first phase, from a total of 40 photographs, the gender of only one woman and one man was determined correctly by more than 90% of the evaluators. In contrast, photographs of one man and two women were erroneously identified by more than 85% of the participants. In the second phase, two photographs of men were correctly determined by more than 90% of the evaluators, whereas one woman was incorrectly identified by more than 85% of the participants. Figures 1 and 2 are examples of photographs classified correctly by a majority of judges as "female" and "male," respectively. Figures 3 and 4 are examples of images classified incorrectly by a majority of judges as "female" and "male," respectively. The photographs of male patients were correctly selected 58.8% of time; females were correctly identified 57.6%.

Regarding the criteria used for gender identification by the professionals, the predominate criteria noted were

- For women: rounded shapes; disproportionate sizes between central and lateral incisors; diastemas; short teeth; and inclinations of canines and lateral incisors.
- For men: square shapes; flat incisal edges; long, broad, and large teeth; incisal wear; and inclination of canines.

Figure 2 A majority of the judges correctly identified this person as male.

Figure 3 Example of a photograph of a male patient that was judged incorrectly as female.

Figure 4 Example of a photograph of a female patient that was judged incorrectly as male.

The main criteria used for the layman group for gender determination were

- For women: small, aligned, delicate teeth; small dental arches; and high levels of oral hygiene.
- For men: large, broad, and overlapping teeth; misaligned, serrated teeth with diastemas; yellow hues; large dental arches; and normal levels of oral hygiene.

Discussion

The factors of gender, personality, and age were reported by Frush and Fisher.[13,16] Regarding gender, they stated that rounded contours of incisal angles produced spherical effects of maxillary central and lateral incisors. They classified these characteristics as feminine. Straight angles, which produced cube-like effects in teeth, were classified as consistent with the male gender. In the present study, factors related to anatomical contours and alignment of teeth did not appear to be isolated determinants for correct gender identification.

Judges did not receive information regarding identifying characteristics relative to the determination of gender prior to

the evaluations. This enabled all judges to use their perceptions of esthetics. It may be concluded that, in this study, professionals used their knowledge and/or perceptions that they received as part of their life experiences and/or training; this is consistent with the observations of Hyde et al.[2]

In a study by McCord et al,[1] patients, dental students, and prosthodontists attempted to determine the gender and age of patients from photos of complete dentures. They reported that this was not a reliable method to identify gender and age. Hyde et al[2] reported that specialists, when asked to distinguish gender from plaster casts prepared from natural dentitions of men and women, could not differentiate between casts according to gender; however, they considered that casts reproduced the shapes, contours, and angulations of the teeth, but anatomical features such as hue, chroma, and value and the texture of gingival tissues could not be determined. In a study reported by Wolfart et al,[4] black and white intraoral photographs were used specifically avoid identifying the coloration of teeth and gingival tissues. The authors of the present study, in contrast to the above-mentioned studies, used color photographs. It should be noted that all of the above studies drew similar conclusions to those in this study: judges, whether professionals, patients, or laymen, were not able to identify gender in a statistically significant manner. These results are also consistent with reports published by Burchett and Christensen,[15] Sellen et al,[3] and Berksun et al[9]

The judges were asked about their evaluation criteria, something not done in the studies mentioned above. The answers confirmed that the professionals made their decisions based on the "dentogenic" esthetic concepts. Only two photographs in the present study were correctly identified by more than 90% of the evaluators; three of the 40 photographs were erroneously identified by more than 85% of the evaluators. Thus, it may be assumed that criteria used by professionals are not based on gender differences. In fact, there may be no discernible differences in tooth morphology related to gender. The "dentogenic theory" could therefore not be confirmed.

Regardless of whether the decision of the judges was correct, an analysis of the selection of each evaluator in the two phases was carried out. The rate of agreement varied between 52.5% and 82.5%. These results were close to those obtained by Wolfart et al[4] who observed variations between 54% and 77%. In this study, the intraobserver agreement was not statistically significant for any evaluator. In the study by Wolfart et al[4] 8 of 10 dentists showed statistically significant results. It can thus be observed that, in this study, none of the evaluators, despite having in mind certain criteria to differentiate gender, failed to replicate the second phase responses to the first phase. Thus, besides gender difference criteria not being evidence based, judges still applied the principles to the task at hand.

Factors influencing identification were length, position, and proportion of teeth, and the results of oral hygiene practices of the subjects. This latter factor, according to the observations of this study, was a criterion frequently used by layman judges, who had no anatomical references. In relation to the factors that influenced dentists, these were probably influenced by doctrines and theories widely discussed in dental schools, and are frequently mentioned in publications.[11-14,16,17] This may explain why some photographs with characteristics typical of one gender, according to the literature, were identified, in high percentages, correctly or incorrectly.

Conclusions

In this study, the photographs of male patients were correctly selected 58.8% of time; females were correctly identified 57.6%. It was not possible to correctly identify gender exclusively from intraoral photographs (anterior teeth). Dentists should be careful to create dental restorations consistent with patients' individual needs, whether the patient is male or female.

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