

RESEARCH ARTICLE

Prevalence of tooth forms and their gender correlation

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Abstract

Objective: This study evaluated different tooth shapes from female and male genders, matching them with the firstly proposed pure basic forms, and proposed different hybrid shapes; it also evaluated the percentage of correct gender identification of lay people, dentists and dental students.

Materials and Methods: Standardized digital photos were taken from 460 people and analyzed by 3 experts regarding genders and tooth forms: pure basic forms—oval (O), triangular (T), square (S) and rectangular (R); and combined hybrid forms—oval-rectangular (OR), triangular-rectangular (TR), triangular-oval (TO), square-oval with flat lateral incisors (SOF), and square-oval with scalloped lateral incisors (SOS). Then, correct gender identification (%) was evaluated among lay people, dentists and dental students ($n = 10$).

Results: Pure forms showed less prevalence in the population studied (O:6.52%; S:3.48%; T:3.26%; R:2.39%) than hybrid ones (TO:20.87%; SOS:20.65%; OR:19.57%; SOF:16.96%; TR:6.30%). Tooth gender selection among different evaluators was not significantly different ($\approx 50\%$ correct answers).

Conclusions: No correspondence exists between tooth shapes and patient genders. Pre-standardized pure tooth forms appeared less than hybrid ones, while the most frequently found in the population studied were TO, SOS, and OR forms, disregarding genders.

Clinical significance

Esthetic perception is an increasingly important criterion critical to satisfy patients. The correlation of reported tooth shapes with specific genders was not reliably observed in natural smiles. Tooth shapes should be selected according to the wishes of the patient rather than by previously believed gender specific tooth shapes. Pure basic tooth forms should be complemented with the addition of combination forms to more accurately portray forms found in nature.

KEYWORDS

forms perception, gender classification, tooth shapes

1 | INTRODUCTION

It has been proposed that optimal esthetics is accomplished if face, arch and tooth forms are in harmony.¹ When planning a treatment, dentists need to understand beauty, harmony, balance, and proportion, as perceived by the society;^{2,3} thus, smile components make a strong contribution in order to achieve an attractive face and pleasant smile. Different aspects need to be taken into consideration when observing

an ideal smile, such as symmetric composition of teeth, color and tooth shapes.¹⁻¹⁰ It has been said that tooth forms might be determined by sex gender,¹¹⁻¹³ age,¹¹ gingival arrangement,¹⁴ facial form,¹⁵ and even patient's emotions,^{10,11,16} among others. Esthetic perception and patients concerns are becoming an increasingly important issue, along with the demand of patients wanting to esthetically change their teeth.

When the upper anterior teeth need to be restored, natural dentition clues can be used to help achieving individual and attractive

restorations, therefore, photographs or cast models are of great help.¹ However, today, issues regarding dissatisfaction of patients with their original smile seem to be increasing, and the search for a pleasant smile is a trend within healthy patients. Improvements in dental materials made it possible to achieve tooth form and function using minimally invasive approaches.¹⁰ Final results must meet patient's esthetic expectations regarding harmony of the smile design and tooth shapes, frequently different than the ones they had originally.

It has been suggested by some that tooth forms should be influenced by the emotional aspects of the patient, the "theory of temperament," which was characterized by temperaments such as sanguine or dynamic, choleric or strong, melancholic or sensitive, and phlegmatic or peaceful.^{10,11} Williams suggested that the shape of the central incisor is supposed to be the inverted frontal view of the face (characterized as square, ovoid, and tapered), known as the "law of harmony" and considered until today as the pure basic forms.¹⁵ Further studies proposed additional combinations of the pure forms.⁸ Another theory is correlated to sex genders, which is a theory based on stereotypes that suggest that women presents more rounded, soft and delicate teeth (tapering/ovoid), and men should have square, angular teeth.^{11,12} Many dental schools instruct students to consider gender when arranging teeth and selecting tooth molds.^{11,12}

Among all those theories, innumerous papers cited that such correlations might not exist in nature.^{1,4,5,17,18} Different studies stated that it cannot be distinguished by photographs the patients' gender just by looking at their teeth.^{1,18} Also, it's been proved that inverted shape of the face does not correspond to the teeth shapes.⁴ A research that observed differences in genders concluded that some photos are wrongly identified as male, as well as the opposite.¹ They stated that it might happen because decisions are taken based on accepted assumptions regarding sex related differences of tooth forms, which might not reflect the reality. Also, it was noted in nature that among pure forms, oval are more frequent than other shapes, in both female and male genders.¹⁹

To visualize and study those different characteristics, digital software and digital cameras are tools that can be used.^{6,20} Digital tools exist for the purpose of designing anatomically shaped tooth restorations,²⁰ and digital cameras are the most common tool present in dental offices and laboratories, and can be used for communication between, dentists, technicians and patients to accomplish a desirable treatment regarding forms and colors.⁶

Contradictory results regarding tooth shapes among different studies might be related to the belief that diverse characteristics exist between genders and tooth forms, and digital photographs might be of great help in order to identify these characteristics. Thus, the aim of this study was to evaluate, throughout digital photos, the different tooth shapes found in different people regarding female and male genders, matching them with the firstly showed pure basic forms, and to propose different hybrid shapes according to the needs; and to evaluate the percentage of correct gender identification of lay people, dentists and dental students throughout the photos. Hypotheses tested were that: (1) Pure basic forms do not correlate to the majority of the

population studied; and (2) Percentage of correct gender identification by teeth photographs is showed to be different when evaluated by lay people, dentists and dental students.

2 | MATERIALS AND METHODS

This study was performed according to protocols approved by Universidad de los Andes, Chile, Institutional Review Board. Four hundred and sixty students (285 female; 175 male) from the University of Los Andes, Chile were randomly selected; research details were explained and each student signed a consent of agreement. Inclusion criteria regarded students within 18–32 years which anterior teeth had not undergone restorative treatments.

Digital photos were taken by an iSight camera from iPhone 6 (Apple, Cupertino, CA) and a 60-mm Moment lens (Moment; Los Angeles, CA), in artificial light calibrated into 5.500 Kelvin (IceLight; F.J. Westcott, Toledo, OH). A total of 920 photographs were taken and evaluated by three calibrated operators, being two per patient, with the camera positioned perpendicular to the floor at a standard distance of 40 cm from the patient's nose. Patients were instructed to stay with their head upright, without rotating, and with the occlusal plane of maxillary teeth parallel to the floor. For the first photo, a lip retractor was used and the patient was asked to open the mouth until a dark space was seen between both superior and inferior arches. Second photo was also taken with a lip retractor, from the superior arch with a dark contrast. Both photos were taken from the face of the patients, with a perfect observation of the teeth, which were separately analyzed after.

Photographs were evaluated in the Keynote software from a Macbook Air 13-in. 2015 (Apple, Cupertino, CA) by three different experts, and an agreement was obtained within them regarding the shapes. In the software, photographs were superimposed in the four conventional prototyped pure basic tooth shapes and evaluated: oval (O), triangular (T), square (S), and rectangular (R). While photographs were evaluated, it was observed numerous patients that did not fit the scope of the prestandardized tooth biotypes, and five new hybrid combinations were purposed, according to the combination of the previous biotypes: oval-rectangular (OR); triangular-rectangular (TR); and triangular-oval (TO), square-oval with flat lateral incisors (SOF), square-oval with scalloped lateral incisors (SOS). After the observation of the new tooth shapes, images of hybrid prototypes were created and the superimposition of the images to the photographs that did not match the first tooth shape criteria were performed again, with the new shapes. After that, a correlation between shapes and genders were performed.

The same photos were used to evaluate the percentage of correct responses of 10 dentists, 10 dental students and 10 lay persons regarding the gender of the patient in the photo. Data were analyzed using a one-way analysis of variance.

TABLE 1 Total prevalence of tooth shapes regarding genders

Tooth shapes	Total (%)	% Female	% Male
Oval (O)	6.52%	7.37%	5.14%
Square (S)	3.48%	4.56%	1.71%
Triangular (T)	3.26%	1.75%	5.71%
Rectangular (R)	2.39%	1.05%	4.57%
Triangular-oval (TO)	20.87%	21.40%	20.00%
Square-oval/scalloped (SOS)	20.65%	21.40%	19.43%
Oval-rectangular (OR)	19.57%	17.89%	22.29%
Square-oval/flat (SOF)	16.96%	20.00%	12.00%
Triangular-rectangular (TR)	6.30%	4.56%	9.14%
Total	100%	100%	100%

3 | RESULTS

Table 1 shows the percentages of the nine evaluated tooth shapes, the basic and hybrid ones. It was observed a higher prevalence of combined tooth forms than pure basic forms. Pure basic forms corresponded to: 6.52% (O); 3.48% (S); 3.26% (T); 2.39% (R); while combined hybrid tooth shapes corresponded to a total of: 20.87% (TO); 20.65% (SOS); 19.57% (OR); 16.96% (SOF); and 6.30% (TR). Difference between female and male genders concerning each tooth shape is also distinguished in Table 1. Figure 1 shows the pure basic tooth shapes and Figure 2 shows the combined hybrid ones, together with photographs that corresponded to the correlated form.

Tables 2 show the differences on tooth gender selection among lay people, dentists and dental students. It was not observed a statistical significant difference among lay people (51.37% of correct gender answers), dentists (52.99%), or dental students (54.33%) ($P > .05$).

Figure 3 shows correctly and incorrectly identified photographs regarding genders.

4 | DISCUSSION

Different aspects have been studied in order to correlate tooth shapes, genders and facial structures.^{11,12,15} However it is difficult to routinely correlate these factors with patient gender.^{1,4,5,17,18} This study aimed to evaluate different tooth shapes and propose hybrid shapes in order to clarify the large amount of possibilities in which a clinician can restore function and/or esthetic of a patient.

The first hypothesis was accepted, once it was observed a larger percentage of teeth characterized by the combined hybrid tooth shapes than the pure basic forms. Also, tooth forms are, in the wide majority of the cases, showed not to be correlated to gender. Tooth forms with the most ranked percentages (TO—20.87%, SOS—20.65%, and OR—19.57%) showed to have similar percentages among female and male genders. Regarding the basic forms, it was observed a slightly higher prevalence of square form for female than male, and slightly higher percentages of triangular and rectangular shapes for male than female, going in accordance to previous studies.^{18,19} Oval form showed to be similar for both genders, and was the shape with the highest percentage among the pure basic forms, also in accordance to previous studies.^{4,8,18,19} When evaluating the combined forms, TO, SOS and OR showed to have similar percentages within each other and when comparing female and male genders, while SOF showed higher percentage for female gender and TR showed prevalence for male gender. The combined shapes showed a tendency when evaluated together with the pure forms, as triangular and rectangular forms separately showed a tendency for male genders, and when the two forms were combined, the same tendency was observed, although it was not dramatic.

On the contrary of what was believed at first about female showing a rounded form,¹¹ oval shape and its combinations (TO, SOS, and

**FIGURE 1** Pure basic tooth shapes and their correspondent photographs



FIGURE 2 Combined tooth shapes and their correspondent photographs

OR) were not showed as a characteristic of female gender only and showed to be homogeneous among female and male genders, and was the most observed tooth shape in both hybrid and pure forms. This goes in accordance to previous studies.^{18,19} It was previously mentioned that a truly accurate method to measure and compare shapes such as face and teeth probably does not exist;⁴ moreover, it has been previously observed that tooth shapes cannot be correlated to genders,¹⁸ which was once again proved in this study.

Identification of genders by anterior tooth segment photographs has been showed in the literature.^{1,14,18} An average of 53% was found when correct answers were analyzed by dentists (54.33%), dental students (52.99%) and lay people (51.37%), and were not significantly different among each other in total, rejecting the second hypothesis. When evaluating correct answers when compared answers from male and female genders, it was observed that male gender was more easily detected than female (higher percentage of correct answers). A study that evaluated experts' answers from 60 digital photos showed that around 53–58% were correct, depending on gender.¹ Although the mentioned study evaluated less photographs than the present study, percentages of correct answers showed to be similar.¹ However, this study evaluated different types of people, and they all showed the statistical same values. The high number of pictures analyzed in this study, that showed no differences between lay people, dentists and dental

students (all close to 50%), means that results came closer to random (only two options were possible, male or female), showing the impossibility to correlate tooth form and gender. No studies or background can help a person identify gender based on tooth form. These results might also reflect the idea that not only experts believe that there is a specific form for woman and man, but the society in general has also the same erroneous perception, which is not observed in reality, as seen in this study. Careful analysis of the pictures also showed that lay people have a tendency to choose a "male" form when teeth have certain defects, misalignments, or just an undesirable appearance. Also, it was observed that, although a perception of rounded is characteristic for woman and square for man according to previous beliefs,¹¹ contrary to what was seen in the present study, there is a different perception by people when dealing with what they think is more esthetic or not.^{2,8} Schools should teach the students that gender and forms are not always related, other than teaching the past doctrines and theories.¹³ Until the date, there is no accepted rule or mathematical method to define morphologic features,¹ and most likely it will never exist, since tooth form results are not specific for a certain gender.

Obviously, the hybrid combinations cited in this study are not the only ones that exist and options must be given for patients to make a decision. Central incisors have been cited to be the key determinant for judge's esthetic preferences⁷ and the most dominant teeth displayed during smile;⁸ also, ridges, grooves, lobes, cingulum, and surface texture are easily detectable features recognized by the human observer²⁰ and should be taken into account when dealing with an esthetic treatment. Although photographs are the most used method to evaluate shapes and color,^{2,4,6,8,9,18} different diagnosis methodologies can also be used in the clinic to design the restorations according to patient's needs, such as the digital smile design, based on drawings in the screen of a computer, the morphogenic design method, CAD/CAM software, wax up and mock up, which by their turn shows the

TABLE 2 Correct answers among lay people, dental students and dentists, regarding female and male genders

	Lay-people	Dental students	Dentists
Correct answers (%)	51.37% A	52.99% A	54.33% A
Correct female (%)	37.82%	48.11%	39.14%
Correct male (%)	73.14%	67.14%	72.25%



FIGURE 3 Correctly and incorrectly identified photographs regarding to female and male genders. First row relates to male gender and the second row relates to female gender. Note that a more square shape results in a higher percentage of correct answers for male and a more rounded shape results in a higher percentage of correct answers for female for dentists and dental students. Lay people have the tendency to choose a “male” form when teeth have certain defects, misalignments, or just an undesirable appearance.

final outcome of the treatment via a resin applied onto the teeth of the patient.^{10,20} Such details must be taken into consideration, since different shapes have been described to be more pleasant in a rank of order of attractiveness when evaluated by dentists, technicians or patients.⁸

Results from this study show evidence that tooth shapes should be evaluated separately and according to patients' opinions, and not generalized according to genders or any pre-established parameters and shapes. Moreover, not only the pure basic forms should be considered, but also a combination of them (hybrid shapes), since the combined forms are much more prevalent than pure forms, as previously shown. Even more, in order to achieve natural looking restorations, clinician should rather think in combined forms as the first choice, since the prevalence of the just four combinations (TO-OR-SOS, and SOF) is roughly 80% compared to the four pure form together with <16% combined. Dentists and technicians should always consider several factors like recessions, alignment, gingival zeniths, gingival biotype, relation with the face and lips and show the patient a previous expected result of the case, allowing options regarding shapes to be chosen.

5 | CONCLUSIONS

Results from this study confirm the evidence that there is no correspondence between tooth shapes and patient genders, as believed previously. In addition, the pre-established four conventional tooth forms (oval, triangular, rectangular, and square) do appear in the population; however, it corresponds to a low percentage of people. It was observed that the highest percentages of tooth shapes observed in the population studied was hybrid forms, such as TO (20.87% total; 21.4% female and 20% male), SOS (20.65% total; 21.4% female and 19.43% male) and OR (19.57% total; 17.89% female and 22.29% male), while within the pure

basic forms, the oval was the most prevalent (6.52% total; 7.37% female and 5.15% male). Because of this, five new hybrid tooth shapes were proposed, being them: TO (triangular-oval), SOS (square-oval with scalloped lateral incisors), OR (oval-rectangular), SOF (square-oval with flat lateral incisors), and TR (triangular-rectangular). Clinically, there is no such thing as correlation among tooth forms and genders, and when dealing with esthetic procedures, trials must be performed and patient's suggestions must be taken into consideration, without considering only a specific tooth form, but the wide variety of it. Although not described in anatomy texts, combined hybrid forms should be primarily chosen, since their prevalence is much higher than classic pure forms, when wax ups and mock ups, prosthesis teeth or final restorations are done. Also, dental photographs are of good help in the dental practice and can help to guide decisions of patients and clinicians. Further studies should be performed to study prevalence in bigger samples.

DISCLOSURE STATEMENT

Author Eduardo Mahn declares that he has no conflict of interest. Author Stephanie Walls declares that she has no conflict of interest. Author Gilbert Jorquera declares that he has no conflict of interest. Author Ana María Valdés declares that she has no conflict of interest. Author Alejandra Val Jimenez declares that she has no conflict of interest. Author Camila S Sampaio declares that she has no conflict of interest. The authors do not have any financial interest in the companies or products used in this study.

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