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Gender-specific evaluation of variation of maxillary exposure when smiling

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ABSTRACT

Introduction: Excessive exposure of maxillary teeth when smiling can have a negative effect on the aesthetics and attractiveness of the face. The presented study was aimed to evaluate the effect of different amounts of gingival exposure on the perception of such human characteristics and qualities as age, attractiveness, gender specificity, and felt sympathy in the context of the whole face.
Materials and methods: Forty-two participants (21 female and 21 male students of Dental Medicine) were recruited as evaluators for the study. Two average-looking subjects (one female, one male) were photographed. The images were processed to create a series of eight clones with different gingival exposure (shift A-H; A = full over-exposure, H = invisibility of the crown surfaces of the teeth). The panellists evaluated characteristics as attractiveness, gender specificity, age, and felt sympathy.
Results: 42 participants joined the study (21 female, 21 male). Shift H was assessed as worst for sympathy and attractiveness, and resulted in the highest estimated age. Best attractiveness was observed for shifts C and D. Gender dimorphism was noticed, with own gender being rated as less attractive and opposite gender as more attractive.
Conclusions: Female and male evaluators assess excessive gingival and maxillary incisor display differently for female and male probands. Excessive over- or underexposure of the maxillary gingiva and teeth when smiling is perceived as unattractive and results in less observer sympathy.

1. Introduction

The smile, a unique characteristic of an individual, has a major effect on facial appearance. Deviations from harmonious smile patterns can have a negative effect on the aesthetics and attractiveness of the whole face (Eli et al., 2001). Growing awareness of the problem of "abnormal" exposure of maxillary teeth and gingiva reflects both modern society's demand for beautiful, healthy smiles and the effect of facial aesthetics on interpersonal relationships, everyday life, and career options (Hosoda et al., 2003). Such traits as the amount of gingival exposure, declination of the midline, appearance of the buccal corridor, incisal width-to-height ratio, incisal crown inclination, and the gingival contour are used to evaluate smile aesthetics (Moore et al., 2005; Wolfart et al., 2004).

It has been reported that a harmonious smile pattern arises from an aesthetically ideal combination of shape and colour of the hard tissues (teeth) and a good proportion of the soft tissues (upper lip and gum tissues) (Jørnung and Fardal, 2007; Akarslan et al., 2009). Gingival exposure of approximately 0–2 mm when smiling, and 2–4 mm exposure of the maxillary incisor edge when the lips are at rest are regarded as reasonable (Câmara and Martins, 2016).

Overexposure of gum tissues, i.e. >3 mm, when an individual smiles is described by professionals as "gummy smile." Although the condition is often regarded as unappealing (Ahmad, 1998; Garber and Salama, 1996; Levine and McGuire, 1997; Guo et al., 2011), what is attractive or beautiful to health professionals from the perspective of their training and experience may not coincide with what a patient or other individuals think is beautiful or attractive (Peck and Peck, 1970). Some movie stars and models, especially women, reveal more gingival tissue than others, when smiling but their appearance is still regarded as pleasant (Geron

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and Atalia, 2005). Smile pattern also varies with patient sex, age, nationality, and race (Guo et al., 2011).

Aesthetic perception of the components of an individual's smile has been evaluated by several authors. Such studies are usually based on a clipping of the face to display the mouth and teeth only (Geron and Atalia, 2005; Al-Habahbeh et al., 2009; Guo et al., 2011; Pithon et al., 2013; Drummond and Capelli, 2016; Machado et al., 2016). This, however, furnishes little information about perception of gingival exposure in the context of the whole face.

The purpose of this study was to evaluate the effect of different amounts of gingival exposure, achieved by alteration of photographs, on the perception of such human characteristics and qualities as age, attractiveness, gender specificity, and felt sympathy.

2. Materials and methods

2.1. Study participants

A total of 42 participants (21 female and 21 male students of Dental Medicine, mean age 24.7 years) at the Faculty of Dental Medicine of the University of Leipzig were recruited as evaluators for the study. The selection criterion for participation in the study was voluntary agreement of the students to evaluate eight portrait photographs. This study was exempt from institutional ethical review because it did not involve human subjects directly.

2.2. Study probands, photography

An average-looking female subject (age 22 years) and an average-looking male subject (age 26 years), each with a class 1 occlusal relationship, volunteered to be photographed with a smiling open mouth. Agreement to join the study and for their faces to be published in original and modified photographs was recorded in a written informed consent document. Digital photographs, taken with a Canon 50 D, were standard size, minimum 1500 pixel (width) × 2000 pixel (height), resolution 300 dpi.

2.3. Image modification

The photographs were digitally processed (Adobe Photoshop Elements 2.0, Arc Soft Photo Impression TM4) by the first author (N.C.P.) to create a series of eight clones with different gingival exposure. Variation of the visible anterior teeth was calibrated in steps of 2.3 mm in a 1:1 full-head photograph (vertical height from vertex to chin 26 cm, size of incisor crown 10.0–11.6 mm). Gingival exposure ranged from full overexposure (gummy smile, visible gingival height 4.5 mm above the incisors) to total invisibility of the crown surfaces of the teeth (Fig. 1A–H, female; Fig. 2A–H, male).

2.4. Image presentation

PowerPoint presentation was used to show the images to the panel. The panellists were shown each photograph separately and had 1 min to evaluate such characteristics as attractiveness, gender specificity, age, and felt sympathy for the probands. The evaluation was performed in one session, in a dark, silent room, without the presence of third parties or exchange of opinions. To prevent bias in the assessment, the sequence of appearance of the eight female and eight male images was random. Images of male and female clones were alternated.

2.5. Questionnaires

The ratings were noted on a questionnaire that consisted of two parts: demographic data of the participant (age and sex) and a numerical scale on which the participant was asked to rate each photograph from 0 (best) to 10 (worst) according to attractiveness, gender specificity, and felt sympathy. The estimated ages of the subjects in each photograph were noted separately. At the end of the session, the raters saw all eight female and all eight male clones together and had to assess their most and least favourites of all of the male and female clones.

2.6. Data transformation and statistical analysis

Ordinal- and binary-scaled variables were described by use of absolute and relative frequencies. Continuously scaled variables were described by use of mean value, standard deviation, minimum, maximum, and median value. Tables are accompanied by figures (scatter plots, bar charts, bubble plots, and box–whisker plots).

Box–whisker plots present data in a form that shows the distribution of the data. The box is limited by the 25th and 75th percentiles, and the line within the box shows the median. The length of the box represents the interquartile range (IQR), which includes the middle 50% of the data. The whiskers show the ranges outside the 25th and 75th percentiles. Outliers are shown separately as points or stars. In this work, outliers are defined as data outside the range from the 25th percentile $- k \times$ IQR to the 75th percentile $+ k \times$ IQR, where $k = 1.5$ and 3.0 for outliers and extreme outliers, respectively. For statistical analysis the data were restructured (factorial structure). Tables used for analysis contained the columns listed in Table 1.

A separate table was used for data describing best and worst ratings (Table 2). Complete descriptive data and tables are not shown, but are available on request. Statistical analysis was performed by use of SPSS 20. The *t*-test and ANOVA were used for investigation of differences and relationships between assessments of the male and female probands.

3. Results

A total of 42 individuals participated in the study (21 female, mean age 23.9 ± 2.1 years, range 21–30 years; 21 male, mean age 25.6 ± 3.1 years, range 22–35 years).

3.1. Estimated ages of proband clones

The ages of the eight female clones estimated by the raters were: female rater: mean 27.4 ± 3.8 years, range 20–40 years; male rater: mean 27.3 ± 4.7 years, range 18–50 years. The ages of the eight male clones estimated by the raters were: female rater: mean 27.0 ± 4.1 years, range 18–40 years; male rater: mean 26.9 ± 4.6 years, range 16–50 years. The estimated ages of the proband clones are depicted graphically in Fig. 3. The box–whisker plots are indicative of very similar rating by male and female panellists. Age was overestimated for gingiva shift “A” (maximum gingival exposure) for the female proband, for gingiva shift “G” (almost minimum exposure of gingiva and teeth crowns) for the male proband, and for gingiva shift “H” (no exposure of teeth crowns) for both probands (Fig. 3).

3.2. Estimated attractiveness of proband clones

A U-shaped pattern was obtained, with worst attractiveness for gingiva shifts “A” and “H” and, to a lesser extent, for shifts “B” and “F” (Fig. 4). Attractiveness was best for shifts “C” and “D”; the U shape was not completely symmetric. The figure is indicative of very similar rating by male and female panellists. The attractiveness of the female proband was rated higher by female raters than by male raters (white boxes without pattern).