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ORIGINAL ARTICLE

Gender Influence in Maxillary Incisor Display and Buccal Corridor

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ABSTRACT

Introduction: A person's smile, can improve the first impression in interpersonal interactions, which is known as one of the ways to get positive feedback from society. In dental aesthetics, smile analysis helps dentists arrange a patient's appropriate dental treatment plan, which is influenced by balancing and harmonizing the maxillary incisor display and the buccal corridor. This present study was intended to determine the differences between the maxillary incisor display and the buccal corridor based on the social smiles exhibited by males and females. **Materials and methods:** This analytical observational study was conducted using a cross-sectional design. A total of 110 profile photographs, consisting of 55 males and 55 females who met the inclusion criteria, were taken when the subjects made a social smile. It was then measured using CorelDraw Graphic Suite 2022 and analyzed using the Chi-Square Test. **Results:** A significant difference was found in the buccal corridor between males and females, with a significance value of 0.022 ($p < 0.05$). However, no significant difference was found in the maxillary incisor display on both, with a significance value of 0.979 ($p < 0.05$). **Conclusion:** A difference in a social smile was found based on the component of the buccal corridor in males and females. However, no differences in the maxillary incisor display were observed.

Keywords: Smile, Social smile, Maxillary incisor display, Buccal corridor, Gender

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INTRODUCTION

Smiling is a behavior that conveys positive emotions, such as happiness, pleasure, friendliness, and appreciation, and may contribute to facial attractiveness. This expression was supported by a dynamic and complex movement that involves the simultaneous interaction of several facial muscles.(1,2) An attractive and pleasant smile may improve interpersonal relationships and often determine how well a person mingles with society.

A smile is anatomically defined as a facial expression resulting from the contraction of the facial muscles around the mouth. This contraction stretches the midline of the lips laterally, elevates the mouth corners, and highlights the *sulcus nasolabialis*. Furthermore, it has been observed that the act of smiling results in the

narrowing of the eye slits and the development of fine lines on the outer corners of the eyes. The mouth usually slightly opens, revealing the maxillary anterior teeth.(3) The *musculus zygomaticus major* is the primary muscle involved in creating a smile. This muscle elevates the mouth corners upward and outward, leading the lips to form a smile.(4) Other facial muscles such as *musculus risorius*, *musculus levator anguli oris*, *musculus zygomaticus minor*, and *musculus buccinator* also contribute to creating a smile.(3)

Smiles can be categorised into two types: a controlled smile (social or *non-Duchenne* smile) and an uncontrolled smile (genuine or *Duchenne* smile). A social smile, or *non-Duchenne*, occurs when *musculus zygomaticus major* and *musculus levator labii superioris* contract and raise the upper lip forming *sulcus nasolabialis*. *Musculus levator labii superioris* contraction results in the superiorly raising of the upper lip in the region of the anterior teeth. Whereas, *musculus zygomaticus major* contraction attracts the mouth corner superiorly and laterally until it meets the resistance area of the

adipose tissue of the cheek. The *musculus buccinator* then helped in further elevating the lips.(5–9) Contrary to a social smile, a genuine smile, known as *Duchenne*, is characterized by squinting while smiling. It occurs when the *musculus orbicularis oculi* and *musculus zygomaticus major* coordinate to support the maximum elevation of the upper lip.(6)

An aesthetic smile may have an impact on a person's attractiveness. Thus, it becomes one of the important factors that may affect a person's psychosocial health. A person with an aesthetically pleasing smile is often perceived as smarter and more valued due to their display of preferred behaviours in social interactions. (10,11) In accordance with this statement, Pithon et al., (12) asserted that a person with an aesthetically pleasing smile has a higher chance of getting a job because they appear more intelligent. As more people realize the benefits of an aesthetic smile, more people are looking to improve the attractiveness of their smile through various cosmetic treatments such as plastic surgery and dental treatments such as orthodontics, periodontal surgery(13), and orthognathic surgery.(14)

Dentists need to evaluate a patient's smile when arranging a dental treatment plan to ensure that the treatment won't harm its appearance. This evaluation includes analyzing the harmony and balance of the patient's smile components.(15) The components of smile include the lip line, the smile arch, the upper lip curvature, the buccal corridor, the smile symmetry, the occlusal frontal plane, the dental components, and the gingival components.(3) One important dental component to be considered is the maxillary incisor display.(16,17) The maxillary incisor display plays a crucial role in achieving an aesthetically pleasing smile, particularly in prosthodontic treatments that involve replacing anterior teeth.(18) Excessive display of the maxillary incisor can negatively affect the appearance and attractiveness of a person's smile.(19) The buccal corridor is another component that should also be considered, as it contributes to a more natural-looking smile.(20)

The maxillary incisor display is the vertical length of the central incisors that are visible during mouth rest or function.(18) According to Jeelani et al.,(21) the maxillary incisor display in females is generally greater than that of males. This might be caused by the different vertical length of the upper lips among genders.(21,22) However, Bahirrah et al.,(23) did not find a significant difference in maxillary incisor display between genders. The aging process may affect the maxillary incisor display due to the loss of elasticity in the lip muscles. (24)

Another key aspect to consider when assessing smile aesthetics is the buccal corridor.(8) It refers to the black or dark area visible between the buccal surface

of posterior teeth and the lip corner during smiling. Its appearance may give the illusion of a natural-looking smile.(25) Smiles with minimal buccal corridor (0%-10% buccal corridor) are considered the most attractive smile, whereas smiles with an extensive buccal corridor (15%-25% buccal corridor) are considered less attractive.(25,26) Research by Ira(27) suggested a significant difference in the buccal corridor between males and females due to the different shape of the jaw forming the buccal corridor. However, Analia et al.,(22) stated that gender has no impact on the variation in the width of the buccal corridor and does not interfere with the assessment of the buccal corridor.

Based on the background mentioned above, including the contradictory findings from previous studies, the present study aimed to determine if there was a difference in the maxillary incisor display and buccal corridor between males and females based on their type of social smile.

MATERIALS AND METHODS

Our present study conducted analytical observational research using a cross-sectional design in the Laboratory of the Faculty of Dentistry, Universitas Trisakti, from October until December 2022. The Research Ethics Commission at the Faculty of Dentistry, Universitas Trisakti, approved all procedures for this study, with the assigned number 021/S3/KEPK/FKG/6/2022. From a total of 289 participants, only 110 participants (50 males and 50 females) ranging in age from 17 to 24 years had complete upper teeth distributed uniformly on both the right and left sides, with healthy periodontal tissue. Participants who have had dental treatments on the anterior teeth such as orthodontic, conservative, and prosthodontic treatment; had facial trauma that may interfere with the movement of facial expression muscles; had experienced a damage to the anterior teeth, dental trauma, disease, or steroid drug intake that may lead to changes in facial appearance; had facial aesthetic treatment such as lip fillers or botox; and for men, had moustache due to blocking the point measurement on the lip corners were excluded. Furthermore, we explained the research procedure to the participants, who confirmed their agreement with the signing of the informed consent form.

Photograph Capture

The same operator captured all photographs in the laboratory under natural sunlight using a Canon EOS-600D with an 18-megapixel resolution, ISO 100–6400, and an 18–135 mm lens. The camera is mounted on a tripod and placed in front of the subject at a distance of 30 cm. The points of interest included the top of the forehead, the lower edge of the chin, and both earlobes. Makeup should be removed. To obtain head photographs in neutral head position (NHP), the participant was instructed to sit upright and stare straight

ahead at the spot at eye level on the wall in front of them. A waterpass attached to the glasses was worn by the participant to maintain his or her head's position at NHP. Moreover, an elbow ruler was also equipped with waterpass to confirm their position parallel to the floor. This technique was introduced by Maniyar, et al.(28)

Afterwards, the participant was instructed to say "cheese" to produce a social smile and pose a bigger smile to obtain the height of the cervico-incisal of the maxillary central incisor. A 20 x 30 cm elbow ruler was used as a benchmark for further measurement and placed on the right side aligned with the participant's head while capturing photographs (Figure 1).

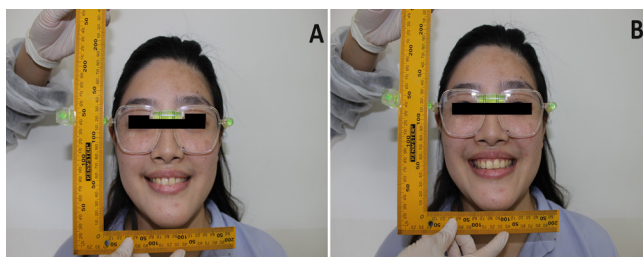


Figure 1: Procedure for Participant's Profile Photography Captured. (A) A social smile pose of the participant with a right-angled 20 x 30 cm ruler placed to their right. (B) The participant's widest smile pose, with perfect visibility of their maxillary incisor teeth. A 20 x 30 cm angled ruler was placed on the participant's right side.

Photograph Assessment

Photographs were assessed using *parallel dimension tools* in CorelDraw Graphic Suite 2022 by two calibrated examiners who were both healthy and stable emotionally. The smile components that would be evaluated were:

-Maxillary Incisor Display: was calculated by dividing the visible length of the maxillary central incisor (from the incisal edge to the inferior line of the upper lip) while smiling with the length of the actual tooth (from the incisal edge to the cervical crest). The score was presented in percentage, then described in terms of three types of smiles: low, average, and high.(23,29) A low smile is defined when less than 75% of the maxillary incisor is seen while smiling. An average smile is defined as 75–100% of the maxillary incisor and interdental papilla being seen while smiling. Whereas, when a complete cervico-incisal maxillary incisor (100%) with some amount of gingival margin is seen, it is called a high smile.

-The buccal corridor: was known as the dark space that appears between the buccal surface of the last teeth of the maxillary posterior displayed during smiling and the inner commissure. It was calculated by dividing the difference between the width of the inner commissure and the width of the visible maxillary teeth (from right to left) by the width of the inner commissure (also from right to left), and then it was presented as percentages and categorized into six types of smiles: extra broad (0% buccal corridor), broad (5% buccal corridor), medium-broad (10% buccal corridor), medium (15% buccal

corridor), medium-narrow (20% buccal corridor), and narrow (25% buccal corridor)(30).

Statistical Analysis

A Chi-square test was performed to determine if there was a significant difference in the appearance of smile components (the maxillary incisors and buccal corridor) and gender (male and female). Significant level was set at 0.05.

RESULTS

A total of 110 participants, consisting of 55 males and 55 females, were recruited for the present study. Profile photographs were captured while these subjects were socially smiling. An elbow ruler, 20 x 30 cm, was employed as a reference for measurement.

Interrater Reliability

To determine the reliability of two calibrated assessors measuring the maxillary incisor display and buccal corridor, Cohen's Kappa was performed and showed the *kappa* coefficient values for the maxillary incisor display and buccal corridor were 0,831 and 0,812, respectively (Table 1). These indicated that the agreement degree between two assessors was almost perfect.

Table 1: Cohen's Kappa Test Result

No.	Smile Components	Kappa Value	Power of Agreement
1.	Maxillary Incisor Display	0,831	Perfect
2.	Buccal Corridor	0,812	Perfect

The Maxillary Incisor Display

Low smile was frequently observed among the genders in both males (50,9%) and females (52,7%) followed by average smile (male 36,4% and female 34,5%) and high smile (male 12,7% and female 12,7%) (Figure 2 – 4). There was no statistically significant difference in the maxillary incisor display based on gender, with a significant value of 0,979 ($p < 0,05$).

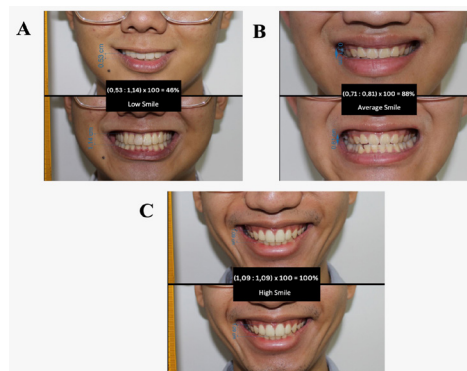


Figure 2: Result of The Maxillary Incisor Display of Males During a Social Smile. A) Low smile exposes 75% of the maxillary incisor. B) Average smile exposes 75–100% of the maxillary incisor and interdental papilla. C) High smile exposes a complete cervico-incisal maxillary incisor (100%) with some amount of gingival margin.

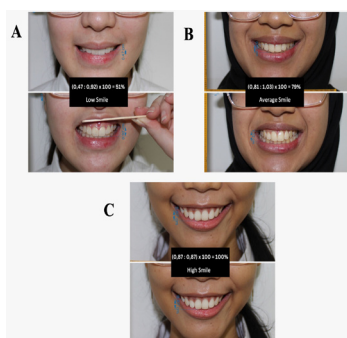


Figure 3: Result of The Maxillary Incisor Display of Females During a Social Smile. A) Low smile exposes 75% of the maxillary incisor; B) Average smile exposes 75–100% of the maxillary incisor and interdental papilla; C) High smile exposes a complete cervico-incisal maxillary incisor (100%) with some amount of gingival margin.

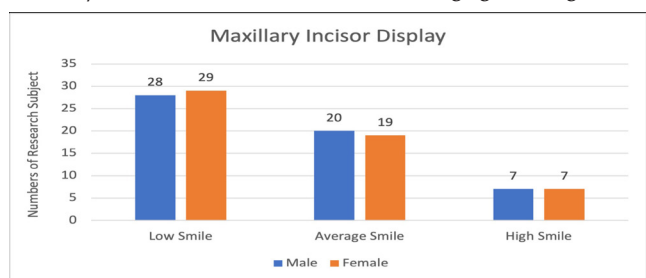


Figure 4: Frequency Distribution of Maxillary Incisor Display Based on Social Smiles.

The Buccal Corridors

The buccal corridor-based smile frequency pattern was differently distributed between genders (Figure 5 – 7); medium-broad (10% buccal corridor) was the most observed among participants in both males (40%) and females (34,5%), followed by broad (male 18,2% and female 27,3%), extra broad (male 7,3% and female 18,2%), medium (male 16,4% and female 9,1%), medium-narrow (male 12,7% and female 3,6%) and narrow (male 5,5% and female 7,3%). The least observed in males and females were narrow (25% buccal corridor) and medium-narrow (20% buccal corridor), respectively. Due to the fact that the chi-square test revealed that the value did not meet the requirement and more than 20% of the cells had less than the expected value, Mann-Whitney was performed as the alternative method, and it showed that the buccal corridor among genders was significantly different, with a significant value of 0,022 ($p < 0,05$).

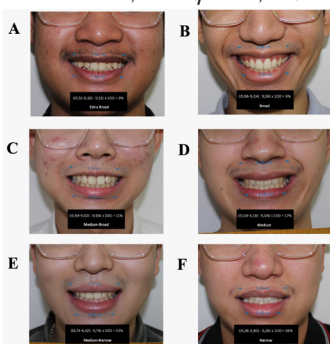


Figure 5: Result and Calculation of The Buccal Corridors of Males During a Social Smile. A) Extra Broad Smile (0% buccal corridor); B) Broad Smile (5% buccal corridor), C) Medium-broad Smile (10% buccal corridor); D) Medium Smile (15% buccal corridor); E) Medium-narrow Smile (20% buccal corridor); F) Narrow Smile (25% buccal corridor).

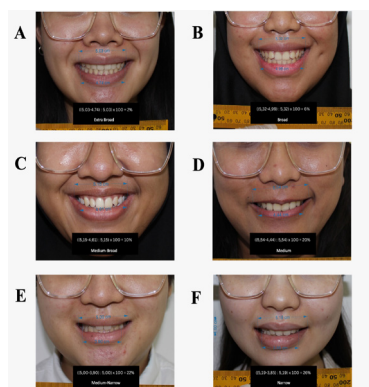


Figure 6: Result and Calculation of The Buccal Corridors of Females During a Social Smile. A) Extra Broad Smile (0% buccal corridor); B) Broad Smile (5% buccal corridor), C) Medium-broad Smile (10% buccal corridor); D) Medium Smile (15% buccal corridor); E) Medium-narrow Smile (20% buccal corridor); F) Narrow Smile (25% buccal corridor).

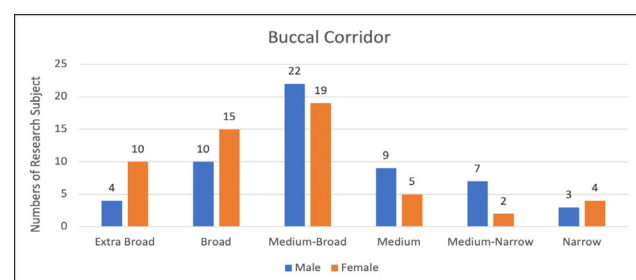


Figure 7: Frequency Distribution of Buccal Corridors Based on Social Smiles.

DISCUSSION

The smile components must be considered by dentists as a reference in planning patient dental treatment in order to achieve an aesthetic smile. The maxillary incisor display and buccal corridor are two components which have a considerable impact on a person’s smile’s beauty. As a result, the present study aimed to observe differences in maxillary incisor display and buccal corridor between males and females when performing social smiles.

A total of 110 photographs from 55 male and 55 female participants were collected for the present study. Two calibrated assessors used Corel Draw Graphic Suite 2022 to measure the maxillary incisor display and buccal corridor. The Cohen’s Kappa test was first performed to determine the strength of agreement in measuring between them. The Kappa coefficient values on the maxillary incisor display and buccal corridor were 0.831 and 0.812, respectively. These indicated that the strength of the measurement agreement between the two assessors was almost perfect, meaning that the data can be trusted.

No significant difference between genders in maxillary incisor display was found in this study. Most participants were classified as having a low smile, males (50.9%) and females (52.7%), followed by an average smile (males 36,4%, females 34,5%) and a high smile (males and females 12,7%). This finding is consistent with a

previous study(23) which found that low smile was the second most common smile among the gender. However, it was in contrast to previous study(18). They reported that the maxillary incisor crown visible during smiling was longer in women than in men. The contrast might be due to a difference in measurement techniques and ethnicity between the participant population.

The appearance of maxillary incisor display when smiling depends on the contribution of *musculus zygomaticus major* and *musculus levator labii superioris*, depending on which muscle contracts more dominantly. Iwanaga et al.(6) explained in their research, when *musculus zygomaticus major* is dominant, the mouth corners are lifted superiorly and laterally then *musculus levator labii superioris* raises the upper lip and exposes the maxillary teeth. In other hand, when *musculus levator labii superioris* is dominant and firstly contracts, the maxillary incisor teeth are revealed up to the canines. The simultaneous contraction of *musculus depressor labii inferioris* also contributes to the smile pattern, revealing the entirety of the upper and lower teeth.

The maxillary central incisor display during smiling may decrease with age in both males and females from 20 years of age.(18,24) Facial muscle exercises could help to create an aesthetic smile and prevent muscle sagging.(18) The dentoalveolar height of the anterior maxilla has also been shown to have a relationship with the excess of maxillary incisors display. Excessive anterior maxillary height is likely to result in gummy smile exposure(21) and reduce the aesthetic value of the smile.(31)

The assessment of smile aesthetics includes the evaluation of the buccal corridor(32) which is known as the dark space between the buccal surface of the last of the maxillary posterior teeth displayed during smiling and the inner commissure.(16,25) Its presence was important for a natural-looking smile. The excessive buccal corridor, more than 15% (narrow smile), was considered as less attractive by orthodontists and dental students.(33)

Most participants were classified as having a medium-broad smile, males (40%) and females (34,5%). The results also show that males tend to have a medium to a narrow smile, while women tend to have a broad to a very broad smile. This finding was in agreement with previous study(22) which found that the buccal corridor in females was mostly classified as medium-broad smile (32,9%) whereas in males, most of buccal corridor was categorised as a medium smile (58,3%). This indicated that females have a wider smile than males. This study found a significant difference in buccal corridor among genders. Hadi et al.,(34) also found a significant difference in buccal corridor among the genders, but stated that males tended to have an extra broad smiles than females. The difference might be due to differences in the technique used to measure the buccal corridor.

Its appearance is affected by various factors, such as the width of the maxillary arch, the facial muscles, the labial surface of the maxillary premolars, and the prominence of the canines, particularly at the distal marginal ridge.(22,25,35) The maxillary arch has a direct impact on the buccal corridor. A broad arch that forms a U shape is considered an ideal arch. However, a narrow arch is considered an unattractive arch because it has a wide buccal corridor.(36) The facial type also contributes to the appearance of the buccal corridor. A medium smile was seen in the dolichofacial facial type. A medium-broad smile was seen in those with mesofacial. Whereas, the brachyfacial tends to have a broad smile.(22) Furthermore, as people age, changes occur in the facial muscles that result in a loss of muscle elasticity and tone.(17)

The lack of age group variation, such as young adulthood, adulthood, and the elderly, is a limitation of our study because the maxillary incisor display(17,18) and buccal corridor(17) may change with age. Further research is needed with more focus on the type of smile, upper lip contraction, dental appearance, and gingival tissue in different age groups. This study shows that the use of individual profile photos during social smiling can be used for evaluation in the preparation of dental treatment plans. Clinicians should remember that a small change in the maxillary incisor and buccal corridor may significantly affect the perceived aesthetics of the smile.

CONCLUSION

The study found significant differences in the buccal corridor between male and female social smile types, but no significant differences in maxillary incisor display.

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