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EFFECT OF BUCCAL CORRIDORS ON SMILE ESTHETIC IN DIFFERENT FACIAL TYPES AMONG THAI POPULATION

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Abstract: Esthetic has become the major concerns for the majority of patients seeking orthodontic treatment. One factor that can affect attractiveness of the smile is buccal corridor size. Therefore this study aimed to evaluate the smile attractiveness of facial display in frontal view with different buccal corridor sizes and different facial types in Thai population**.** Using visual analog scale survey, facial display sets of selected male and female models with five different sizes of buccal corridors (2%, 10%, 15%, 22%, and 28%) in three different facial types (brachyfacial, mesofacial, and dolichofacial) were rated by the subjects. Subjects were 403 Thai laypersons (107 males and 296 females) aged between 18-40 years old from all geographic regions. The results indicated that, Thai people rated buccal corridor size of 15% as the most while the least attractive buccal corridor size was found to be 28% (the widest buccal corridor/the narrowest smile) for all facial type in both genders. Compared to the most attractive buccal corridor size, statistical analysis showed that the range of the buccal corridor size that did not compromise smiling attractiveness were 10-15% in mesofacial, 2-22% in brachyfacial, 10-15% in dolicofacial male and 10-22% in dolicofacial female.

Keywords: Buccal corridors, Smile esthetics, Facial type

บทคัดย่อ ในปัจจุบันความสวยงามเป็นสิ่งสำคัญที่ทำให้ผู้ป่วยส่วนใหญ่มาเข้ารับการรักษาทางทันตกรรมจัดฟัน ปัจจัยหนึ่งที่ส่งผลต่อความสวยงามของรอยยิ้มบนใบหน้า ได้แก่ขนาดของบัคคัลคอร์ริดอร์ ดังนั้นการศึกษานี้จึงมีวัตถุประสงค์เพื่อประเมินความสวยงามของรอยยิ้มที่มีขนาดของบัคคัลคอร์ริดอร์ที่ต่างๆกัน ในคนไทยที่มีใบหน้าแบบต่างๆ การศึกษานี้ประเมินความสวยงามโดยใช้ visual analog scale เพื่อให้คะแนนของภาพถ่ายใบหน้าของตัวแบบชาย 1 คน และหญิง 1 คน ซึ่งจะถูกปรับให้มีใบหน้า 3 แบบ (brachyfacial, mesofacial, and dolichofacial) และในแต่ละแบบของใบหน้า ให้มีขนาดของบัคคัลคอร์ริดอร์ที่ต่างๆกัน 5 ขนาด ได้แก ร้อยละ 2, ร้อยละ 10, ร้อยละ 15, ร้อยละ 22 และร้อยละ 28 ผู้ประเมินประกอบด้วยคนไทยจำนวน 403 คน (ชาย 107 คนและหญิง 296 คน) ที่มีอายุระหว่าง 18 ถึง 40 ปี อาศัยอยู่ในภาคต่างๆของประเทศไทย ผลการศึกษาพบว่า บัคคัลคอร์ริดอร์ขนาดร้อยละ 15 มีความสวยงามมากที่สุดสำหรับคนไทย ในรูปหน้าทั้งสามแบบทั้งในชายและหญิง ส่วนบัคคัลคอร์ริดอร์ขนาดร้อยละ 28 ซึ่งเป็นขนาดของบัคคัลคอร์ริดอร์ที่กว้างที่สุด พบว่ามีความสวยงามน้อยที่สุด ในรูปหน้าทั้งสามแบบทั้งในชายและหญิง จากการวิเคราะห์ทางสถิติพบว่า ช่วงของขนาดของบัคคัลคอร์ริดอร์ที่จะยังคงความสวยงามไม่ให้ลดลงอย่างมีนัยสำคัญ ได้แก่ ร้อยละ 10-15 ในใบหน้าแบบ mesofacial, ร้อยละ 2-22 ในใบหน้าแบบ brachyfacial, ร้อยละ 10-15 ในเพศชายที่มีใบหน้าแบบ dolicofacial และร้อยละ 10-22 ในเพศหญิงที่มีใบหน้าแบบ dolicofacial

คำสำคัญ บัคคัลคอร์ริดอร์; ความสวยงามของรอยยิ้ม; รูปหน้าแบบต่างๆ

INTRODUCTION

Esthetics has increasingly become an important aspect of concerns for dental patients**.** Most patients seek orthodontic treatment for the purpose of improving smile esthetics**.** The smile as one of displaying components on the face is one of the important factors contributing to facial attractiveness**.** Facial and dental esthetics correlated with **'**quality of life**'**, because those who benefit from facial attractiveness have an increased interpersonal acceptability, seen as intelligent, adds confidence and socially acceptable therefore facial attractiveness is the key to social success (Chang et al., 2011)**.** Although ideal occlusion is the primary functional goal of orthodontics, esthetic outcome is another critical treatment goal should be taken into consideration in order to achieve patient**'**s satisfaction of orthodontic treatment outcome (Desai, Upadhyay, & Nanda, 2009)**.**

Buccal corridor is the negative space between the lateral aspect of maxillary dentition and commissures of the mouth. Buccal corridor appears as black spaces and can affect smile esthetic. According to Frush & Fisher (1958), having the right amount of buccal corridor space can give an impression of natural dentition (Frush & Fisher, 1958)**.** However, the absence of buccal corridor or revealing too much of buccal corridor space may instead lead to resemblance of artificial-liked dentition when smiling (Frush & Fisher, 1958; Parekh, Fields, Beck, & Rosenstiel, 2007)**.** Therefore, different size of buccal corridor can affect the attractiveness of smile.

Factors affecting the size of buccal corridor include arch form (McNamara, McNamara, Ackerman, & Baccetti, 2008; Sarver & Ackerman, 2003a, 2003b; Snyder, 1999; Yang, Nahm, & Baek, 2008) and facial type**.** Facial type can be categorized into 3 types; brachyfacial type, mesofacial type, and dolichofacial type, according to facial index, which is the ratio of facial height over the facial width **(**Figure 1**).** It is postulated that extremely short-faced and long-faced person**'**s buccal corridor may be affected by transverse or vertical changes more than those with mesofacial type (Ackerman, 2005)**.** Furthermore, previous study found negative correlation found between vertical facial pattern and buccal corridor size (Yang et al., 2008) meaning that long-faced person might naturally have smaller buccal corridor than short-faced person. Pithon et al., 2014 found slight differences between the size of buccal corridor preferred with each facial type (Pithon et al., 2014)**.** However, the trend is towards that the small size of buccal corridor is more esthetically perceived than larger buccal corridor size (Pithon et al., 2014)**.**

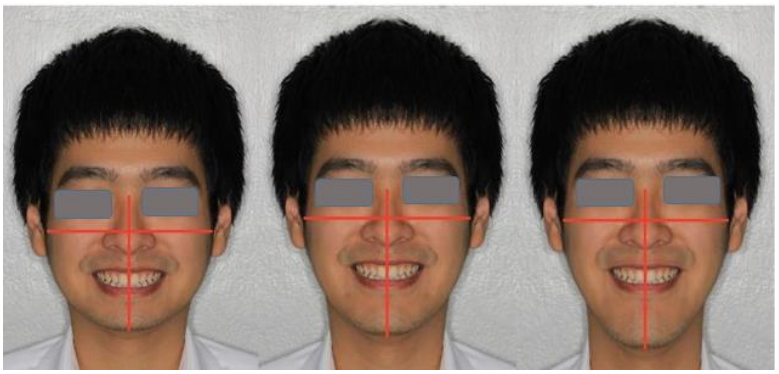


Figure 1. Facial Index in brachyfacial (left), mesofacial (middle) and dolichofacial (right). The vertical lines represent the facial height and the horizontal lines represent the facial width.

Other factors that could potentially influence the smile esthetics perception include dental education background, race and ethnic groups of the individual's judgment. For dental education background, different in esthetic judgement was found between laypersons, dentists, and orthodontists in rating the esthetic score. Orthodontists were more critical in rating the score than the dentists and the dentists more than the laypersons (Meyer, Woods, & Manton, 2014). Also, it was suggested that the usage of full-face photograph and perioral photographs may have impact upon the esthetic rating as well (Meyer et al., 2014).

MATERIALS AND METHODS

Image manipulation

Two Thai undergraduate dental students (a male and a female) were selected as the model using the following criteria: 1) age between 20 and 30 years old, 2) possess an 'ideal' smile line with symmetry between maxillary central incisors, 3) absence of diastema, 4) presence of normal upper incisor angle and gingival exposure no greater than 3 mm, and 5) no midline shift with normal tooth anatomy.

Each model's 'head position' was oriented to a natural forward angle. Photographs of each model were taken from frontal view with a posed smile by using a Canon EOS 600D camera with a 100-mm macro lens and Canon Macro Ring Lite.

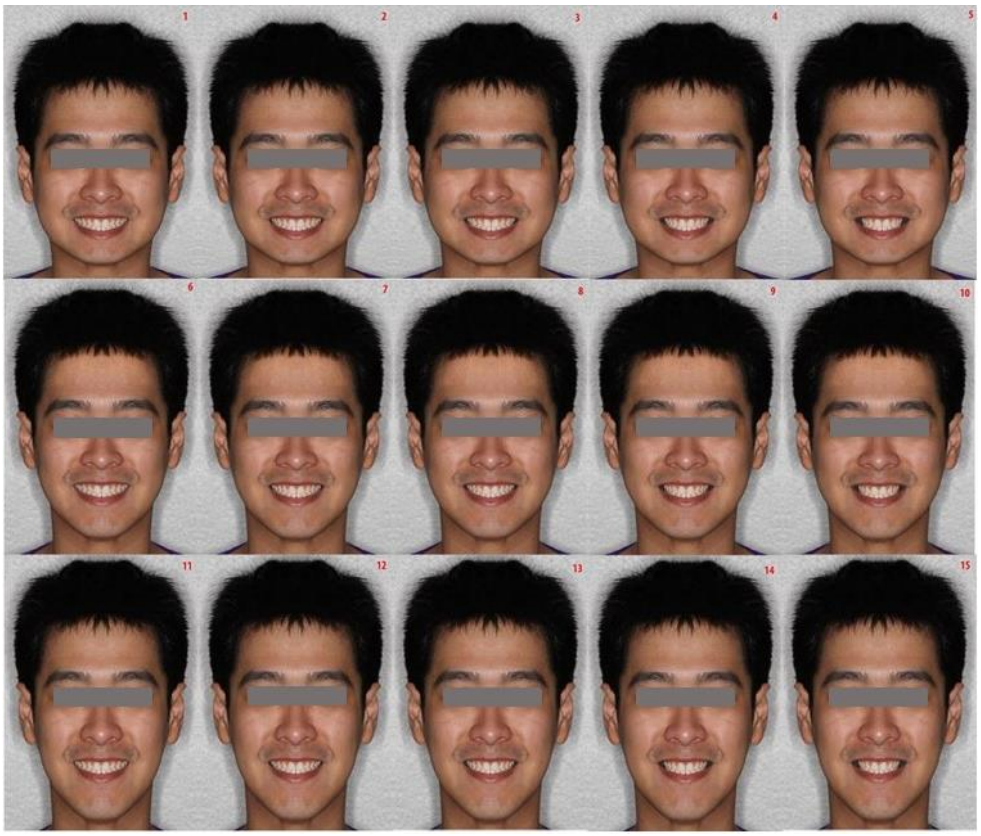
The original image of frontal photograph of each model represented mesofacial type. Then the photographs were modified from a mesofacial to brachyfacial and dolichofacial type according to the facial index. Each photo was then edited by using Adobe Photoshop program to remove any small imperfections.

After facial type modification, the images were further edited to create five different buccal corridor sizes for each facial type. The size of buccal corridor created were 28% (largest buccal corrodor/narrowest smile), 22%, 15%, 10% and 2% buccal corridor. These size was the percentage of buccal corridor width compared to inter commissure width. The width of buccal corridor was derived from the different between the width maxillary dentition and the width of inner commissure measured (Moore et al., 2005). These distances were measured by the ruler tool in the Photoshop software. The resulting 30 images total were created as shown in Figure 2 each photo was numbered from 1 to 30 and printed in A5 paper for further use for rating by subjects.

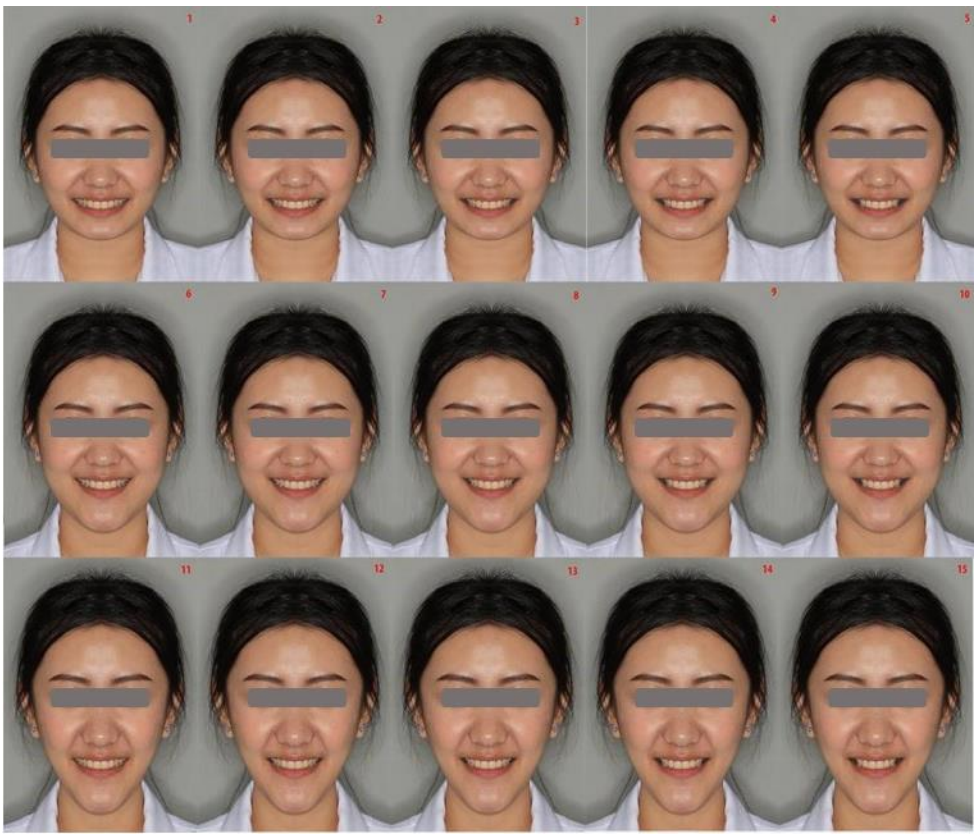
Survey

The subjects included in this study were 403 Thai laypersons aged between 18-40 years old who reside in Thailand. The subjects having careers associated with dentistry and/or have severe visual impairment were excluded from the study.

Subjects were asked to assess the attractiveness of the smile and gave a score for each image by marking on a horizontal 200 mm line representing a visual analog scale. The scale consisted of 2 points, there were descriptors on the scale labeled from least attractive (0) to most attractive (100). Subjects were presented with sets of pictures of brachy facial, mesofacial and dolichofacial categories for assessment respectively. The order of pictures of each facial type presented to the subjects was 28%, 22%, 15%, 10% and 2% respectively. However, subjects were allowed to return to the previously scored picture. Black background images were presented for 20 seconds of viewing before changing the category of facial type. The presentation time for each image were 20 seconds. Subjects were allowed to hold the pictures to ensure the best vision of the pictures was provided them. Mean VAS scores for each image of different size of buccal corridor width were compared within the same facial type using one-way ANOVA test followed by *post hoc* Tukey's HSD test for variance analysis. This study was approved by the Rangsit University ethic committee (RSEC 41/58).



(a)



(b)

Figure 2. The images of **(a)** male and **(b)** female used in this study. For each model, the photographs consisted of 3 different facial types, each with 2%, 10%, 15%, 22%, and 28% buccal corridor sizes.

RESULTS

Data were collected from a total of 403 subjects composed of 107 males and 296 females. The average age of subjects was 20.95 years old. Figure 3 and 4 shows the mean VAS score of the brachyfacial pictures of female and male model respectively. The mean VAS score of mesofacial are displayed in figure 5 and 6 for female and male model respectively while the mean VAS score of dolicofacial picture are showed in figure 7 and 8.

The highest VAS score was for the smile images with 15% buccal corridor in all facial types in both gender. In female, the VAS score for 15% buccal corridor images of brachyfacial type, mesofacial type, and dolichofacial type were 40.31, 48.46, and 42.34 respectively. And for male, the VAS score of 35.89, 54.50, and 59.12 were given for 15% buccal corridor in brachyfacial type, mesofacial type, and dolichofacial type respectively.

For brachyfacial image of both male and female model, the subjects perceived any buccal corridor sizes from 2% to 22% as no significant difference in terms of esthetic but for buccal corridor size of 28%, subjects rated as significantly less esthetic than all other buccal corridor sizes (Figure 3 and 4).

For female model images with mesofacial type, the VAS score of 15% buccal corridor size which was the highest VAS score was found significantly different than all other buccal corridor sizes (2%, 22%, and 28%) except for 10% buccal corridor, in which the difference was not statistically different (Figure 5). Statistical analysis also indicated that smile with 2% and 22% buccal corridors were rated as significantly more attractive than the 28% buccal corridor. In mesofacial images of male model, it was found that 15% buccal corridor was significantly perceived as more attractive than other buccal corridor sizes (Figure 6). And the 28% buccal corridor size was rated as significantly less esthetic from the rest of buccal corridor sizes.

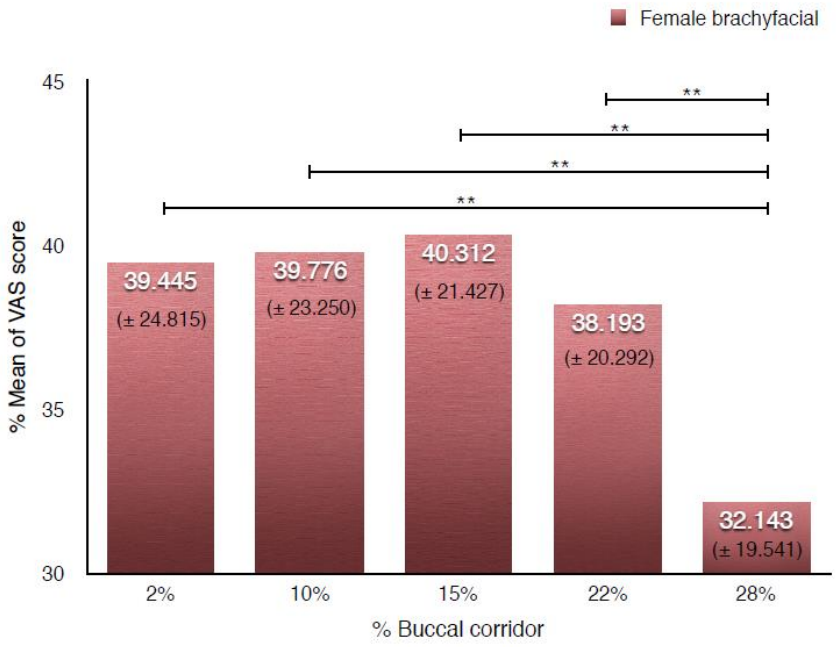


Figure 3. Mean VAS score of five different buccal corridor width in brachyfacial pictures of female model. The labels on the each bar graph shows the value of mean±SD for that bar. (*p < .05, **p < .01)

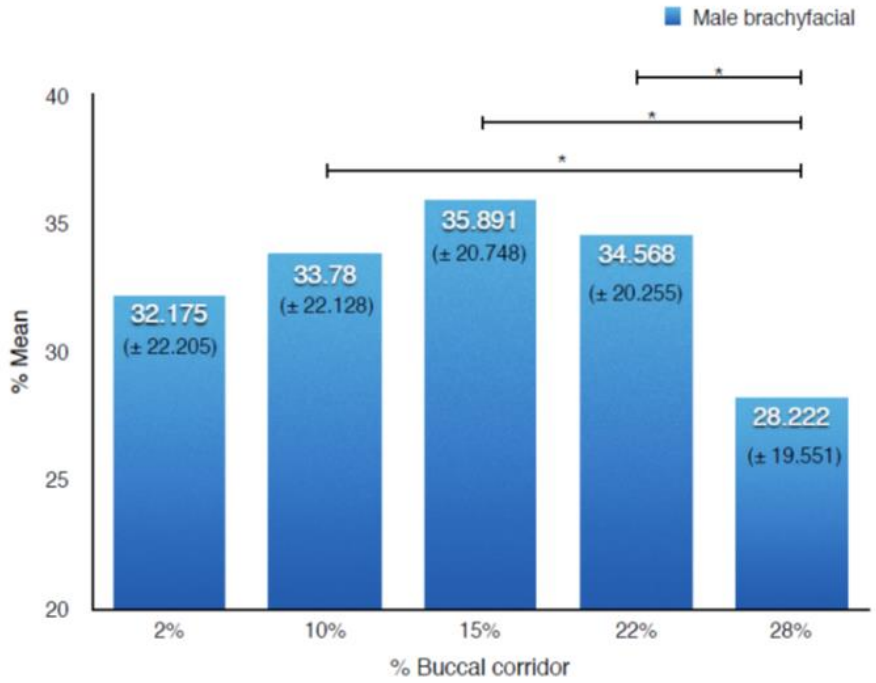


Figure 4. Mean VAS score of five different buccal corridor width in brachyfacial pictures of male model. The labels on the each bar graph shows the value of mean±SD for that bar. (*p < .05, **p < .01)

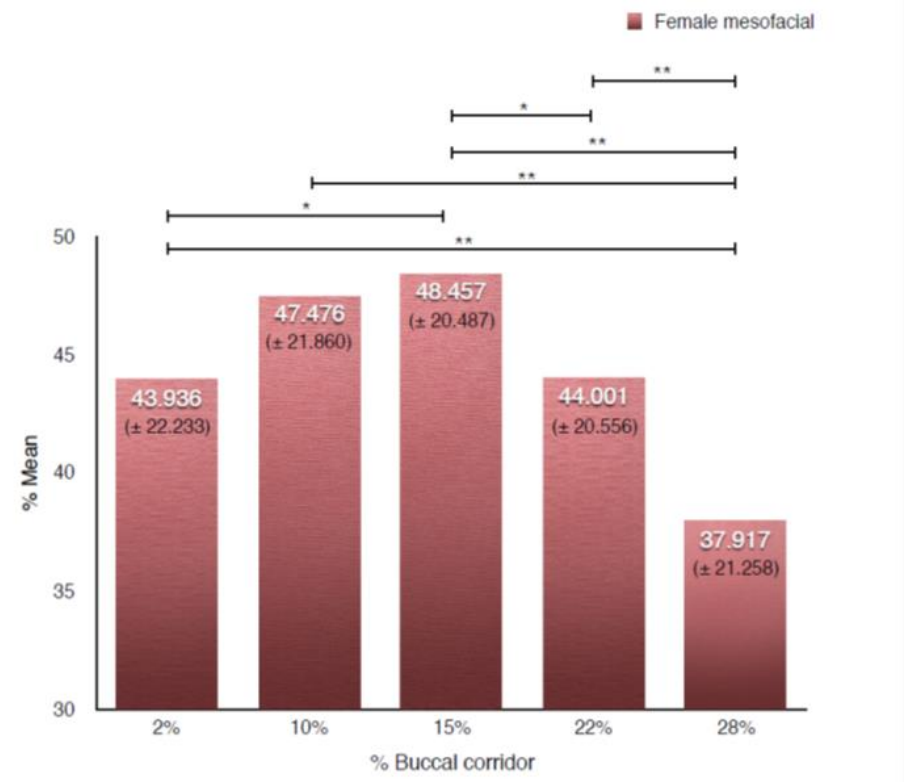


Figure 5. Mean VAS score of five different buccal corridor width in mesofacial pictures of female model. The labels on the each bar graph shows the value of mean±SD for that bar. (*p < .05, **p < .01)

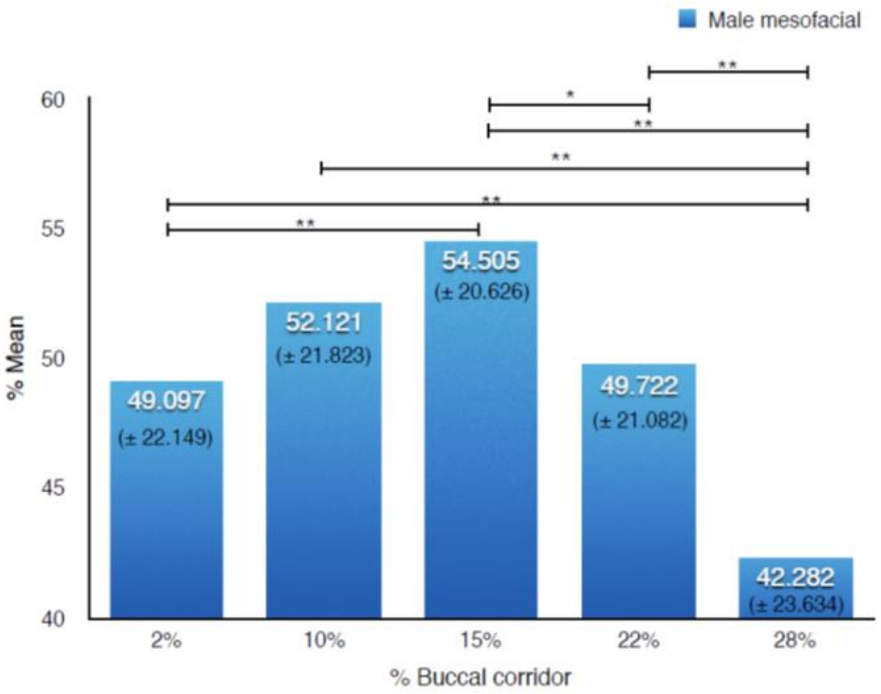


Figure 6. (a) Mean VAS score of five different buccal corridor width in mesofacial pictures of male model. The labels on the each bar graph shows the value of mean±SD for that bar. (*p < .05, **p < .01)

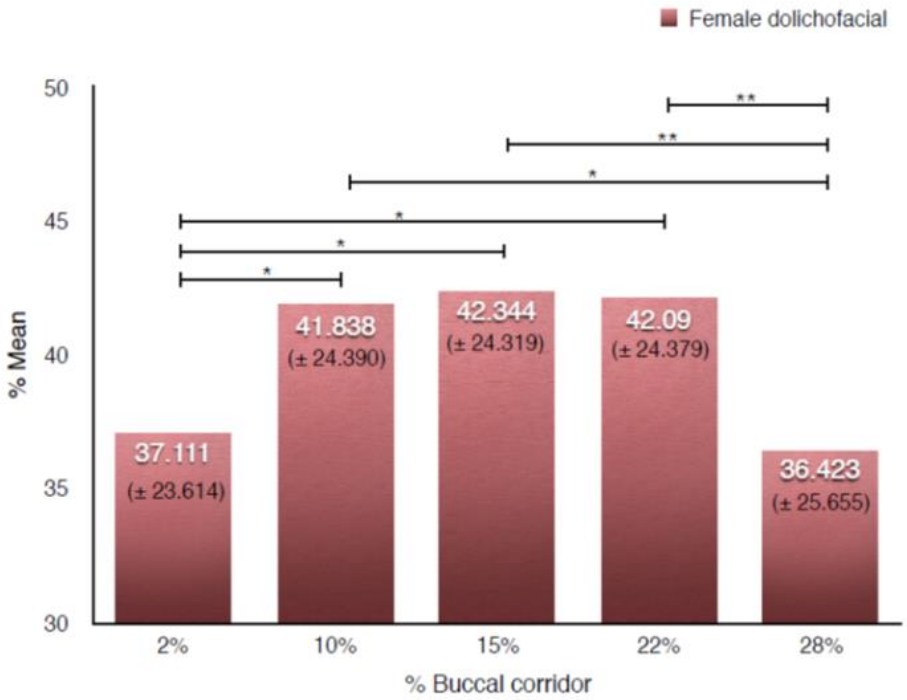


Figure 7. Mean VAS score of five different buccal corridor width in dolicofacial pictures of female model. The labels on the each bar graph shows the value of mean±SD for that bar. (*p < .05, **p < .01)

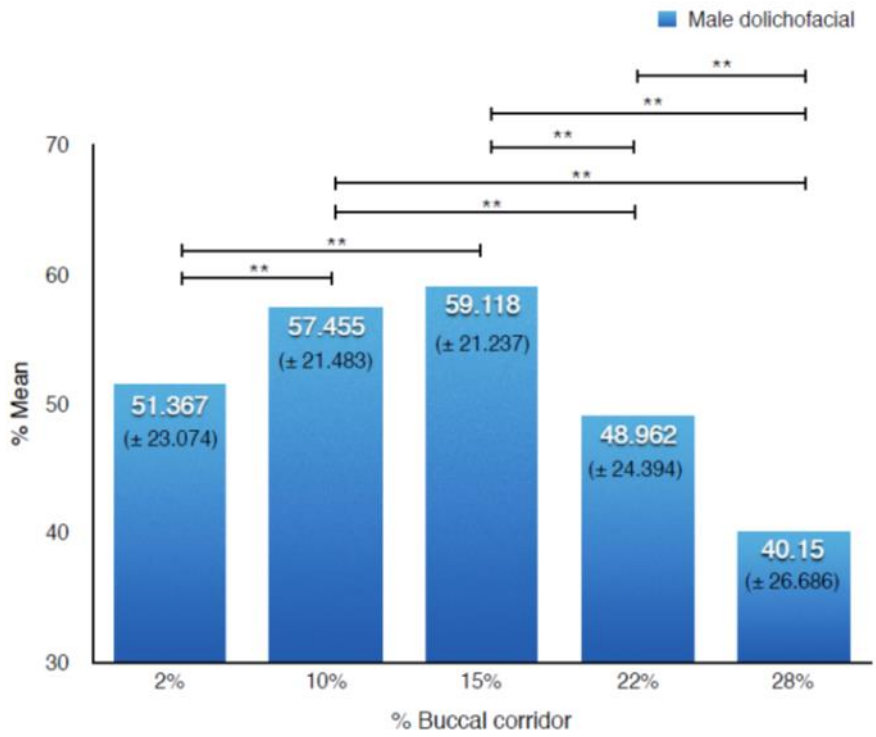


Figure 8. Mean VAS score of five different buccal corridor width in dolicofacial pictures of male model. The labels on the each bar graph shows the value of mean±SD for that bar. (*p < .05, **p < .01)

For female model images with dolichofacial type, the results indicated that no statistically difference was found between VAS score of buccal corridor size of 10%, 15% and 22% (Figure 7). However, 28% buccal corridors received significantly lower VAS score compared to others. For male model images with dolichofacial type, the results indicated that 10% and 15% buccal corridor sizes were significantly more attractive than others (Figure 8). Although 2% and 22% buccal corridor were rated as less attractive than 10% and 15% buccal corridor, they were significantly more attractive than 28% buccal corridor.

DISCUSSION

The findings of this study suggested that the representative sample of Thai population perceived the smile with the buccal corridor size of 15% as the most attractive while perceiving the buccal corridor size of 28% as the least attractive. When comparing the results of male and female models, similar preference of buccal corridor size could be found in in brachyfacial and mesofacial type. In contrast, the slightly difference in buccal corridor preference between genders could be observed in dolichofacial type, in which female model image had wider range of buccal corridor width that gave no different in attractiveness compared to the most attractive width of 15%.

When comparing the results of this study to the previous study of Pithon et al. (2014), that investigated the effect of five buccal corridor sizes (2%, 10%, 15%, 22%, 28%) on smile attractiveness in three different facial types, it was found that there was a difference in the preferences of buccal corridor in that Pithon et al. (2014) found that smile with narrow buccal corridors (2% buccal corridor) was rated highest in terms of smile attractiveness while the result from our study indicated that medium size buccal corridor (15% buccal corridor) was the most attractive regardless of facial type and model's gender. This difference may result

from the difference in ethnicity of the raters as well as the model. The study *Piton et al* used the Brazilian models which have different anthropometric facial structures compared to Asian people like Thai models used in this study. However, despite the difference in the most attractive buccal corridor size, the findings of the least attractive buccal corridor size was similar between this study and the study of Pithon et al. (2014) in that the smile with wide buccal corridors of 28 was considered as the least attractive.

The results from this study was consistent with the findings of Ioi et al. (2012) in Korean and Japanese in that large buccal corridor size, which was 28% buccal corridor in our study and 25% in *Ioi et al*' s study, were found to be the least attractive. However, the results of the most attractive buccal corridor width was different. Ioi et al. (2012) found that 0-10 % buccal corridor was the most attractive while in this study, 15% buccal corridor received the highest VAS score. However, it should be noted that the peri-oral images were used in their study in contrast to full-face images used in this study.

Ker, Chan, Fields, Beck, & Rosenstiel (2008) reported that Canadian laypersons rated buccal corridor size of 9.10% as the ideal buccal corridor, whereas the American laypersons preferred broader buccal corridor size of 16% which is close to the most attractive buccal corridor size found in this study.

Although, the preference of the most attractive size of buccal corridor is vary among different studies done in different ethnicity, similar findings is observed in that large buccal corridor (more than 25%) is rated as least attractive.

CONCLUSION

This study found that 15% buccal corridor size was the most attractive and 28% buccal corridor size was the least attractive among Thai people regardless of facial type and model's gender. However, the range of the buccal corridor size that will not significantly compromise facial attractiveness are 10–15% in mesofacial, 2-22% in brachyfacial, 10-15% in dolicofacial male and 10-22% in dolicofacial female.

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