การเปรียบเทียบความสวยงามภาพใบหน้าด้านข้างของบุคคลที่มีลักษณะขากรรไกรบน-ล่างยื่น โดยเทียบการรับรู้ระหว่างเจ้าของภาพใบหน้า ทันตแพทย์จัดฟัน และบุคคลทั่วไป

Comparison of Facial Profile Esthetics of Subjects with Bimaxillary Protrusion, as Preferred by the Subjects, Orthodontists and Laypersons

ดวงพร ศรีศุกร์เจริญ[1], บุญศิวา ซูซูกิ[1], เอดวาร์ดโด ยูโก้ ซูซูกิ[1]
[1]ภาควิชาทันตกรรมจัดฟัน คณะทันตแพทยศาสตร์ มหาวิทยาลัยกรุงเทพธนบุรี
Tuangporn Srisoogcharoen[1], Boonsiva Suzuki[1], Eduardo Yugo Suzuki[1]
[1]Department of Orthodontics, Faculty of Dentistry, Bangkokthonburi University

ชม. ทันตสาร 2563; 41(2) : 113-122
CM Dent J 2020; 41(2) : 113-122

Received: 6 December, 2019
Revised: 11 December, 2019
Accepted: 3 January, 2020

บทคัดย่อ

วัตถุประสงค์: เพื่อศึกษาการเปรียบเทียบการรับรู้ความสวยงามภาพใบหน้าด้านข้างของบุคคลที่มีลักษณะขากรรไกรบน-ล่างยื่น ซึ่งภาพถูกสร้างจากเครื่องกราดภาพใบหน้าสามมิติ โดยเทียบการรับรู้ระหว่างเจ้าของภาพใบหน้า ทันตแพทย์จัดฟัน และบุคคลทั่วไป

วิธีการ: บุคคลที่มีลักษณะขากรรไกรบน-ล่างยื่น จำนวน 44 คน ถูกบันทึกภาพถ่ายใบหน้า จากนั้นใช้โปรแกรมคอมพิวเตอร์ที่มีการผสมผสานภาพรังสีเซฟฟาโลเมทริกกับภาพถ่ายสามมิติ มาสร้างภาพใบหน้าด้านข้าง จำนวน 5 ภาพ ที่มีการลดความอูมใบหน้า โดยมีการปรับ

Abstract

Introduction: The purposes of this study were to compare preferred facial profiles of subjects with bimaxillary protrusion produced by a 3D facial light scanner between subjects, orthodontists and laypersons.

Methods: Facial images were recorded for 44 Thai subjects with bimaxillary protrusion. A computer program which combined cephalometric radiographs and 3D photographic images was used to produce five modified profiles by retroclining

Corresponding Author:

บุญศิวา ซูซูกิ
รองศาสตราจารย์ ดร., ภาควิชาทันตกรรมจัดฟัน
คณะทันตแพทยศาสตร์ มหาวิทยาลัยกรุงเทพธนบุรี 10170

Boonsiva Suzuki
Associate Professor, Dr., Department of Orthodontics,
Faculty of Dentistry, Bangkokthonburi University,
Bangkok 10170, Thailand
E-mail: ***boonsiva.suz@bkkthon.ac.th***

เปลี่ยนให้ฟันตัดบนซี่กลางเอียงหลังและถอยหลัง เจ้าของภาพจะทำการประเมินให้ลำดับคะแนนแค่ภาพของตนเอง ส่วนทันตแพทย์จัดฟันจำนวน 18 คน และบุคคลทั่วไป จำนวน 30 คน จะทำการประเมินให้ลำดับคะแนนทุกภาพ นอกจากนี้ภาพที่ถูกชอบมากที่สุดจะถูกวัดตำแหน่งริมฝีปากบนและล่างที่สัมพันธ์กับเส้นอ้างอิงความสวยงาม

ผลศึกษา: ในแต่ละกลุ่มส่วนใหญ่เลือกภาพใบหน้าด้านข้างที่มีการเปลี่ยนแปลงร้อยละ 50 มีตำแหน่งของริมฝีปากบนจากเส้นอ้างอิงความสวยงาม อยู่ระหว่างช่วง -2.11 ถึง -1.99 มม. และริมฝีปากล่างอยู่ ระหว่างช่วง -1.74 ถึง -1.48 มม. การรับรู้ความสวยงามภาพใบหน้าด้านข้าง และตำแหน่งริมฝีปาก ของทั้งสามกลุ่มไม่แตกต่างอย่างมีนัยสำคัญ

สรุปผล: ทั้งสามกลุ่มมีความชอบใบหน้าด้านข้างคล้ายกัน และชอบลักษณะริมฝีปากถอยหลังเล็กน้อยจากเส้นความสวยงาม

คำสำคัญ: ขากรรไกรหน้าบน-ล่างยื่น กราดภาพสามมิติ เครื่องกราดภาพใบหน้า สุนทรียศาสตร์

and retruding the maxillary central incisors. The subjects ranked only their own facial profiles. Eighteen orthodontists and 30 laypersons ranked all profiles. The position of the upper and lower lips in relation to the E-line was measured on the most preferred images.

Results: The majority of observers in all of the groups chose the images at 50% of profile change, -2.11 to -1.99 mm for the upper lip to E-line, and -1.74 to -1.48 mm for the lower lip to E-line, as the most esthetic preferences. There were no significant differences in preferred facial profiles or lip position.

Conclusions: All three groups of observers preferred the same facial profiles, a slightly retruded upper and lower lip in relation to the E-line.

Keywords: bimaxillary protrusion, three-dimensional scanning, facial scanner, esthetics

Introduction

The face is a key feature of human physical attractiveness.[1] Many people have the motive to see the orthodontist for improvement of tooth mal-alignment and inharmonious face.[2] Orthodontic treatment can contribute to facial aesthetics in many ways, such as by providing well-aligned teeth, an attractive smile, and a harmonious facial profile.[3] The characteristics of bimaxillary protrusion are proclined and protruded maxillary and mandibular incisors, conditions that are commonly found in Asian and African-American populations.[4,5] The etiology of bimaxillary protrusion is multifactorial, and includes genetics, the environment, soft tissue function, tongue volume and tongue habits.[4,6] Japanese as well as Thais consider protrusion not to be beautiful.[6] Treatment options are extraction of all four first premolars, with or without orthognathic surgery.[4,7]

Facial esthetics are complex because many factors, such as the sex, age, ethnicity and knowledge background of observers, influence esthetic perception; however, the relative significance of these factors is controversial.[3,8-13] An ideal occlusion outcome does not necessarily result in desirable dentofacial features, and using cephalograms alone for orthodontic treatment does not satisfy esthetic principles.[13] The soft tissue profile is an important consideration in the development of orthodontic treatment plans.

Three-dimensional (3D) facial scanning with light is now available as an aid in treatment planning.[14] It helps orthodontists communicate to patients about the treatment plan, especially in cases where ortho-

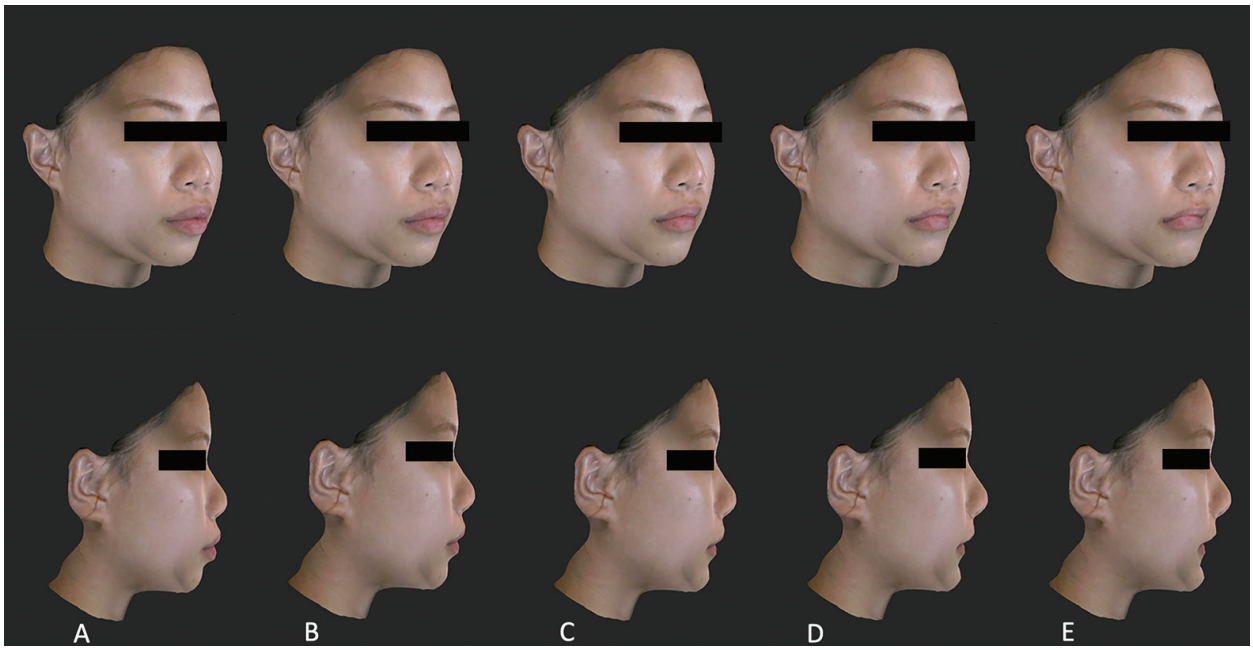
dontic-orthognathic surgery is being considered.[8] Success in treatment is determined, not only by the satisfaction of the orthodontist, but also by the satisfaction of the patient.[15] Patients should take part in the decisions made during the development of treatment plans.[11] The purpose of this study was to compare preferred facial profiles between subjects, orthodontists and laypersons.

Materials and Methods

Lateral cephalograms and digital 3D facial images (Morpheus3D, Seoul, Korea) were recorded for 44 Thai subjects aged 17-39 years (average age 26±5.7) with skeletal Class I or mild skeletal Class II jaw relationships, bimaxillary dental protrusion, and no previous orthodontic treatment.

The 3D images were combined with cephalometric radiographs and 3D photographic images to retrocline the maxillary central incisors 30° and retrude them 3 mm, to create five 3D image profiles for evaluation. The mandibular central incisors were correspondingly retroclined and retruded, in harmony with the maxillary central incisors, by maintaining normal overjet and overbite. The image series of each subject consisted of the 45° and 90° lateral profile images, which were captured at 0%, 25%, 50%, 75% and 100% of profile change (Fig 1). The forty-four image series were printed using a high-quality printer (Aficio SP 250DN Color laser printer, Ricoh, Tokyo, Japan).

There were three groups of observers. Forty-four subjects ranked the images of only their own facial profiles. Eighteen orthodontists (aged 29.9±3.03 years) and 30 laypersons (aged 30.5±12 years) viewed all images of the subjects and ranked the facial profile of each subject with a score of 1 for



รูปที่ 1 *ชุดภาพใบหน้าด้านข้าง แถวบนเป็นภาพใบหน้าด้านข้างทำมุม 45 องศา แถวล่างเป็นภาพใบหน้าด้านข้างทำมุม 90 องศา (A) ภาพใบหน้าด้านข้างที่เปลี่ยนแปลงร้อยละ 0, (B) ภาพใบหน้าด้านข้างที่เปลี่ยนแปลงร้อยละ 25, (C) ภาพใบหน้าด้านข้างที่เปลี่ยนแปลงร้อยละ 50, (D) คือ ภาพใบหน้าด้านข้างที่เปลี่ยนแปลงร้อยละ 75 และ (E) คือ ภาพใบหน้าด้านข้างที่เปลี่ยนแปลงร้อยละ 100*

Figure 1 *A series of facial profile images. Top row represents 45° lateral profile images; bottom row represents 90° lateral profile images. (A) 0% of profile change, (B) 25% of profile change, (C) 50% of profile change, (D) 75% of profile change, and (E) 100% of profile change.*

the most preferred to 5 for the least preferred. The most preferred profile was compared between the three groups. The position of the upper and lower lips in relation to the line from the tip of the nose to the most anterior projection of the chin (E-line) on the most preferred images was measured. Cephalometric analyses of maxillary central incisor inclination (U1-SN) and mandibular central incisor inclination (IMPA) of the most preferred images were recorded. Moreover, the effects of the sex of observers and the sex of the image subjects on the most preferred profiles were also studied.

Statiscal Analysis

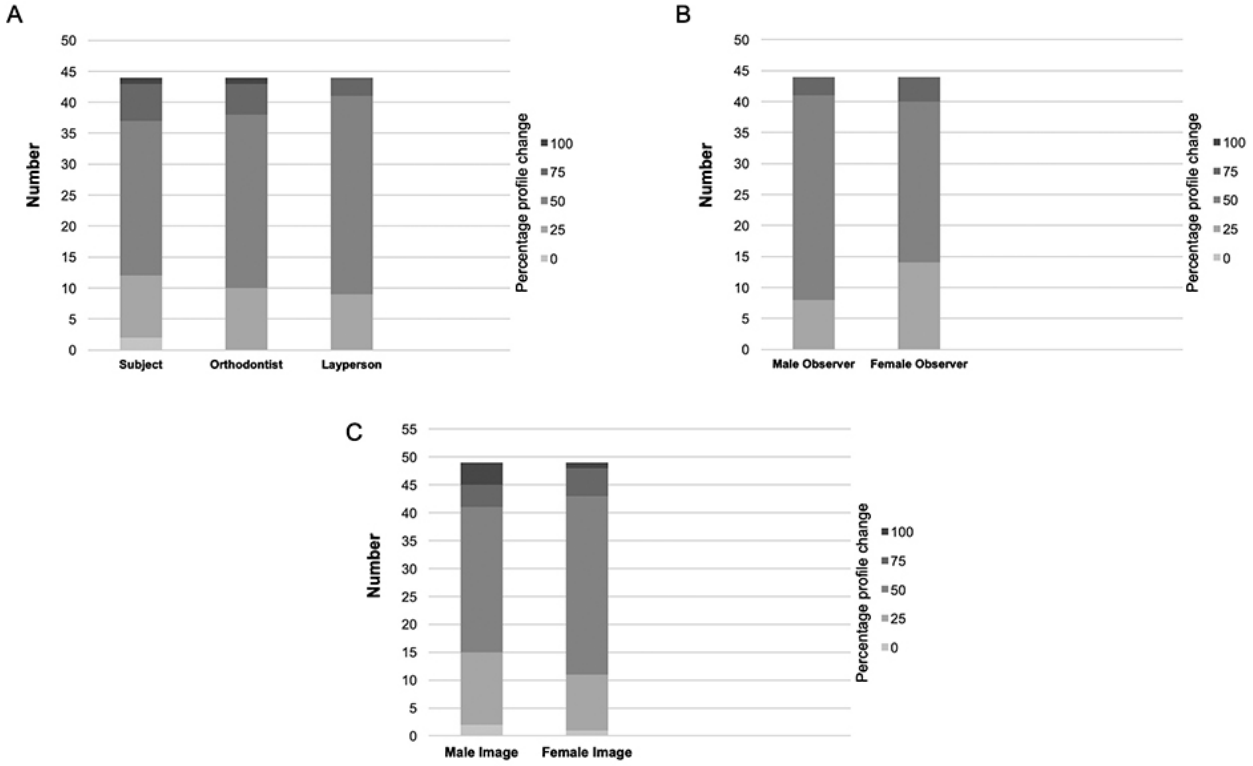
The data analysis was calculated using SPSS 19.0 software (SPSS Inc., Chicago, IL, USA). Mode was calculated for the most preferred profile in each image series for the three groups. The most preferred profile between the three groups was tested using the Chi-Square test. These tests were also used to compare the sex of observers and sex of image subjects. The positions of the upper and lower lips in relation to the E-line, measured on the profile images most preferred by the three groups, were tested using the repeated measures ANOVA. The paired samples t-test was used to compare the difference in the most preferred lip positions between the male and female observers and to compare the most preferred lip positions of all the observers in relation to the male and female subject images. Statistical significance was set at $p < 0.05$.

Results

When profile preferences were compared, the majority of the subjects, orthodontists and laypersons chose the images at 50% of profile change as the most preferred (Fig 2A). There were no significant differences in the most preferred facial profile between the three groups (Table 1). The most preferred positions of the upper lip in relation to the E-line by the subjects, orthodontists and laypersons were -2.01 mm, -1.99 mm and -2.11 mm, respectively (Fig 3A). The most preferred positions of the lower lip in relation to the E-line by the subjects, orthodontists and laypersons were -1.64 mm, -1.48 mm and -1.74 mm, respectively (Fig 3B). There were no significant differences in the most preferred positions of the upper and lower lip in relation to the E-line between the three groups (Table 2). The U1-SN cephalometric analysis of the most preferred profile by the subjects, orthodontists and laypersons showed angles of 101.00ϒ, 101.51ϒ and 102.33ϒ, respectively. The IMPA cephalometric analysis of the most preferred profile by the subjects, orthodontists and laypersons showed angles of 88.93ϒ 88.27ϒ and 88.77ϒ, respectively.

When profile preferences were compared, the majority of the male and female observers chose the images at 50% of profile change as the most preferred (Fig 2B). There were no significant differences in the most preferred facial profile between the two groups (Table 1). The upper lip to E-line positions most preferred by the male and female observers were -1.96 mm and -2.07 mm, respectively (Fig 3, C). The lower lip to E-line positions most preferred by the male and female observers were -1.45 mm and -1.66 mm, respectively (Fig 3D). There were no significant differences in the most preferred lips to E-line positions between the two groups (Table 3).

When the profile images of males and females were compared, the majority of observers chose the images of males and females at 50% of profile change as the most preferred (Fig 2C). There were no significant differences in choosing the most preferred facial profile between the images of males and females (Table 1). The upper lip to E-line positions most preferred in images of males and females were -2.31 mm and -2.01 mm, respectively (Fig 3E). The lower lip to E-line position most preferred in images of males and females were -1.65 mm and -1.58 mm,



รูปที่ 2 *การแจกแจงร้อยละของความชอบภาพใบหน้าด้านข้าง (A) การเปรียบเทียบระหว่างเจ้าของภาพใบหน้า ทันตแพทย์จัดฟัน และบุคคลทั่วไป, (B) ระหว่างผู้สังเกตการณ์เพศชาย และเพศหญิง และ (C) ระหว่างภาพเพศชาย และเพศหญิง*

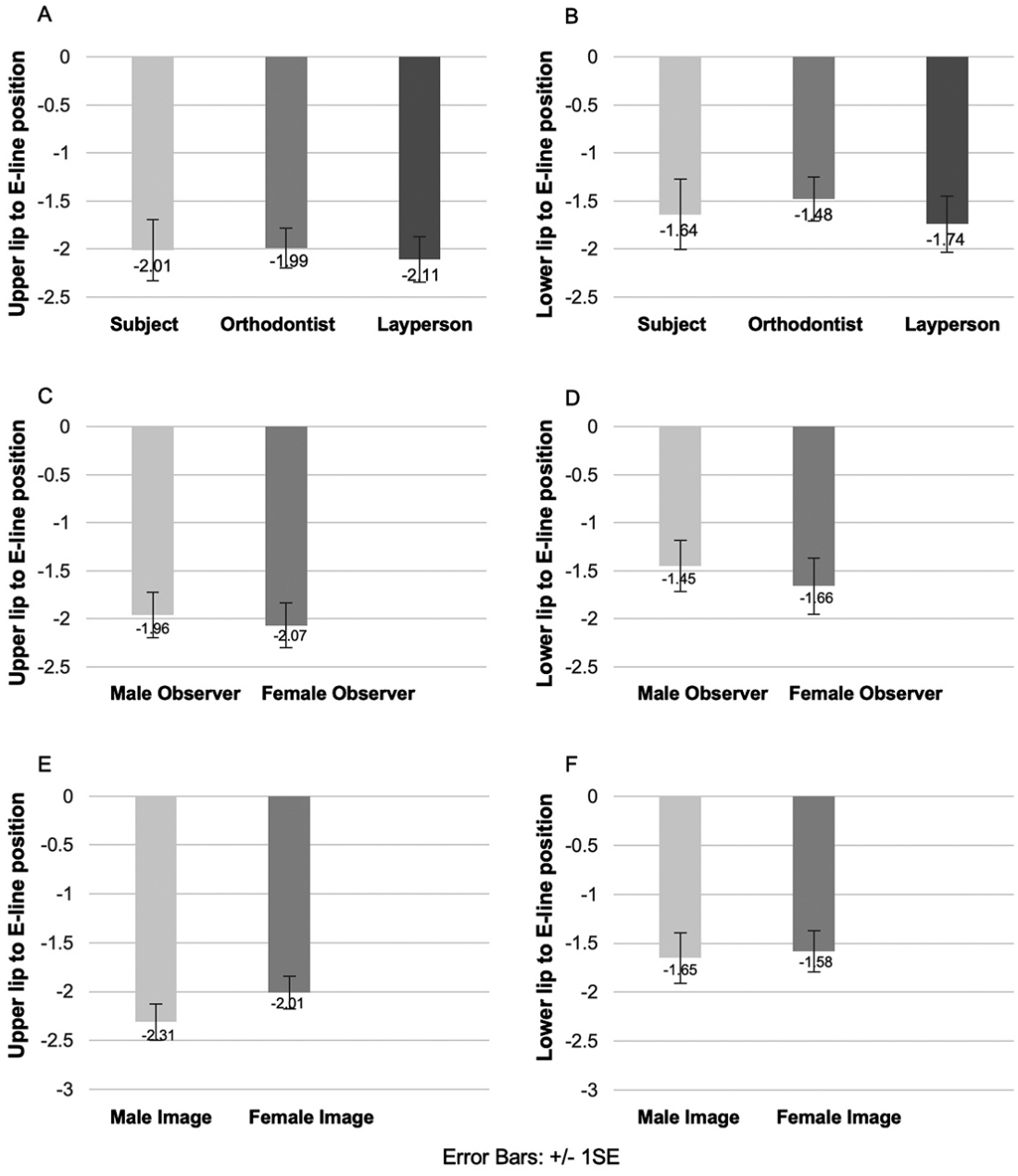
Figure 2 *Distribution of percentages of preferred facial profiles. Comparison between (A) subjects, orthodontists and laypersons, (B) male and female observers, and (C) images of males and females.*

respectively (Fig 3F). There were significant differences in the most preferred upper lip to E-line position between the two groups ($p<0.01$) (Table 4). There were no significant differences in the most preferred lower lip to E-line position between the two groups.

Discussion

The results of this study showed that the subjects, orthodontists and laypersons preferred the same facial profiles. Although they had differences in dental knowledge, those differences did not influence facial profile preference. One of the reasons may have been that media, such as the Internet, television, books, newspapers and magazines can influence esthetic preference.[10,16] Miyajima, *et al.*[17] reported that Japanese people gradually shifted their preference of facial profile from the typical Japanese profile to a flatter facial profile because of the influence of European and American media.

The use of the lip to E-line position is a popular measure of lip position.[18] All three groups preferred retruded upper and lower lip to E-line positions. The three groups preferred more retruded upper and lower lip to E-line positions than average Thai norm values.[19] The upper lip to E-line positions were still within ±2SD of the average Thai norm value, but the lower lip to E-line positions were within ±2SD of the average Thai norm value. Observers in many studies preferred retruded profiles than norm value.[10,16,18,20-22] Alley and Cunningham[23] stated that "averaged faces are attractive, but very attractive faces are not average".



รูปที่ 3 *ค่าเฉลี่ยตำแหน่งของริมฝีปากบนที่สัมพันธ์กับเส้นอ้างอิงความสวยงามในภาพใบหน้าด้านข้างที่ชอบมากที่สุด: (A) การเปรียบเทียบระหว่างเจ้าของภาพใบหน้า ทันตแพทย์จัดฟัน และบุคคลทั่วไป, (C) การเปรียบเทียบระหว่างผู้สังเกตการณ์เพศชาย และเพศหญิง และ (E) การเปรียบเทียบระหว่างภาพเพศชาย และเพศหญิง; ค่าเฉลี่ยตำแหน่งของริมฝีปากล่างที่สัมพันธ์กับเส้นอ้างอิงความสวยงามในภาพใบหน้าด้านข้างที่ชอบมากสุด: (B) การเปรียบเทียบระหว่างเจ้าของภาพใบหน้า ทันตแพทย์จัดฟัน และบุคคลทั่วไป, (D) การเปรียบเทียบระหว่างผู้สังเกตการณ์เพศชาย และเพศหญิง และ (F) การเปรียบเทียบระหว่างภาพเพศชาย และเพศหญิง*

Figure 3 *Means of position between upper lip to E-line position in the most preferred profiles: (A) comparison between subjects, orthodontists and laypersons, (C) comparison between male and female observers, and (E) comparison between male and female images; Means of position between of lower lip to E-line position in most preferred profiles: (B) comparison between subjects, orthodontists and laypersons, (D) comparison between male and female observers, and (F) comparison between male and female images*

ตารางที่ 1 *การทดสอบไคสแควร์*

Table 1 *Chi-square test*

Compared Groups	Value	df	*p*-Value
Subjects, Orthodontists and Laypersons	2.445	2	0.294
Male observers and Female observers	2.520	1	0.112
Images of males and females	1.521	1	0.218

*p <0.05

ตารางที่ 2 *การเปรียบเทียบตำแหน่งของริมฝีปากที่ชอบมากที่สุดที่สัมพันธ์กับเส้นอ้างอิงความสวยงาม ระหว่างเจ้าของภาพใบหน้าทันตแพทย์จัดฟัน และบุคคลทั่วไป*

Table 2 *Comparison of most preferred position of lip to E-line positions between subjects, orthodontists and laypersons*

	Subjects (N=44)		Orthodontists (N=44)		Laypersons (n=44)		*p*-Value
	Mean	±SD	Mean	±SD	Mean	±SD	
Upper Lip to E-line position	-2.01	2.12	-1.99	1.38	-2.11	1.57	0.765
Lower Lip to E-line position	-1.64	2.45	-1.48	1.5	-1.74	1.94	0.569

*p <0.05

ตารางที่ 3 *การเปรียบเทียบตำแหน่งของริมฝีปากที่ชอบมากที่สุดที่สัมพันธ์กับเส้นอ้างอิงความสวยงาม ระหว่างผู้สังเกตการณ์เพศชาย และเพศหญิง*

Table 3 *Comparison of most preferred lip to E-line positions between male and female observers*

	Male observers (N=44)		Female observers (N=44)		*p*-Value
	Mean	±SD	Mean	±SD	
Upper Lip to E-line position	-1.96	1.55	-2.07	1.54	0.427
Lower Lip to E-line position	-1.45	1.77	-1.66	1.93	0.255

*p <0.05

ตารางที่ 4 *การเปรียบเทียบตำแหน่งของริมฝีปากที่ชอบมากที่สุดที่สัมพันธ์กับเส้นอ้างอิงความสวยงาม ระหว่างภาพเพศชาย และเพศหญิง*

Table 4 *Comparison of most preferred lip to E-line positions between images of males and females*

	Image of males (N=49)		Image of females (N=49)		*p*-Value
	Mean	±SD	Mean	±SD	
Upper Lip to E-line position	-2.31	1.29	-2.01	1.17	0.0098**
Lower Lip to E-line position	-1.65	1.8	-1.58	1.47	0.614

*p <0.05, **p <0.01

The image series were modified by changing the positions of the maxillary and mandibular incisors, so that the inclination of the maxillary central incisors (U1-SN) and mandibular central incisors (IMPA) were studied in the most preferred facial profile. The U1-SN and IMPA cephalometric analyses of the three groups indicated that the maxillary and mandibular central incisor inclinations were more retroclined than the average Thai norm values. The inclination of maxillary incisors was still within ±1SD of the average Thai norm value, but the mandibular incisors was within ±2SD of the average Thai norm value.

With regard to the observers' sex, this study found that the female observers preferred more retruded upper and lower lips than did the male observers but there was no significant difference between the two groups. Farrow, *et al.*[16] and Shimomura, *et al.*[10] also found that the sex of observers did not influence preferred facial profile. Türkkahraman[22] found that the sex of observers had an effect on female facial profile but not on male facial profile. The female observers preferred female concave profile than did the male observers.

For the comparison between facial profile images of males and females, the results showed there were no significant differences in choosing the most preferred facial profile between the two groups. But in the detail, the most preferred position of the upper lip to E-line in images of males was significantly different from that in images of females, whereas the most preferred position of the lower lip to the E-line was not significantly different. The observers preferred a more retruded upper lip in images of males than in images of females. Loi, *et al.*[24] studied the effect of facial convexity on lip position in Japanese subjects. Their data showed ranges of preferred lip to E-line position in images of males and females. Mostly, the ranges in images of males were more retruded than those in images of females. Moreover, Skinazi[25] found the characteristic male profile straighter than the female profile.

Many studies have used silhouettes in evaluating esthetic profile preference[10,20] and some have used photographs.[16,21,22] Hockley, *et al.*[26] concluded that photographs provided esthetic preference results that were closer to the established esthetic norm than did silhouettes.

Many studies have reported on preferred facial profile between dental professionals and laypersons.[12,16,21] This study differed from the others because it included comparisons between subjects, orthodontists and laypersons, and comparisons between lip positions in each group. The success of treatment plans depends not only on the dentists but also on the patients.

Conclusions

Although the laypersons preferred more retruded positions of upper and lower lips in relation to the E-line than did the subjects, and the subjects preferred more retruded positions than did the orthodontists, no significant differences were observed between the three groups. The subjects, the orthodontists and the laypersons preferred the same facial profiles and retruded upper and lower lip to E-line positions.

The maxillary and mandibular central incisor inclinations in the most preferred profiles of three groups were more retroclined than average Thai norm values.

The sex of the observers did not influence the most preferred facial profiles. The male and female observers preferred the same facial profiles and retruded positions of upper and lower lip in relation to the E-line.

When comparing the most esthetic profiles between images of males and females, the observers significantly preferred more retruded positions of the upper lip in relation to the E-line in images of males than in images of females. But there was no

significant difference in the preferred positions of the lower lip in relation to the E-line.

Acknowledgements

The financial support from Bangkokthonburi University, and the Thailand Research Fund (RDG5750069 and MRG 5080347) are gratefully acknowledged. We also acknowledge Dr. M. Kevin O. Carroll, Professor Emeritus of the University of Mississippi School of Dentistry, USA, Professor at Bangkokthonburi University, Bangkok, Thailand and Faculty Consultant at Chiang Mai University Faculty of Dentistry, Thailand, for language editing.

References

1. Mesaros A, Cornea D, Cioara L, Dudea D, Mesaros M, Badea M. Facial Attractiveness Assessment using Illustrated Questionnairers. *Clujul Med* 2015; 88(1): 73-78.
2. Giddon DB. Orthodontic applications of psychological and perceptual studies of facial esthetics. *Semin Orthod* 1995; 1(2): 82-93.
3. Abu Arqoub SH, Al-Khateeb SN. Perception of facial profile attractiveness of different antero-posterior and vertical proportions. *Eur J Orthod* 2011; 33(1): 103-111.
4. Bills DA, Handelman CS, BeGole EA. Bimaxillary dentoalveolar protrusion: traits and orthodontic correction. *Angle Orthod* 2005; 75(3): 333-339.
5. Leonardi R, Annunziata A, Licciardello V, Barbato E. Soft tissue changes following the extraction of premolars in nongrowing patients with bimaxillary protrusion. A systematic review. *Angle Orthod* 2010; 80(1): 211-216.
6. Lamberton CM, Reichart PA, Triratananimit P. Bimaxillary protrusion as a pathologic problem in the Thai. *Am J Orthod* 1980; 77(3): 320-329.
7. Chu YM, Bergeron L, Chen YR. Bimaxillary protrusion: an overview of the surgical-orthodontic treatment. *Semin Plast Surg* 2009; 23(1): 32-39.
8. Choi JY, Kim T, Kim HM, Lee SH, Cho IS, Baek SH. Effect of frontal facial type and sex on preferred chin projection. *Korean J Orthod* 2017; 47(2): 108-117.
9. Park NS, Park JH, Bayome M, Mo SS, Kim Y, Kook YA. An evaluation of preferred lip positions according to different age groups. *Int J Oral Maxillofac Surg* 2013; 42(5): 637-642.
10. Shimomura T, Ioi H, Nakata S, Counts AL. Evaluation of well-balanced lip position by Japanese orthodontic patients. *Am J Orthod Dentofacial Orthop* 2011; 139(4): 291-297.
11. Mantzikos T. Esthetic soft tissue profile preferences among the Japanese population. *Am J Orthod Dentofacial Orthop* 1998; 114(1): 1-7.
12. Maple JR, Vig KWL, Beck FM, Larsen PE, Shanker S. A comparison of providers' and consumers' perceptions of facial-profile attractiveness. *Am J Orthod Dentofacial Orthop* 2005; 128(6): 690-696.
13. Cao L, Zhang K, Bai D, Jing Y, Tian Y, Guo Y. Effect of maxillary incisor labiolingual inclination and anteroposterior position on smiling profile esthetics. *Angle Orthod* 2011; 81(1): 121-129.
14. Kim SH, Jung WY, Seo YJ, Kim KA, Park KH, Park YG. Accuracy and precision of integumental linear dimensions in a three-dimensional facial imaging system. *Korean J Orthod* 2015; 45(3): 105-112.
15. Margolis MJ. Esthetic considerations in orthodontic treatment of adults. *Dent Clin North Am* 1997; 41(1): 29-48.

16. Farrow AL, Zarrinnia K, Azizi K. Bimaxillary protrusion in black Americans--an esthetic evaluation and the treatment considerations. *Am J Orthod Dentofacial Orthop* 1993; 104(3): 240-250.
17. Miyajima K, McNamara JA, Kimura T, Murata S, Iizuka T. Craniofacial structure of Japanese and European-American adults with normal occlusions and well-balanced faces. *Am J Orthod Dentofacial Orthop* 1996; 110(4): 431-438.
18. Chong HT, Thea KW, Descallar J, et al. Comparison of White and Chinese perception of esthetic Chinese lip position. *Angle Orthod* 2014; 84(2): 246-253.
19. Dechkunakorn S, Chaiwat J, Sawaengkit P, Anuwongnukroh N, Taweesedt N. Thai adult norms in various lateral cephalometric analysis. *J Dent Assoc Thai* 1994; 44(5-6): 202-214. (in Thai)
20. Ioi H, Shimomura T, Nakata S, Nakasima A, Counts AL. Comparison of anteroposterior lip positions of the most-favored facial profiles of Korean and Japanese people. *Am J Orthod Dentofacial Orthop* 2008; 134(4): 490-495.
21. Soh J, Chew MT, Wong HB. A comparative assessment of the perception of Chinese facial profile esthetics. *Am J Orthod Dentofacial Orthop* 2005; 127(6): 692-629.
22. Türkkahraman H, Gökalp H. Facial profile preferences among various layers of Turkish population. *Angle Orthod* 2004; 74(5): 640-647.
23. Alley TR, Cunningham MR. Article Commentary: Averaged Faces Are Attractive, but Very Attractive Faces Are Not Average. *Psychol Sci* 1991; 2(2): 123-125.
24. Ioi H, Nakata S, Nakasima A, Counts A. Effect of facial convexity on antero-posterior lip positions of the most favored Japanese facial profiles. *Angle Orthod* 2005; 75(3): 326-332.
25. Skinazi GL, Lindauer SJ, Isaacson RJ. Chin, nose, and lips. Normal ratios in young men and women. *Am J Orthod Dentofacial Orthop* 1994; 106(5): 518-523.
26. Hockley A, Weinstein M, Borislow AJ, Braitman LE. Photos vs silhouettes for evaluation of African American profile esthetics. *Am J Orthod Dentofacial Orthop* 2012; 141(2): 161-168.