การเปรียบเทียบความสวยงามภาพใบหน้าด้านข้างของบุคคลที่มีลักษณะขากรรไกรบน-ล่างยื่น โดยเทียบการรับรู้ระหว่างเจ้าของภาพใบหน้า กันดแพทย์จัดฟัน และบุคคลทั่วไป

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

บทคัดย่อ
วัตถุประสงค์: เพื่อศึกษาการเปรียบเทียบการรับรู้ความสวยงามภาพใบหน้าด้านข้างของบุคคลที่มีลักษณะขากรรไกรบน-ล่างยื่น ซึ่งภาพถูกสร้างจากเครื่องกราดภาพใบหน้าสามมิติ โดยเทียบการรับรู้ระหว่างเจ้าของภาพใบหน้า กันดแพทย์จัดฟัน และบุคคลทั่วไป

วิธีการ: บุคคลที่มีลักษณะขากรรไกรบน-ล่างยื่นจำนวน 44 คน ถูกบันทึกภาพใบหน้า จากนั้นใช้โปรแกรมคอมพิวเตอร์ที่มีการผสมผสานภาพรังสีเซฟฟ้าโลเมทริกกับภาพถ่ายสามมิติ มาสร้างภาพใบหน้าด้านข้างจำนวน 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

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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.\(^\text{(8)}\)

Success in treatment is determined, not only by the satisfaction of the orthodontist, but also by the satisfaction of the patient.\(^\text{(15)}\) Patients should take part in the decisions made during the development of treatment plans.\(^\text{(11)}\) 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

![Figure 1](image-url)
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 101.00'$\degree$, 101.51'$\degree$ and 102.33'$\degree$, respectively. The IMPA cephalometric analysis of the most preferred profile by the subjects, orthodontists and laypersons showed angles of 88.93'$\degree$, 88.27'$\degree$ and 88.77'$\degree$, 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,
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.

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.\(^\text{10,16}\) Miyajima, \textit{et al}\(^\text{17}\) 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.\(^\text{18}\) 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.\(^\text{19}\) 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.\(^\text{10,16,18,20-22}\) Alley and Cunningham\(^\text{23}\) stated that “averaged faces are attractive, but very attractive faces are not average”.

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.
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>
<thead>
<tr>
<th>Compared Groups</th>
<th>Value</th>
<th>df</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Subjects, Orthodontists and Laypersons</td>
<td>2.445</td>
<td>2</td>
<td>0.294</td>
</tr>
<tr>
<td>Male observers and Female observers</td>
<td>2.520</td>
<td>1</td>
<td>0.112</td>
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<tr>
<td>Images of males and females</td>
<td>1.521</td>
<td>1</td>
<td>0.218</td>
</tr>
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*p <0.05

ตารางที่ 2 การเปรียบเทียบตำแหน่งของริมฝีปากที่ชอบมากที่สุดที่สัมพันธ์กับเส้นอ้างอิงความสวยงาม ระหว่างเจ้าของภาพใบหน้าทันตแพทย์ และบุคคลทั่วไป

<table>
<thead>
<tr>
<th>Subjects (N=44)</th>
<th>Orthodontists (N=44)</th>
<th>Laypersons (n=44)</th>
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<tbody>
<tr>
<td></td>
<td>Mean ±SD</td>
<td>Mean ±SD</td>
</tr>
<tr>
<td>Upper Lip to E-line position</td>
<td>-2.01 2.12</td>
<td>-1.99 1.38</td>
</tr>
<tr>
<td>Lower Lip to E-line position</td>
<td>-1.64 2.45</td>
<td>-1.48 1.5</td>
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*p <0.05

ตารางที่ 3 การเปรียบเทียบตำแหน่งของริมฝีปากที่ชอบมากที่สุดที่สัมพันธ์กับเส้นอ้างอิงความสวยงาม ระหว่างผู้สังเกตการณ์เพศชาย และเพศหญิง

<table>
<thead>
<tr>
<th>Male observers (N=44)</th>
<th>Female observers (N=44)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>p-Value</td>
</tr>
<tr>
<td>Upper Lip to E-line position</td>
<td>-1.96 1.55</td>
</tr>
<tr>
<td>Lower Lip to E-line position</td>
<td>-1.45 1.77</td>
</tr>
</tbody>
</table>

*p <0.05

ตารางที่ 4 การเปรียบเทียบตำแหน่งของริมฝีปากที่ชอบมากที่สุดที่สัมพันธ์กับเส้นอ้างอิงความสวยงาม ระหว่างภาพเพศชาย และเพศหญิง

<table>
<thead>
<tr>
<th>Image of males (N=49)</th>
<th>Image of females (N=49)</th>
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<tr>
<td></td>
<td>p-Value</td>
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<tr>
<td>Upper Lip to E-line position</td>
<td>-2.31 1.29</td>
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<td>Lower Lip to E-line position</td>
<td>-1.65 1.8</td>
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*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.

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References


