Perception of Facial Profile Attractiveness in the Anteroposterior and Vertical Planes by Lay People

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Abstract

Introduction: The aims of this study were to evaluate the perception of facial attractiveness in male and female profile silhouette images that were incrementally altered to produce different combinations of anteroposterior positions and lower anterior facial heights and to determine whether a difference exists in evaluating the male and female profile images.

Methods: A profile photograph of an adult male and adult female that presented with a Class I anteroposterior relationship and an average lower anterior facial height was used. The positions of the mandible and maxilla were incrementally changed in the anteroposterior and vertical dimensions using Adobe Photoshop to produce nine different profile images for each of the male and female models. Silhouettes were produced from these images and rated for attractiveness by 109 lay people on a scale of 1 to 10. The means and standard deviations for the rankings were calculated. A Wilcoxon signed rank test was used to test for the differences in the ratings of the male and female profile images.

Results: The Class I image with reduced vertical dimensions was scored significantly more attractive for the female than the male facial profile ($P < 0.01$). While the Class III with average vertical dimensions and the Class III with reduced vertical dimensions images were considered less attractive for the female than the male facial profiles ($P < 0.05$).

Conclusions: Class I male and female profile images were perceived as the most attractive and Class III profile images as the least attractive by lay people. The results may assist orthodontists and maxillofacial surgeons in treatment planning and in presenting different treatment options for patients. Racial and cultural differences exist in the perception of facial attractiveness, and clinicians should take that into consideration.

Keywords: Facial attractiveness, anteroposterior skeletal relationship, vertical skeletal relationship, silhouettes.

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Introduction

In the current era, orthodontic treatment is not confined to aligning teeth and achieving proper occlusion. There is more emphasis on facial appearance and achieving facial harmony when planning orthodontic treatment or orthognathic surgery.

A paradigm shift in diagnosis and treatment planning has taken place over the past century. A patient's perception of facial attractiveness

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should be an integral part of treatment planning between orthodontists and surgeons especially when planning orthognathic surgery.

Most studies on facial attractiveness assessed the perception of attractiveness of images in which one plane was altered, either the anteroposterior[1-3] or the vertical.[4-8] Few studies have assessed the attractiveness of combined vertical and anteroposterior discrepancies.[9-11]

The perception of facial attractiveness differs from one society to another. Ethnicity and cultural differences may play a role in the assessment of facial aesthetics. There are studies that have assessed the perception of profile attractiveness of Caucasians and African Americans,[12-14] Japanese,[15,16] Turkish[17] and Chinese populations.[3] Some of these studies were limited to small or biased sample sizes or had many confounding variables in the profile images being assessed. The use of silhouettes would reduce such confounding variables and would limit the assessment of attractiveness to one variable which is the outline of the profile.

Furthermore, controversy still exists regarding which of the lower vertical facial proportion is considered to be more attractive and whether there is a difference in the perception of attractiveness between male and female profile images.

The aims of this study were to evaluate the perception of facial attractiveness in male and female profile silhouette images that were incrementally altered to produce different combinations of anteroposterior positions and lower anterior facial heights, to determine whether a difference exists in evaluating the male and female profile images and whether age and gender have an influence on ranking facial attractiveness.

Subjects and Method

An adult female and male, 23 years old, who presented with a Class I anteroposterior skeletal pattern and average vertical proportions, lower anterior face height to the total anterior face height ratio (LAFH/TAFH) = 55%, were selected for the study.

A standardized facial profile photograph was taken for each subject with the head in the natural position using a digital camera (Fujifilm FinePix 4800) while maintaining the same distance of 5 feet each time.

This photograph represented the normal Class I with average vertical dimensions. The male and female standard Class I photographs were transferred to a computer and manipulated using Adobe Photoshop CS2 (Adobe Systems, San Jose, California) to produce nine different anteroposterior and vertical positions as seen in table (1).

The vertical dimensions were changed by stretching and compressing the original image at subnasale and at sublabiale to produce a total increase of 63% and a decrease of 47% to the LAFH/TAFH, respectively. The soft tissue outline above the columella and below the soft tissue pogonion was not altered.[7] This resulted in three profile images for each of the male and female Class I profile views: average (55%), increased (63%) and reduced (47%) LAFH/TAFH proportions.

Class II anteroposterior facial profiles were obtained by stretching the soft tissue profile at subnasale forward by 4 mm and depressing the soft tissue outline at sublabiale backwards by 4 mm for each of the three profile images with altered vertical proportions. This resulted in a total of an 8 mm change in the anteroposterior dimension.

Class III anteroposterior images for each of the three vertically altered facial profiles were obtained by depressing the soft tissue outline at subnasale by 4 mm and stretching the soft tissue outline at sublabiale by 4 mm, producing a total change of 8 mm.

This 4-mm increment change was based on a study by Romani et al.; [9] they found that lay people and orthodontists were sensitive to changes of 3 mm or more.

These alterations generated a series of nine different profile images for each of the male and female original profile view (table 1).

Areas around the alterations were airbrushed to disguise any indications of alteration and to remove any unrealistic areas, especially in lip morphology. This was carried out using Photoshop and did not alter the profile.[10] Silhouettes were generated from the images using the same software and printed on glossy photo-paper (4 x 5 inches). One of the images was duplicated and printed to assess intra-examiner repeatability thus producing 10 images in total. Figures 1 and 2 show the nine altered profile images for the female and male models respectively.

The sample comprised 109 Jordanian lay people who came to the University Dental Hospital seeking treatment (33 males and 76 females, with a mean age of 31 years and a range of 14-70 years). Their consent was obtained before participating in the study. The sample was divided into three groups according to age: group 1was adolescents below 20 years, group 2 was young adults between 21-38 years, and group 3 was adults above 38 years.

Each participant was shown all 10 profile images for the male and female profile images separately. They were asked to score the image on a scale of 1 to 10 (one being 'the most attractive' and 10 being 'the least attractive'). They were asked to assign a different score for each image. In addition, information about the participants' age, gender, and profession was included in the questionnaire.

Statistical Analysis

The data were analyzed using the Statistical Package for the Social Sciences (version 17.0; SPSS Inc., Chicago, Illinois, USA). The means and standard deviations for facial attractiveness ratings were calculated for the male and female images. The mean rank scores for the male and female profile images were used to determine the ranking of the profiles. Comparison of rank scores according to gender for each of the male and female facial profiles was performed using the Mann-Whitney U test. The Kruskal-Wallis test was used to study the influence of the three age groups on ranking facial attractiveness. A comparison between the same image of the female and male models was performed using the Wilcoxon signed rank test. The level of significance was set at 0.05 and confidence intervals at 95% for all tests.

Intra-examiner repeatability for the duplicate image was measured using intra-class correlation coefficient.

Results

The intra-class correlation coefficient for the repeated male and female images was 0.82 and 0.98, respectively, indicating very good agreement.

Table (2) shows the mean scores and standard deviations for the female and male profile images as ranked by the laypeople. The most attractive male and female profile alike was the Class I facial profile with an average lower face height, while the least attractive was the Class III facial profile with reduced lower face height.

A comparison between the male and female facial profiles revealed that there was a statistically significant difference between Class I with a reduced LAFH ($P < 0.01$), Class III with an average LAFH ($P < 0.05$), and Class III with a reduced LAFH ($P < 0.05$). The Class I image with a reduced LAFH was scored significantly more attractive for the female than the male facial profile. While the Class III with an average LAFH and the Class III with reduced LAFH images were considered less attractive for the female than the male facial profiles (table 2).

There were no significant differences in ranking the male and female facial profile between the different age groups. The gender of the raters did not have any significant effect on ranking the male and female profile images either.

Table (1): The nine profile images with altered anteroposterior and vertical proportions (LAFH/TAFH ratio; lower anterior face height to total anterior face height ratio)

Image	***Description***
1. Class I with average vertical proportions	*Normal maxillary and mandibular position. LAFH/TAFH ratio 55%*
2. Class I with reduced vertical proportions	*Normal maxillary and mandibular position. LAFH/TAFH ratio 47%*
3. Class I with increased vertical proportions	*Normal maxillary and mandibular position. LAFH/TAFH ratio 63%*
4. Class II with average vertical proportions	*4 mm maxillary protrusion and 4 mm mandibular retrusion. LAFH/TAFH ratio 55%*
5. Class II with reduced vertical proportions	*4 mm maxillary protrusion and 4 mm mandibular retrusion. LAFH/TAFH ratio 47%*
6. Class II with increased vertical proportions	*4 mm maxillary protrusion and 4 mm mandibular retrusion. LAFH/TAFH ratio 63%*
7. Class III with average vertical proportions	*4 mm maxillary retrusion and 4 mm mandibular protrusion. LAFH/TAFH ratio 55%*
8. Class III with reduced vertical proportions	*4 mm maxillary retrusion and 4 mm mandibular protrusion. LAFH/TAFH ratio 47%*
9. Class III with increased vertical proportions	*4 mm maxillary retrusion and 4 mm mandibular protrusion. LAFH/TAFH ratio 63%*

Table (2): Facial attractiveness scores (means and standard deviations) and difference in mean rank scores for the male and female facial profile images calculated using the Wilcoxon signed ranks test.

Facial profile	***Female profile***		***Male profile***		
	Mean	***SD***	***Mean***	***SD***	***Z value***
Class II, reduced vertical proportions	*5.44*	*1.987*	*5.29*	*1.958*	*-.731*
Class II, average vertical proportions	*4.77*	*1.975*	*4.62*	*2.077*	*-.313*
Class II, increased vertical proportions	*4.87*	*1.601*	*5.31*	*1.907*	*-1.804*
Class III, reduced vertical proportions	*9.08*	*1.354*	*8.62*	*1.903*	*-2.218**
Class III, average vertical proportions	*8.70*	*1.209*	*8.34*	*1.584*	*-2.190**
Class III, increased vertical proportions	*8.61*	*.895*	*8.56*	*1.493*	*-.110*
Class I, reduced vertical proportions	*2.79*	*1.819*	*3.63*	*1.984*	*-3.410***
Class I, average vertical proportions	*1.97*	*1.249*	*1.99*	*1.482*	*-.208*
Class I, increased vertical proportions	*3.92*	*1.939*	*3.52*	*2.030*	*-1.894*

**** P<0.05***
***** P<0.01***

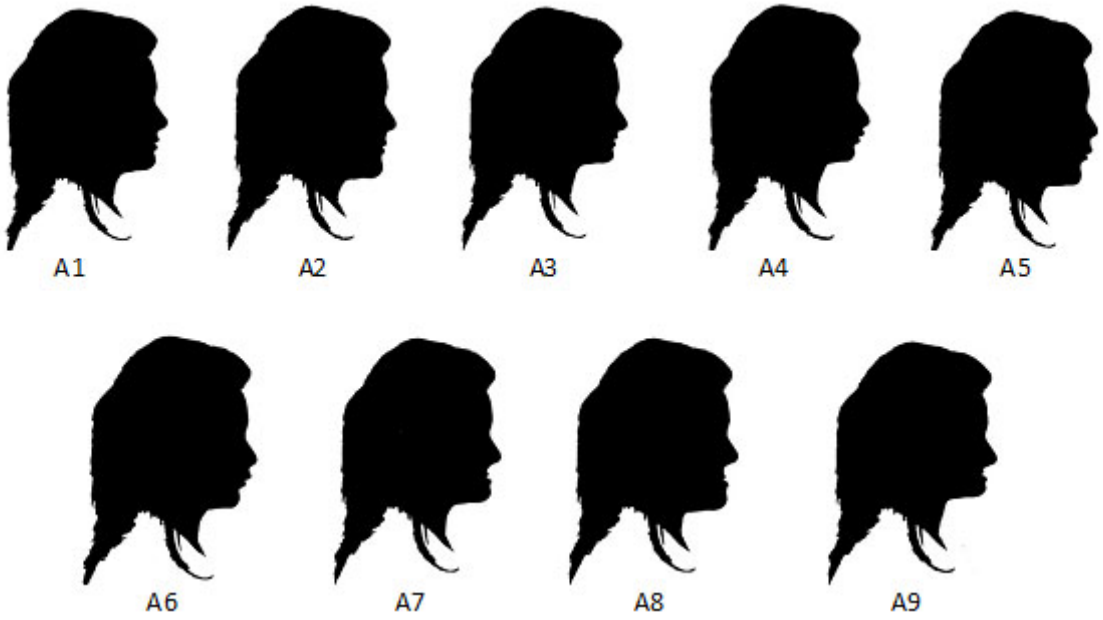

Figure (1): The nine altered female profile images. A1: Class I average LFH, A2: Class I increased LFH, A3: Class I reduced LFH, A4: Class II reduced LFH, A5: Class II increased LFH, A6: Class II average LFH, A7: Class III average LFH, A8: Class III increased LFH, A9: Class III reduced LFH.

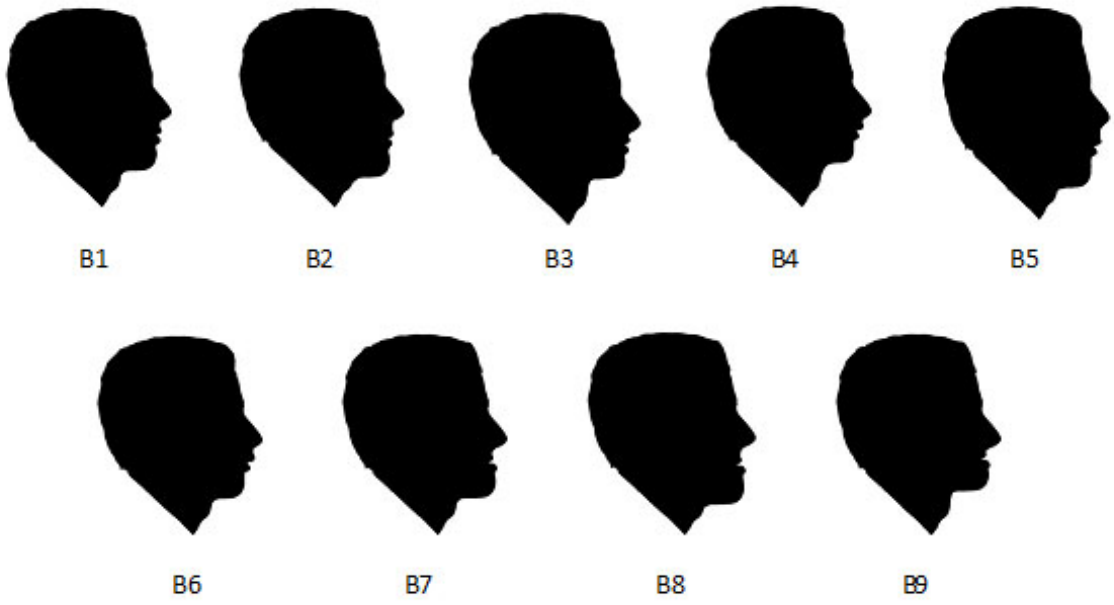

Figure (2): The nine altered male profile images. B1: Class I average LFH, B2: Class I increased LFH, B3: Class I reduced LFH, B4: Class II reduced LFH, B5: Class II increased LFH, B6: Class II average LFH, B7: Class III average LFH, B8: Class III increased LFH, B9: Class III reduced LFH.

Discussion

In order to reduce any confounding variables such as skin color, hair, eyes and other facial features, the images used to assess facial attractiveness were silhouettes reproduced from facial profile photographs of an adult male and an adult female. This ensured that raters focused their assessments on the lower part of the face which was the purpose of the study.

In this study, the raters were asked to rate the images on a scale of 1 to 10. Using this method can have an advantage over using a visual analogue scale (VAS) in that the score represents the actual feeling of the rater about the attractiveness of the image. A VAS may mean different things to different raters,[18] and raters will use certain portions of the scale and ignore others.[19]

The ranking scores in this study revealed that the most attractive anteroposterior facial profile was the Class I profile for both the female and male images. Most studies on facial attractiveness found that people rated the normal Class I facial profile as the most attractive profile.[1,2,11,16,17,20-22]

Class III facial profiles were rated as significantly less attractive than Class II. There is variability in the findings between different studies. Soh *et al.*[21,22] reported that the Class III facial profiles with protrusive mandibles were perceived as the least attractive facial profiles by the Asian community. Mantzikos[16] also reported similar findings with the Japanese people favouring the Class II facial profile over the Class III. Other studies on Western and American populations found that the Class II facial profiles were considered to be less attractive than the Class III facial profiles.[5,10,17,20,23] The reason for this could be a difference in judgment between different races, where the Asians and Arabs prefer a Class II profile while the Europeans and Americans favour Class III over Class II facial profiles.

The results of another study carried out on Jordanians[11] also found that Class II facial profiles were ranked as less attractive than Class III profiles which is not in concurrence with the results of this study. One reason for this difference could be that they used coloured photograph images as opposed to silhouettes used in this study so that their raters were influenced by all the intrinsic factors such as skin and hair colour, eyes, nose and other facial features that could have diverted their attention from the lower face. Another reason could be a difference in the degree of the manipulation of the images.

The profiles with average vertical dimensions were generally perceived as the most attractive which is in concurrence with other findings.[4,7,24,25]

Variations in both anteroposterior and vertical dimensions, however, did produce variable results. Class III images with decreased vertical height were rated as the least attractive for both male and female facial profiles. Similar results were reported by Maple *et al.*[10] They concluded that any change in the vertical proportions can have an effect on the anteroposterior change; i.e.: an increase in the vertical dimension in a Class II profile would accentuate the poor appearance of the anteroposterior skeletal pattern, while a reduction in the vertical dimension would accentuate the poor appearance of a Class III sagittal relationship. Most studies in Western communities [4,5,7,24] and the Japanese population,[25] on the other hand, reported that profiles with increased vertical dimensions were perceived as less attractive than those with reduced vertical dimensions. Similar findings were reported by Abu Arqoub and Al-Khateeb[11] on a Jordanian sample. Such differences in the findings may be attributed to differences in the methodology or the characteristics of the raters such as their socio-economic background, level of education or profession which was not investigated in this study. Nonetheless, controversy still exists as to what is considered attractive regarding the vertical face height.

The Class I facial profile for both the male and female images was ranked as the most attractive facial profile. When ranking images with increased vertical proportions, however, the male Class I image with increased vertical height was scored as more attractive than the female's same

image. Soft and delicate features are more preferred for females and having an increased lower facial profile would be at odds with such features.

Class III facial profiles were the least attractive for both the female and male images. However, a comparison between the mean scores for the male and female images revealed that the Class III facial profile was rated as significantly less attractive for the female image. This reveals that lay people find a Class III facial profile more acceptable for males than for females where Class III gives a more manly appearance.

There were no significant gender differences in ranking facial attractiveness. Several studies failed to find significant gender differences in assessing facial attractiveness.[4,7,11,23,27] Turkkahraman and Gokalp[17], on the other hand, found that gender had an effect on the profile preferences in a Turkish population. The sample in this study was not matched for gender; therefore, care should be exercised when interpreting this result.

Age did not have an effect on the perception of facial profile attractiveness which is in concurrence with some studies[21,22] but not others.[11,17,27]

Conclusions

A patient's perception of facial attractiveness should be considered when planning treatment. The results of this study are not to be generalized and each patient should be treated on an individual basis. Nonetheless, clinicians should bear in mind that cultural differences exist in the assessment of facial attractiveness. The Jordanians in this study ranked Class III facial profiles as less attractive than Class II profiles. This is similar to the Asian and Japanese perception of facial profile attractiveness but dissimilar to the perception of Westerners and Americans.

Class III facial profiles were more acceptable for the male images compared to the female images while the opposite was true for the Class II facial profiles.

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تقييم جاذبية الوجه في الوضعية الأمامية الخلفية والشاقولية

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الملخص

مقدمة: تهدف هذه الدراسة الى تقييم مدى جاذبية الوجه على صور الذكور والاناث التي تم تغييرها تدريجياً في الأوضاع المشتركة الأمامية الخلفية وارتفاعات الوجه السفلي وتحديد ما إذا كان هناك فروق في تقييم صور الذكور والاناث المدروسة.

الطرق: تم أخذ صورة جانبية لذكر وأنثى بالغين ممن لديهم نموذج صنف أول من العلاقة الأمامية الخلفية وارتفاع متوسط للوجه السفلي.

تم تعديل أوضاع الفكين تدريجياً في الوضعية الأمامية الخلفية والشاقولية باستخدام برنامج معالجة الصور للحصول على مجموعات من تسع صور للجنسين.

تم انجاز صور ظلية من تلك الصور وتم تصنيف جاذبيتها من قبل 109 أشخاص من غير اختصاصيي طب الأسنان وفق مقياس 1-10 وتم استخدام مشعر T للمجموعات المضاعفة ومشعر مان ويتني لاختبار الفروقات في تصنيف جاذبية الوجه وتصنيف مجموعة صور الذكور والإناث

النتائج: تم ترتيب النموذج الأول لمتوسط ارتفاع الوجه السفلي على أنه الأكثر جاذبية في الجنسين على حد سواء أما الصنف الثالث المتضمن صور تراجع ارتفاع الوجه فقد رتبت على انها الأقل جاذبية خاصةً عند النساء أما الصنف الثاني فقد كان الأكثر تفضيلاً عند النساء.

خاتمة: تساعد هذه النتائج مقومي الأسنان وجراحي الوجه والفكين على وضع خطة المعالجة وتقديم خيارات علاجية متعددة للمرضى، كما أن هناك اختلافات عرقية وثقافية أحياناً في مدى قبول هذه الجاذبية للوجه وعلى السريريين الاهتمام بذلك.

الكلمات الدالة: جاذبية الوجه، العلاقة الهيكلية الأمامية الخلفية، الارتفاع السفلي، صور ظلية.