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Perception of facial profile attractiveness of different antero-posterior and vertical proportions

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SUMMARY This study investigated the influence of changing the antero-posterior (AP) and vertical proportions of the lower face on the rankings of facial attractiveness.

Four hundred and fifty-four (219 males and 235 females) native Jordanians of various ages and professions rated the attractiveness of a sequence of antero-posteriorly and vertically altered male and female profile images. Attractiveness ranking scores were obtained from the visual assessment of these digitally altered male and female profile images that represented a range of AP and vertical lower facial proportions. The mean and standard deviation (SD) for the rank scores were calculated. Statistical analyses were employed for comparison between the different age groups, genders, and professions.

A Class I male profile with a normal lower face height and Class I female profile with a reduced lower face height were ranked as the most attractive. Class II male and female profiles with increased lower face heights were ranked as least attractive. As the vertical and AP dimensions diverged from normal, attractiveness decreased. Images with Class II profile features and increased lower face heights were considered less attractive than corresponding images with Class III profile features and reduced lower face heights. Gender had a limited influence on the perception of attractiveness. A significant difference was found between dentists and lay people in the perception of profile attractiveness.

Introduction

Modern society places strong emphasis on physical attractiveness and facial beauty. The face remains a key feature in the determination of human physical attractiveness (Riggio *et al.*, 1991). One reason why patients seek orthodontic treatment is to improve facial aesthetics. Orthodontic treatment can influence facial aesthetics in a number of ways, including well-aligned teeth (Giddon, 1995; Orsini *et al.*, 2006), an attractive smile (Sarver, 2001; Orsini *et al.*, 2006), and a pleasing facial profile (Lines *et al.*, 1978; Orsini *et al.*, 2006). Angle (1899) stated that the orthodontist 'for each of his efforts, whether he realizes it or not, makes for beauty or ugliness, for harmony or disharmony, or for perfection or deformity of the face'. Thus, the contribution of orthodontics and orthognathic surgery to the aesthetic well-being of individuals cannot be ignored.

Perception has been defined as the process by which patterns of environmental stimuli are organized and interpreted; it can be influenced by a variety of physical, physiological, and social factors (Giddon, 1995). Several studies have been conducted on the perception of facial profile attractiveness (Albino *et al.*, 1994; Phillips *et al.*, 1995; Orsini *et al.*, 2006). This type of research includes two broad approaches: the first is based on studies that evaluate the facial profile characteristics of attractive people (Zaidel and Cohen, 2005) and the second on studies that present facial photographs (or drawings, silhouettes, etc.) to a panel of judges who evaluate attractiveness by giving certain ratings to these photographs based on their appearance (Shaw, 1981; Kenealy *et al.*, 1989; Albino *et al.*, 1994; Orsini *et al.*, 2006). Some studies have assessed facial profile attractiveness of antero-posterior (AP) skeletal discrepancies (Kerr and O'Donnell, 1990; Phillips *et al.*, 1995; Maganzini *et al.*, 2000), while others have evaluated the attractiveness of vertical discrepancies (De Smit and Dermaut, 1984; Michiels and Sather, 1994; Erbay and Canikliogluo 2002; Johnston *et al.*, 2005; Knight and Keith, 2005; Maple *et al.*, 2005). Very few studies have assessed the attractiveness of combined vertical and AP discrepancies (Romani *et al.*, 1993; Maple *et al.*, 2005). Some of these investigations compared the perception of profile attractiveness between lay people and professionals, others between different categories of clinicians, while many addressed certain races and ethnic groups (De Smit and Dermaut, 1984; Johnston *et al.*, 2005; Maple *et al.*, 2005).

Previous studies that were limited to certain ethnic and racial groups included very small or biased sample sizes, and the relationship between the size of the profile changes and attractiveness was not fully examined (Connor and Moshiri, 1985; Mantzikos, 1998). Furthermore, some did not consider differences in the perception of attractiveness between female and male profile images. Additionally, controversy still remains regarding which of the lower facial

vertical facial proportions is considered to be more attractive and whether there is a difference in the perception of attractiveness of lower face height between male and female profile images. Many studies have evaluated the perception of attractiveness and profile standards of Caucasians and African Americans (Thomas, 1979; Connor and Moshiri, 1985; Polk *et al.*, 1995), Japanese (Miyajima *et al.*, 1996; Mantzikos, 1998), Turkish (Turkkahraman and Gokalp, 2004), and Chinese (Maganzini *et al.*, 2000), but not Arabic populations.

Therefore, the aims of this study were to investigate the influence of changing the AP and vertical facial proportions on the attractiveness rankings scored by a sample of the Jordanian population, and to determine what Jordanian society considers optimal for facial attractiveness and whether this preference is affected by age, gender, and profession.

Subjects and methods

Coloured profile images

Adult native Jordanians, a male (aged 22 years) and female (aged 24 years) who met the following criteria were selected: a Class I incisor and molar relationship; Class I skeletal pattern, an average lower anterior face height/total anterior face height (LAFH/TAFH) of almost 55 per cent (Al-Omar, 2009), a harmonious profile and no previous orthodontic treatment or plastic surgery.

The male and female coloured profile digital images were obtained using an Olympus digital camera (SP-500 UZ; Olympus imaging Europa GmbH, Hamburg, Germany). The two profile images were obtained in a standardized procedure by positioning the subjects 5 ft from the camera with the head in the natural posture and the lips at rest (Turkkahraman and Gokalp, 2004; Maple *et al.*, 2005).

Construction of the altered digitized profile images

The male and female facial profiles were altered in the AP and vertical directions (Figures 1 and 2) in the lower third of the face at the soft tissue points: subnasale and sublabiale.

Four software program were used to generate the profile distortions from the original male and female profile images: Print Shop Design (Suite Professional Edition; Broderbund Software Inc., Novato, California, USA) Adobe Photoshop CS2 (Adobe Systems Inc., San Jose, California, USA), CorelDraw Graphics (suite 12 upgrade; Corel Corp., London, UK), and Microsoft paint for Windows XP (Microsoft Corp., Redmond, Washington, USA).

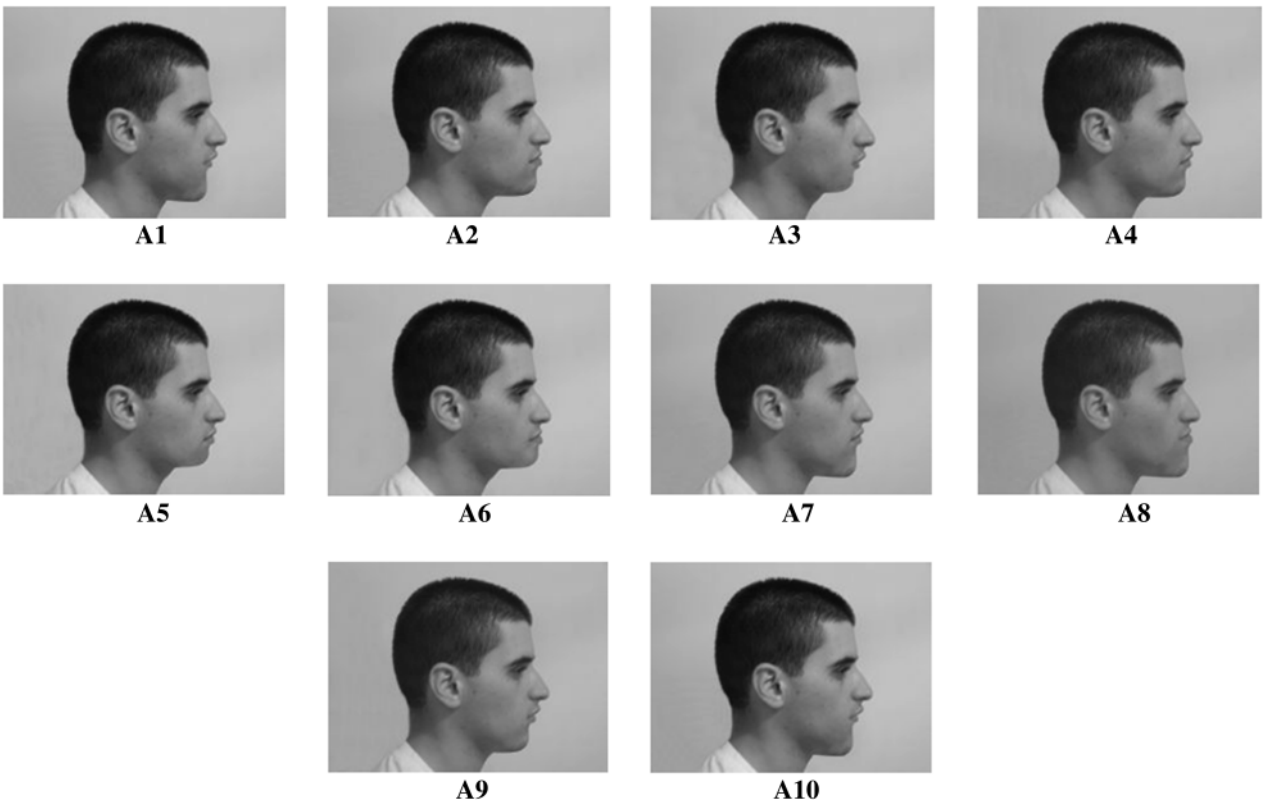

Figure 1 The original and altered images of lower anterior face height/total anterior face height ratio of the male profile. A1: Class II increased 63 per cent, A2: Class III average 55 per cent, A3: Class II reduced 47 per cent, A4: Class I average 55 per cent, A5: Class I reduced 47 per cent, A6: Class III reduced 47 per cent, A7: Class I increased 63 per cent, A8: Class III increased 63 per cent, A9: Class II average 55 per cent, and A10: Class II increased 63 per cent (duplicate image).

Figure 2 The original and altered images of lower anterior face height/total anterior face height ratio of the female profile. B1: Class I with average 55 per cent, B2: Class III with average 55 per cent, B3: Class I with reduced 47 per cent, B4: Class II with increased 63 per cent, B5: Class I with increased 63 per cent, B6: Class III with increased 63 per cent, B7: Class II with average 55 per cent, B8: Class II with reduced 47 per cent, B9: Class III with reduced 47 per cent, and B10: Class I with increased 63 per cent (duplicate image).

Vertical alterations

The LAFH/TAFH of the two original male and female profile images was almost 55 per cent according to Jordanian anthropometric norms for lower anterior facial proportion which is 55 ± 2 per cent (Al-Omar, 2009).

For each of the ideal images, the LAFH/TAFH ratio of 55 per cent was increased and decreased by 4 SD. Forty-seven and 63 per cent LAFH/TAFH ratios were created for each of the images (Johnston *et al.*, 2005). The 63 per cent profile image was created by stretching the soft tissue profile at subnasale and sublabiale and the 47 per cent profile image by depressing the soft tissue profile at these points. The soft tissue outlines above the columella and below the soft tissue pogonion were not altered and were identical for all images.

This vertical alteration generated three profile images of 55, 63, and 47 per cent LAFH/TAFH ratios for each of the male and female profile views, while the AP proportions remained constant (Class I).

AP alterations

For each of the three profile male and female Class I images, the positions of the maxilla and the mandible were changed by stretching and compressing subnasale and sublabiale antero-posteriorly by 4 mm increments (Maple *et al.*, 2005) using the above-mentioned software programs.

The Class II (convex facial profile) was created by stretching subnasale anteriorly by 4 mm and compressing sublabiale posteriorly by 4 mm. A Class III (concave facial profile) was created by stretching the sublabiale anteriorly by 4 mm and compressing subnasale posteriorly by 4 mm, so the total AP alteration was 8 mm in each profile image.

These alterations generated a series of nine different profile images for each of the male and female original profile images.

Areas around the alterations were airbrushed to disguise any indication of alteration and to remove any unrealistic areas, especially in lip morphology. This was carried out with a graphics software program (Corel Paint Shop Pro X; Corel Corp.) which did not alter the profile (Maple *et al.*, 2005).

The questionnaire

A three-page questionnaire with the coloured profile images was used for ranking the profile images.

The first page included detailed information regarding the age, gender, and profession of the raters, the second page the

nine male altered profile coloured images (Figure 1), and the third page the nine female altered coloured profile images (Figure 2). A duplicate image of one of the altered nine profiles for each of the original test images was included in each set to assess intra-examiner repeatability and reliability of the method, so that 10 digitized images were presented on each page to be ranked by the raters. The images of each profile were randomly arranged. The sequence of the profile images for the male was different from that of the female profile images. All the images were resized before being placed in the questionnaire using a software program (Picture Resize genius 2.6.2.58; Lonking Software, LLC, Petersburg, Michigan, USA) so that equal sized images were created. The participants were asked to evaluate and rank each set of the altered 10 images on a 10-point numerical scale, allocating a score of 1 to the most attractive profile and 10 to the least attractive profile for each set separately. They were asked to rank the profiles according to their opinion of the attractiveness of these profiles.

Sample population (raters)

Five hundred questionnaires were prepared and distributed. Five questionnaires that were returned with missing information were excluded. Forty-one questionnaires were not returned leaving 454 respondents (219 males and 235 females). The participants were all native Jordanians from two major cities in Jordan (Amman and Irbid).

The aims of the research and a briefing about study and the altered images were given to the participants, who were divided into four groups:

Group I: 117 school children (56 girls and 61 boys) from the 9th and 10th grades from two randomly selected schools in Amman. The mean age of this group was 15 ± 1 years, range 14–17 years.

Group II: 117 university students (60 females and 57 males) from those attending one of the elective classes at Jordan University of Science and Technology. Dental students were excluded. Their mean age was 20 ± 2 years, range 18–23 years.

Group III: 119 adults with various occupations (69 females and 50 males), parents of the school children and university students, teachers in both schools, and employees at the university. Their mean age was 45 ± 8 years, range 30–65 years.

Group IV: 101 randomly selected dentists (50 females and 51 males). Orthodontists and orthognathic surgeons were excluded to avoid bias in profile judgement based on education and experience. Their mean age was 29 ± 7 years, range 23–63 years.

The total sample was divided into two groups according to age (Turkkahraman and Gokalp, 2004); group 1: adolescents (below 20 years) and group 2: adults (20 years and above).

Reliability of the method

A duplicate image of one of the nine altered profiles for each of the original test images was included in each set to assess intra-examiner repeatability and reliability of the method; raters were not told that there was a duplicate image (Johnston *et al.*, 2005; Maple *et al.*, 2005). Ten randomly selected subjects were also asked to re-rate the images and complete the questionnaires 2 weeks after their initial rating to determine intra-examiner reliability.

Statistical analysis

All statistical analyses were carried out using the Statistical Package for Social Sciences (Version 15.0; SPSS Inc., Chicago, Illinois, USA). The mean and SD for the rank scores were calculated for the male and female profile images as obtained from rankings of the entire sample population. Additionally, the mean and SD for the rank scores were calculated independently for each gender, age, and professional group.

A Mann–Whitney test was used to compare the rankings of each of the male and female profile images according to gender and age groups. A Kruskal–Wallis test was employed to compare the rankings of the male and female profile images between the four professional groups.

For assessment of intra-examiner repeatability, a paired sample *t*-test was used to compare the mean ranking scores of the original male and female profile images with their duplicates. Statistical significance was set at $P \leq 0.05$. Pearson product moment correlation coefficient was also used to compare the rankings of all the profile views by the 10 randomly selected subjects on the two different occasions.

Results

Ranking of the profile images by the entire sample

The mean and SD of the scores for the male and female profiles as ranked by the total sample are shown in Table 1.

Based on the mean rank scores of the male profile, the lowest score was given by the judges to A4, while A10 was ranked as the least attractive with the highest mean rank score.

The B3 female profile was ranked as the most attractive and the B4 as the least preferred with the highest mean rank score.

Ranking of the profile images between genders

Table 2 shows the mean and SD of the scores for the male and female profiles as ranked by the female and male assessors.

No significant differences were found between genders in the ranking of any of the male profile images except for A3, which was ranked as being less attractive by female judges ($P < 0.01$)

Table 1 Mean ± the standard deviation (SD) of the ranking scores of the male and female profile images by the total sample.

Male profiles		Female profiles	
Profile image	Mean ± SD	Profile image	Mean ± SD
A1	8.1 ± 1.6	B1	3.1 ± 1.8
A2	3.7 ± 1.7	B2	5.5 ± 2.4
A3	6.3 ± 2.3	B3	1.8 ± 1.5
A4	2.0 ± 1.3	B4	9.0 ± 1.8
A5	2.3 ± 1.6	B5	5.9 ± 2.2
A6	4.8 ± 2.0	B6	6.4 ± 2.2
A7	5.7 ± 1.8	B7	5.3 ± 2.2
A8	8.5 ± 1.6	B8	6.0 ± 2.5
A9	5.3 ± 1.8	B9	5.4 ± 2.7
A10	8.6 ± 1.6	B10	6.7 ± 2.3

Table 2 Mean ± the standard deviation (SD) of the ranking scores of the male and female profile images according to gender.

	Female assessors ranking	Male assessors rankings	*P* value
Male profile images			
A1	7.9 ± 1.7	8.0 ± 1.4	0.539
A2	3.6 ± 1.7	3.8 ± 1.8	0.210
A3	6.6 ± 2.4	6.0 ± 2.1	0.005**
A4	2.0 ± 1.4	1.8 ± 1.1	0.352
A5	2.4 ± 1.7	2.3 ± 1.4	0.960
A6	4.9 ± 2.0	4.6 ± 2.0	0.221
A7	5.6 ± 1.8	5.8 ± 1.8	0.077
A8	8.4 ± 1.7	8.6 ± 1.5	0.146
A9	5.2 ± 1.8	5.3 ± 1.9	0.764
A10	8.5 ± 1.6	8.7 ± 1.5	0.354
Female profile images			
B1	3.0 ± 1.8	3.1 ± 1.9	0.660
B2	5.5 ± 2.4	5.5 ± 2.5	0.982
B3	1.9 ± 1.6	1.8 ± 1.5	0.574
B4	9.0 ± 2.0	9.0 ± 1.8	0.233
B5	6.0 ± 2.2	5.8 ± 2.2	0.381
B6	6.3 ± 2.1	6.5 ± 2.3	0.256
B7	5.3 ± 2.2	5.3 ± 2.3	0.913
B8	5.9 ± 2.4	6.0 ± 2.6	0.644
B9	5.6 ± 2.7	5.3 ± 2.6	0.334
B10	6.6 ± 2.4	6.7 ± 2.6	0.795

**$P < 0.01$.

No significant differences were found between genders in the ranking of the most and least attractive female profile images.

Ranking of the profile images between the four different professional groups

Table 3 shows the mean and SD of the scores for the male and female profiles as ranked by the four different professional groups.

All the groups selected A4 as the most attractive male profile. A significant difference in the ranking of A4 between the groups was found ($P < 0.05$), with group I giving a higher mean rank score of 2.2 than the other groups and group IV giving it a lower mean rank score of 1.7 than the other groups.

B3 was the female profile most preferred by the four groups. The highest mean rank score was given to B4 as the least attractive female profile, with group I giving it a significantly lower mean score (8.6) than the other three groups ($P < 0.01$).

Ranking of the profile images between the two different age groups

Table 4 shows the mean and SD of the scores for the male and female profiles as ranked by the two different age groups.

Both groups agreed on the selection of A4 as the most attractive male profile. The mean score given to A4 by the adolescent group (2.0) was significantly higher than that given by the adult group ($P < 0.05$).

B3 was chosen by both groups as the most attractive female profile with significant differences in the mean ranking score values between the groups ($P < 0.05$). The adolescents gave B3 a higher mean rank score (2) than the adults (1.7). Both age groups agreed in the selection of B4 as the least attractive female profile with significant differences in the mean rank score values between the two groups ($P < 0.05$). The adolescents gave B4 a lower mean score (8.8) than the adults (9.2), which was significant ($P < 0.05$).

Intra-examiner repeatability and reliability of the method

Pearson correlation coefficient (r) ranged between 0.69–0.97 and 0.23–0.91 for ranking of the male and female profile images, respectively, by the same subjects on two different occasions.

Table 5 shows the mean and SD for the scores of the male profile image and its duplicate and the female profile image and its duplicate as ranked by the entire sample population. No significant difference was found in the ranking scores of the identical male profile images, while a significant difference was found in the ranking scores of the identical female profile images ($P < 0.001$).

Discussion

This study aimed to investigate the influence of changing the AP and vertical facial proportions on attractiveness rankings and to determine if these rankings would be influenced by age, gender, and profession.

The profile images

Facial profile images were used as a mean of stimulus presentation. It has been shown that photographs provide

Table 3 Mean ± the standard deviation (SD) of the ranking scores of the four professional groups for the male and female profile images.

	Group I	Group II	Group III	Group IV	*P* value
Male profile images					
A1	7.7 ± 1.7	8.0 ± 1.6	8.0 ± 1.4	8.2 ± 1.6	0.092
A2	3.9 ± 1.8	3.6 ± 1.8	3.6 ± 1.7	3.6 ± 1.6	0.276
A3	6.1 ± 2.3	6.4 ± 1.4	6.4 ± 2.4	6.4 ± 2.2	0.738
A4	2.2 ± 1.4	1.9 ± 1.4	1.8 ± 1.3	1.7 ± 1.0	0.047*
A5	2.3 ± 1.7	2.6 ± 1.8	2.5 ± 1.5	2.0 ± 1.1	0.032*
A6	4.4 ± 2.0	5.0 ± 2.2	5.0 ± 2.0	4.7 ± 2.0	0.125
A7	5.9 ± 1.8	5.7 ± 1.8	5.6 ± 2.0	5.6 ± 1.7	0.659
A8	8.4 ± 1.7	8.6 ± 1.5	8.5 ± 1.9	8.4 ± 1.4	0.508
A9	5.4 ± 2.0	4.8 ± 1.8	5.3 ± 1.8	5.6 ± 1.6	0.013*
A10	8.7 ± 1.7	8.5 ± 1.7	8.5 ± 1.5	8.8 ± 1.2	0.389
Female profile images					
B1	3.4 ± 2.0	2.8 ± 1.4	3.4 ± 2.0	2.6 ± 1.7	0.001***
B2	6.0 ± 2.4	5.4 ± 2.5	5.3 ± 2.6	5.4 ± 2.2	0.257
B3	2.1 ± 1.7	1.7 ± 1.3	1.9 ± 1.5	1.7 ± 1.5	0.055
B4	8.6 ± 2.1	9.3 ± 1.6	9.0 ± 2.0	9.1 ± 1.6	0.003**
B5	5.9 ± 6.0	5.6 ± 2.1	5.7 ± 2.3	6.3 ± 2.1	0.061
B6	6.7 ± 2.3	6.8 ± 2.1	6.0 ± 2.3	6.0 ± 2.1	0.003**
B7	5.1 ± 2.7	5.4 ± 2.4	5.4 ± 2.3	5.3 ± 2.0	0.788
B8	5.4 ± 2.7	5.8 ± 2.4	6.2 ± 2.5	6.2 ± 2.2	0.055
B9	5.2 ± 3.0	5.6 ± 2.5	5.6 ± 2.7	5.3 ± 2.5	0.473
B10	7.0 ± 2.3	6.6 ± 2.4	6.4 ± 2.4	7.0 ± 2.3	0.473

*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$.

Table 4 Mean ± the standard deviation (SD) of the ranking scores of the male and female profile images by the two different age groups.

	Adolescents	Adults	*P* value
Male profile images			
A1	7.8 ± 1.6	8.0 ± 1.5	0.323
A2	3.8 ± 1.8	3.6 ± 1.7	0.106
A3	6.1 ± 2.3	6.4 ± 2.3	0.343
A4	2.1 ± 1.5	1.8 ± 1.1	0.038*
A5	2.5 ± 1.8	2.3 ± 1.4	0.588
A6	4.6 ± 2.1	4.9 ± 2.0	0.163
A7	5.8 ± 1.8	5.6 ± 1.8	0.134
A8	8.5 ± 1.8	8.5 ± 1.6	0.781
A9	5.1 ± 2.0	5.4 ± 1.7	0.058
A10	8.6 ± 1.7	8.6 ± 1.5	0.629
Female profile images			
B1	3.2 ± 1.8	3.0 ± 1.9	0.197
B2	5.7 ± 2.5	5.3 ± 2.4	0.084
B3	2.0 ± 1.6	1.7 ± 1.5	0.034*
B4	8.8 ± 2.0	9.2 ± 1.7	0.023*
B5	5.6 ± 2.2	6.0 ± 2.2	0.037*
B6	6.7 ± 2.2	6.1 ± 2.2	0.002**
B7	5.3 ± 2.3	5.3 ± 2.2	0.878
B8	5.6 ± 2.6	6.2 ± 2.3	0.025*
B9	5.3 ± 2.8	5.5 ± 2.6	0.530
B10	6.7 ± 2.3	6.6 ± 2.3	0.864

*$P < 0.05$, **$P < 0.01$.

valid, reproducible, and representative ratings of dental and facial appearance (Howells and Shaw, 1985). On the other hand, silhouettes have the advantages of subjectivity and simplification of facial aesthetics, discarding many extrinsic (hair style, make up) and intrinsic (skin complexion, emotional expression) factors that may influence the individual's concept of beauty (Wuerpel, 1981).

The perception of the profile images by the total sample

The sample population perceived the Class I male profile with a normal LAFH/TAFH ratio to be the most attractive followed by the Class I male profile with a reduced LAFH/TAFH. The Class I female profile with a reduced LAFH/TAFH ratio was perceived to be the most attractive followed by the Class I female profile with a normal LAFH/TAFH. The preference of a Class I orthognathic profile by Jordanians was similar to the findings of other studies conducted in Western and Asian communities. Several authors have reported that subjects with Class I profiles were rated as more attractive than those with Class II or Class III profiles (Kerr and O'Donnell, 1990; Phillips *et al.*, 1995; Mantzikos, 1998; Turkkahraman and Gokalp, 2004; Johnston *et al.*, 2005; Soh *et al.*, 2005, 2007).

For the vertical skeletal dimension, the choice of a normal LAFH/TAFH as the most attractive male profile image agrees with previous findings in Western (De Smit and Dermaut, 1984; Edler, 2001; Johnston *et al.*, 2005) and Asian (Loi *et al.*, 2006) communities. For the female profile, a Class I pattern with a reduced lower face height was found to be the most preferred female profile in the present study; a similar result was found for the Japanese female profile judged by a Japanese sample population (Loi *et al.*, 2006). Such findings may indicate that shorter faces appeal more to females due to their tiny and softer features (Loi *et al.*, 2006).

In the present study, most of the subjects perceived the Class II male and female profiles with an increased lower face height to be the least attractive. Considering the AP skeletal discrepancies, the present findings were in agreement with some other studies that found that Class II profiles were regarded as less attractive than Class III profiles (Michiels and Sather, 1994; Cochrane *et al.*, 1999; Turkkahraman and Gokalp, 2004; Johnston *et al.*, 2005). On the other hand, other studies reported Class III profiles with mandibular prognathism to be the least preferred by Japanese and Asian communities (Mantzikos, 1998; Soh *et al.*, 2007). Such findings might be due to cross-cultural differences between different populations.

For the vertical skeletal discrepancies, the choice of an increased lower facial proportion as the least attractive for both male and female profiles strongly agrees with other findings in Western and Japanese populations (De Smit and Dermaut, 1984; Michiels and Sather, 1994; Johnston *et al.*, 2005; Loi *et al.*, 2006). However, this finding was in disagreement with the study of Erbay and Canikliogl

Table 5 Mean ± the standard deviation (SD) for the ranking scores for each of the two identical male and two identical female profile images. LAFH/TAFH, lower anterior face height/total anterior face height.

Pair	Images	Mean ± SD	Difference
Pair I	Male profile Class II with increased LAFH/TAFH ratio of 63%	7.93 ± 1.58	0.67 NS
	Duplicate male profile image (Class II with increased LAFH/TAFH ratio of 63%)	8.60 ± 1.60	
Pair II	Female profile Class I with increased LAFH/TAFH ratio of 63%	5.90 ± 2.20	0.74***
	Duplicate female profile image (Class I with increased LAFH/TAFH ratio of 63%)	6.64 ± 2.32	

NS, not significant. ***$P < 0.001$.

(2002), who found that images of Turkish adults with increased lower facial proportions were more attractive than those with reduced lower facial proportion.

Influence of gender on the rankings of attractiveness

No significant differences were found in the overall rankings of the most and least attractive male and female profile images between the female and male raters in the sample. This indicates a similar standard for facial aesthetics between genders. The only significant difference between genders was in the ranking of the male Class II profile with a reduced LAFH/TAFH. The image was ranked as being significantly less attractive by the female assessors than by the male assessors. Conflicting results exist in the literature in evaluating the relationship between gender and profile preferences. Several studies failed to find significant gender differences in the assessment of facial aesthetics by different population assessors (De Smit and Dermaut, 1984; Barrer and Ghafari, 1985; Cochrane *et al.*, 1999; Johnston *et al.*, 2005; Todd *et al.*, 2005).

However, other studies found that female raters judged all photographs to be more attractive than male raters; male raters were the most critical judges when determining dental facial attractiveness (Tedesco *et al.*, 1983). Turkkahraman and Gokalp (2004) found that gender had an effect on profile preferences in the Turkish population and significant differences were observed between genders. Although overall profile rankings of males and females were similar; males preferred convex female profiles more than females and females preferred concave female profiles more than males.

Influence of profession and education of the assessors on the rankings of attractiveness

The Class I male profile image with a normal LAFH was selected by the four groups as the most attractive male image. However, group IV gave it a significantly lower mean score, considering it to be more attractive than the other groups.

Moreover, dentists found the Class I male profile image with a reduced LAFH to be significantly more attractive than the other groups. They also found the Class II male profile with an average LAFH to be less attractive than the other groups.

The results showed that relative standards exist for facial attractiveness within the different professional subgroups. In general, differences between lay people and dentists for dental and facial aesthetics were consistent with other studies (Peck and Peck, 1970; Shaw *et al.*, 1985; Phillips *et al.*, 1992; Cochrane *et al.*, 1999; Spyropoulos and Halazonetis, 2001; Turkkahraman and Gokalp, 2004; Loi *et al.*, 2006; Soh *et al.*, 2007). Dentists tend to be more sensitive in their judgement than lay persons due to their training, educational background, and knowledge of facial impairments (Todd *et al.*, 2005). Additionally, dentists appear to have a greater ability to discriminate profile changes (Lines *et al.*, 1978; Kerr and O'Donnell, 1990; Maple *et al.*, 2005) due to observing more extreme deviations from normal. Moreover, lay judges tend to concentrate on other extrinsic facial features such as chin shape, size and shape of the nose, hair colour and style, etc., which can influence the perception of attractiveness (Cochrane *et al.*, 1999).

In previous studies, agreement was found between lay judges and clinicians in the judgement of attractiveness (Cox and van der Linden, 1971; Reidel, 1975; Romani *et al.*, 1993; Shelly *et al.*, 2000; Vargo *et al.*, 2003; Knight and Keith, 2005; Soh *et al.*, 2005), which is not consistent with the present results. This could be due to the differences in the methods used for the assessment of attractiveness; when profile drawings and silhouettes are used, little differences are expected between clinicians and lay people in the assessment of attractiveness since both would have to base their evaluation on one variable (the profile outline).

Influence of the age of the assessors on the ranking of attractiveness

Both age groups agreed in the selection of the male profile with a Class I normal LAFH/TAFH as the most attractive of all profiles. However, a significant difference was found in the rankings for this profile between the two different age groups. On the other hand, the Class II male profile with increased LAFH/TAFH ratio was ranked by both groups as the least attractive.

The Class I female profile with a reduced LAFH/TAFH ratio was rated as the most attractive, but the adolescents significantly rated it as less attractive than the adults. The female profile Class II with an increased LAFH/TAFH ratio was ranked as the least attractive by both groups, although

the adolescents significantly rated it more attractive than the adults. The female Class I profiles with an increased LAFH/TAFH ratio and Class II with a reduced LAFH/TAFH ratio were also scored by the adolescents as significantly more attractive than the adults.

Changes in self-image during early, middle, and late adolescence and adulthood may influence the perception and standards for attractiveness and judgements (Turkkahraman and Gokalp, 2004). Interestingly, the younger age group (adolescents) rated the most attractive images significantly less attractive than the older age group. The least attractive female profile was rated as significantly more attractive by the younger age group. This indicates that the younger age group was more tolerant of variations in the profile views and alterations in the images. Some studies found that older raters selected the Class I profile as the preferred image significantly less frequently than younger raters (Todd *et al.*, 2005). Turkkahraman and Gokalp (2004) reported similar results regarding female profile preferences, with no significant effect of age in the male profile preferences.

While this study assessed the effect of age on profile preferences of both male and female images, it should be taken into consideration that the results are derived from only a small number of photographs, which might limit the conclusions.

Conclusions

1. The orthognathic male image with a normal LAFH and the female orthognathic image with a reduced LAFH were the most preferred profiles.
2. The combination of a Class II malocclusion with an increased LAFH was the least preferred of both the male and female profiles.
3. Images with increased lower facial proportions were considered to be less attractive than corresponding images with reduced lower facial proportions, and those with Class II profile features were considered to be less attractive than corresponding images with Class III profile features.
4. Gender did not influence attractiveness rankings, while significant differences were determined between dentists and lay people in the perception of profile attractiveness.
5. The quality of aesthetic preferences increased with age and differed between professions.
6. The ranking procedure used is a simple, rapid, and reliable method for the assessment of attractiveness.

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