The perception of facial aesthetics in a young Spanish population

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SUMMARY Improved facial aesthetics is one aim of orthodontic treatment. This study was designed to determine if the faces considered more beautiful in a young population exhibit the same parameters used by orthodontists to assess successful results.

A panel of 34 laypeople (30 females and 4 males) evaluated a set containing one frontal, one frontal during smiling, and one profile photograph of 89 students (77 females and 12 males) on a 5-point attractiveness scale, in relation to a set of reference photographs. For each photographic set, the mean and final scores were calculated. Once the sample was established, 11 subjects (9 females and 2 males) with the highest final facial aesthetic score were selected and cephalometric analysis was performed.

All cephalometric measurements were within the norm for the total sample. When the sample was divided by gender, Wilcoxon's *W* non-parametric test showed significant differences between the male and female photographs; while females tended to a Class II malocclusion, with the mandible slightly retrusive to the maxilla, males tended to a Class III and showed a straighter profile with a prominent chin; the face height ratio was higher in males. There were no significant differences between genders for lower lip to E plane. The findings show that the faces considered more attractive fulfilled the cephalometric and facial norms.

Introduction

The face has been exhaustively studied by scientists, doctors, and artists; most of whom have tried to measure and reproduce facial features, especially those related to beauty.

Beauty and physical attractiveness are of importance to humans; social acceptance, popularity, mate selection, and careers are all affected by an individual's physical attractiveness (Dipboye *et al.*, 1977; Langlois and Roggman, 1990; O´Doherty *et al.*, 2003). But what makes a face attractive? is beauty 'altogether in the eye of the beholder?' Aesthetic criteria appear to have been defined in almost all cultures (Peck and Peck, 1970; Matoula and Pancherz, 2006), but several findings suggest that the perception of beauty may be innate and, additionally, universal or cross-cultural (Langlois and Roggman, 1990; Langlois *et al.*, 1991, 1994; Cunningham *et al.*, 1995). Accordingly, Langlois and Roggman (1990) and Langlois *et al.* (1994) proposed that averageness is attractive (a face is perceived as attractive when its facial gestalt is close to the average or mean of a population of faces).

Improved facial aesthetics is one of the main aims of orthodontic treatment, and, in recent years, it has acquired even more importance both for patients and orthodontists. Orthodontic patients and their parents believe that having well-aligned teeth is an important factor in facial appearance; they hope that orthodontic treatment will improve their dental, dentofacial, and facial aesthetics and consequently their popularity and social success (Shaw *et al.*, 1985; Kerosuo *et al.*, 1995; Birkeland *et al.*, 2000; Kiekens *et al.*, 2006). A significant correlation has been found between orthodontic treatment and facial appeal (Tatarunaite *et al.*, 2005). However, orthodontists are not always aware of the difference in perception between patients and clinicians as to which result defines treatment success. Whereas patients hope for results determined by social and cultural rules of beauty in their reference group and in society in general, orthodontists prefer to use parameters to determine diagnosis and subsequent treatment planning (Spyropoulos and Halazonetis, 2001; Kiekens *et al.*, 2006; McKoy-White *et al.*, 2006; Miner *et al.*, 2007). This study was designed to determine if faces considered more beautiful in a young population exhibit the same parameters used by orthodontists to assess ideal treatment and successful results.

Subjects and methods

Approval for this study was obtained from the ethical committee of Rey Juan Carlos University and all subjects gave informed consent to participation.

Reference set

A total of 91 (78 females and 13 males, between 20 and 34 years of age) third- and fourth-year students pursuing a degree in Dentistry at Rey Juan Carlos University, who fulfilled the following criteria, were included: no facial or dental trauma, no congenital defects, and who did not wear glasses.

A frontal relaxed, a frontal during smile, and profile photographs were taken of each subject, using a Coolpix 5700 digital camera (5 MP; Nikon, Tokyo, Japan). The photographs were obtained with the Frankfort plane parallel to the floor and perpendicular to the body axis (natural position) and with the interpupilar parallel to the floor. The participants stood against a white background at a distance of 1.5 m from the camera. The photographs were sorted using Microsoft Power Point for Windows XP (2003 version) and a digital photographic panel was produced, in which three views of each individual were displayed simultaneously (Figure 1) (Kiekens *et al.*, 2006).

Judges

Fifty-one fifth-year students (43 females and 8 males) from the dentistry programme of Rey Juan Carlos University, between 22 and 26 years of age, scored the photographs of the 91 subjects. Rating of facial aesthetics was performed on a 5-point attractiveness scale with values from 1 (very unattractive) to 5 (very attractive) (Ong *et al.*, 2006).

The mean and standard deviation (values indicating the final facial aesthetic score for each individual) were calculated for each slide using Microsoft Excel for Windows XP. The mean scores ranged from 1.32 to 3.8, median 2.42. A slide of a male and female (with a final facial aesthetic score close to the median value) was then selected to serve as a reference set for the measuring system (Figure 2) (Shell and Woods, 2004; Kiekens *et al.*, 2005).

Evaluation of the sample

The photographs (frontal relaxed, frontal during smiling, and profile) of each subject, together with a set of reference photographs, were shown to a group of judges formed of 34 students (30 females and 4 males, between 20 and 26 years of age) from the second year of the Physiotherapy Diploma Course of the Rey Juan Carlos University. From the initial sample, the two slides comprising the reference set were eliminated, so the number of slides shown was 89. The slides were randomly placed, showing every female face in relation to the female reference set and every male face in relation to the male reference set.

Each slide was shown for 15 seconds (Kiekens *et al.*, 2005). The rating system was the same as used for the reference set. For each slide, the mean and standard deviation were again calculated as the final facial aesthetic score. For the 11 subjects with highest facial aesthetic final score, lateral cephalometric radiographs were obtained and the following objective parameters were measured (Table 1): SNA, SNB, ANB, facial angle, and facial convexity; these values indicate the maxillomandibular relationship in the antero-posterior plane or skeletal Class, face height ratio (Jarabak); this proportion indicates vertical discrepancy; and lower lip to the E plane.

Figure 1   Digital picture **panel**.

Figure 2   Reference photographs for a male and female. The final facial aesthetic score was 2.38 and 2.5, respectively.

Table 1   Cephalometric measurements.

1. SNA: 82 ± 2° (Steiner, 1953)	Sella–nasion–subnasale (point A) angle
2. SNB: 80 ± 2° (Steiner, 1953)	Sella–nasion–supramentale (point B) angle
3. ANB: 2 ± 1° (Steiner, 1953)	Point A–point B–nasion angle
4. Facial angle: 87 ± 3° (Ricketts, 1960)	Frankfort horizontal plane–facial plane (nasion to pogonion) angle
5. Facial convexity: 2 ± 2 mm (Ricketts, 1960)	Point A to facial plane
6. Face height ratio: 61 ± 2% (Siriwat and Jarabak, 1985)	Posterior face height (sella–gonion) to anterior face height (nasion–menton)
7. Lower lip to the E plane: −2 ± −2 mm (Ricketts, 1960)	

All cephalometric measurements were undertaken twice by the same author (ABMG), with an interval of 2 weeks. For each variable, the average value of the two measurements was used.

All data analyses were carried out using the software PASW (SPSS) version 17 (PAWS/SPSS; IBM Company, Armonk, New York, USA). As the panel of judges contained

a higher number of females than males (30 females and 4 males), the intraclass correlation coefficient (ICC), two-way random effects, was calculated to assess inter-rater reliability in scoring the 89 photographs. To evaluate reproducibility of the measuring system, six duplicate slides were used in order to standardize the judges in terms of scoring.

Results

The cephalometric analysis performed on the 11 subjects to obtain the different variables previously indicated showed that all measurements were inside the norm for the total sample (Table 2). When divided by gender, Wilcoxon's W non-parametric test showed significant differences between the male and female photographs for the following measurement: SNB ($W = 45.0$; $Z = -2.13$; $P < 0.05$), higher in males than females; ANB ($W = 3.0$; $Z = -2.14$; $P < 0.05$), higher in females than in males; facial convexity ($W = 3.5$; $Z = -2.01$; $P < 0.05$), higher in females than in males; and face height ratio ($W = 45.0$; $Z = -2.12$; $P < 0.05$), higher in males than in females. No significant gender differences were found for SNA, facial angle, or lower lip to E plane (Table 3).

The ICC was 0.962 (lower bound 0.95; upper bound 0.973, with 95% confidence) indicating a high level of agreement among the 34 judges, when scoring each of the photographs. Spearman's rho correlations ranged from 0.46 to 0.75 ($P = 0.001$) for the five pairs of repeated photographs, indicating a moderate level of reproducibility for the scores of the same slide. Nevertheless, there was no correlation between scores for one of the duplicated presentations (rho = 0.05, $P > 0.05$).

Discussion

A system to evaluate facial aesthetics should be simple, applicable to the everyday clinic, and provide quantitative data (Moyers, 1992). The use of lateral radiographs, profile silhouettes, or photographs has been reported in the literature (Czarnecki et al., 1993; Spyropoulos and Halazonetis, 2001), but the most complex system is probably simultaneous visualization of a frontal and profile photograph and of the smile (Kiekens et al., 2005). Howells and Shaw (1985) demonstrated a high correlation between scores assigned to individuals classified in vivo and photographs of the same individuals; they also demonstrated that evaluation of facial aesthetics using photographs and a panel of judges is valid and reproducible.

Differences have been found in the evaluation of facial aesthetics, depending on panel composition, with regard to age, gender, and demographic origin (Howells and Shaw, 1985; Newton and Minhas, 2005; Kiekens et al., 2007). As differences in judging facial attractiveness between orthodontists and non-orthodontists (Knight and Keith, 2005; Maple et al., 2005) have also been found, the raters, who were not dental personnel, in the present study were selected to be similar to the subjects on the basis of age, gender, and demographic origin. Since the aims of the study were not only to judge facial aesthetics but also to determine the skeletal features of the subjects considered the most attractive, the sample included a wide range of faces with different features (Kiekens et al., 2008).

When analysing the results of the research without dividing the model by gender, the variables indicating skeletal Class (ANB, facial angle, and facial convexity) had values within

Table 2 Mean and standard deviation (SD) of the cephalometric measurements of the 11 subjects with the highest final facial aesthetic score.

Gender		SNA (°)	SNB (°)	ANB (°)	Facial angle (°)	Facial convexity (mm)	Face height ratio (%)	Lower lip to E plane (mm)
Male, n = 2	Mean	83.50	83.00	0.50	91.00	−1.75	79.46	−4.50
	SD	0.70	0.00	0.70	0.00	1.06	1.89	0.70
Female, n = 9	Mean	78.50	75.27	3.22	89.50	2.05	65.99	−1.66
	SD	3.42	2.85	1.34	3.58	1.89	5.26	2.01
Total, n = 11	Mean	79.40	76.68	2.72	89.77	1.36	68.44	−2.18
	SD	3.67	4.03	1.64	3.26	2.31	7.22	2.14

Table 3 Wilconxon's non-parametric test for the cephalometric measurements of males and females.

	SNA (°)	SNB (°)	ANB (°)	Facial angle (°)	Facial convexity (mm)	Face height ratio (%)	Lower lip to E plane (mm)
W of Wilconxon	46.50	45.00	3.00	49.00	3.50	45.00	4.50
Z	−1.77	−2.13	−2.14	−1.19	−2.01	−2.12	−1.78
Asymptotic significance (two-tailed)	0.07	0.03	0.03	0.23	0.04	0.03	0.07
Exact significance [2 × (significance one-tailed)]	0.07	0.03	0.03	0.32	0.03	0.03	0.07

Grouping variable: gender of slides.

the norm, i.e. the faces considered more attractive had a skeletal Class I occlusion. This is in agreement with previous research where it has been suggested that a Class I occlusion is the more attractive profile (Tulloch *et al.*, 1993; Kitay *et al.*, 1999; Knight and Keith, 2005; Maple *et al.*, 2005; Tatarunaite *et al.*, 2005; Chan *et al.*, 2008).

Although SNB angle in the sample was within the norm, the value was slightly diminished and was similar to that obtained by Johnston *et al.* (2005a) as representative of facial attractiveness. It indicates that a convex profile, with a prominent maxilla relative to the mandible, is a feature of facial attractiveness, which is in agreement with the results of Sforza *et al.* (2007). Because diminution of SNB angle causes an increase in ANB angle, this variation in angles should be minimal for a face to be attractive. Knight and Keith (2005) showed that an ANB angle deviated more than 5 degrees from the norm causes a diminution in facial attractiveness. Johnston *et al.* (2005a) also showed that a Class III outline is considered more attractive than a Class II, with a similar degree of skeletal discrepancy.

When analysing face height ratios, it was observed that even though the value was within the norm, it was slightly increased when compared with the norm determined by Siriwat and Jarabak (1985). This indicates that not only is this proportion related to facial attractiveness (Lundström *et al.*, 1987; Johnston *et al.*, 2005b) but also that the most attractive faces are shorter. Lundström *et al.* (1987) found that a horizontal growth pattern corresponded to a higher facial attractiveness. Johnston *et al.* (2005b) showed that the most attractive faces corresponded with a neutral face height ratio, but they also showed, in agreement with Michiels and Sather (1994), that a diminished inferior face height is more acceptable when it comes to judging facial attractiveness. This indicates that treatment that increases face height should be avoided (Padrós, 2000; Johnston *et al.*, 2005b).

The position of the lips, as determined by maxillomandibular protrusion or retrusion, by dental protrusion or retrusion and/or by lip thickness (Sarver and Jacobson, 2007), was correct for the total sample; therefore, although nowadays the tendency is for protrusive lips to be considered as more attractive, and variations in occlusion and in the thickness of the upper and lower lip vermilion have a significant influence on facial attractiveness perception (Nguyen and Turley, 1998; Kiekens *et al.*, 2006; Scott *et al.*, 2006; McNamara *et al.*, 2008), a correct relationship with Ricketts line should be maintained.

When the sample was divided by gender, it was observed that for the variables that indicate skeletal Class, ANB angle and facial convexity had higher values in females; this indicates a tendency to a Class II in females, with more convex profiles. This result is in accordance with the findings of Matoula and Pancherz (2006), who reported that ANB angle was higher in attractive females, and Foster (1973), who found that in males a straight profile

was considered attractive, whereas in females, convex profiles are considered attractive. According to previous studies, more convex faces have a younger appearance than more concave faces (Nguyen and Turley, 1998; Peck and Peck, 1995) and statistically significant differences were found when comparing facial attractiveness and estimated age, with those perceived as younger being considered more attractive (Tatarunaite *et al.*, 2005). In the same way, Czarnecki *et al.* (1993) reported that straight profiles with a prominent chin are more suited to males than females.

Height ratio was significantly higher in males considered as attractive, indicating a more brachyfacial type. For females, 44 per cent displayed a neutral type and the remaining 55.6 per cent a brachyfacial type. This result is in keeping with the findings of Lundström *et al.* (1987), who showed that the most attractive female profiles were those with neutral growth, followed by brachyfacial; while for males, the most attractive profiles were brachyfacial.

Matoula and Pancherz (2006) did not find differences between attractive and unattractive females with regard to face height. Knight and Keith (2005) showed that a decrease in females and an increase in males in height ratio were associated with less attractive faces. This result is contrary to the present findings for males; this could be because in the study of Knight and Keith (2005), the relationship between height ratio and facial attractiveness was not significant and to the fact that the present sample was small (11 individuals).

Significant differences between males and females were not found for the parameter lower lip to E plane. This result is contrary to the findings of Czarnecki *et al.* (1993) and Padrós (2000) who reported that labial protrusion was better tolerated in females than in males. Matoula and Pancherz (2006) also found an increased distance of the lower lip to the aesthetic line in unattractive females.

Conclusions

1. The faces considered more attractive in this study fulfilled the cephalometric and facial norms commonly used for diagnosis and treatment planning; more attractive individuals have a skeletal Class I, mesobrachyfacial type, and the lips inside Ricketts' aesthetic line.
2. Attractive females showed a tendency to a Class II, with the mandible slightly retrusive to the maxilla; therefore, they present more convex profiles than males. By contrast, attractive males presented a straighter profile with a prominent chin.
3. The facial pattern is more horizontal in attractive males than in attractive females.
4. None of the faces considered attractive had a moderate or severe Class II or Class III skeletal malocclusion.
5. None of the faces considered attractive had a dolichofacial pattern.

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