Original Article

Soft-Tissue Facial Characteristics of Attractive Italian Women as Compared to Normal Women

Chiarella Sforza[a]; Alberto Laino[b]; Raoul D'Alessio[c]; Gaia Grandi[d]; Miriam Binelli[d]; Virgilio Ferruccio Ferrario[a]

ABSTRACT

Objective: To compare the facial characteristics of two different groups of attractive women with those of reference women.

Materials and Methods: The three-dimensional coordinates of 50 facial landmarks were collected in 71 healthy reference women (18–30 years old) and in 24 coetaneous "attractive" women selected during two different beauty competitions; soft tissue facial angles, distances, areas, and volumes were computed and compared using analysis of variance.

Results: When compared with reference women, both groups of attractive women shared several similar facial characteristics: relatively large forehead ($P < .001$), reduced mandible ($P = .008$), and rounded face (reduced surface-to-volume ratio, $P = .002$). They had a more acute soft tissue profile, an increased upper facial width ($P < .001$) and middle facial depth, larger mouth, and more voluminous lips ($P = .005$) than reference women.

Conclusions: Both groups of attractive women had several facial characteristics suggesting babyness. Nonetheless, each group of women was characterized by a different development of these features. Esthetic reference values can be a useful tool for clinicians, but should always consider the characteristics of individual faces. (*Angle Orthod.* 2009;79:17–23.)

KEY WORDS: Face; Women; Attractiveness; Soft tissues

INTRODUCTION

The clinical specialists devoted to the facial area are increasingly asked by patients not only to correct major disfigurements,[1,2] but also to provide modifications of those dentofacial physiognomies considered as nonattractive.[2–5] Orthodontists and maxillofacial surgeons, therefore, should have a deep understanding of the facial characteristics that are currently considered by the public as "attractive."[2,3,6,7–9]

According to the current theories of evolutionary

[a] Professor, Department of Human Morphology, University of Milan, Milan, Italy.

[b] Professor, Dental, Oral, and Maxillo-Facial Sciences, Section of Orthodontics, University of Napoli Federico II, Naples, Italy.

[c] Private practice, Rome, Italy.

[d] Postdoctoral student, Department of Human Morphology, University of Milan, Milan, Italy.

Corresponding author: Dr Chiarella Sforza, Department of Human Morphology, via Mangiagalli 31, University of Milan, Milan, MI I-20133 Italy
(e-mail: chiarella.sforza@unimi.it)

psychology, the esthetic appraisal of adult faces depends on various combinations of averageness, symmetry, neoteny (babyness) and youthfulness, and sexual dimorphism.[1,2,6,10,11] Actually, both natural and sexual selection seem to explain the various perceptions of attractiveness,[10] with almost consistent ratings across sexes, ethnic groups, and ages.[10,11] In summary, whereas attractive female faces possess several characteristics of babyness, male faces mingle symmetry, health, and averageness mingle with perceptions of masculinity and social dominance.[10–12] Indeed, the effect of masculinity in attractiveness of the male face is still controversial.[11]

Overall, previous investigations, performed either on two-dimensional (photographs, radiographs) or three-dimensional (classic and digital anthropometry) records, confirmed these theories. The faces of attractive children, female adolescents, and adult women share several characteristics of babyness: a large face with a large forehead, a relatively large and more prominent facial middle third, reduced vertical development, full and prominent lips, and a more convex soft tissue facial profile than in the normal coetaneous population.[6,8–10,13–20] In contrast, for postpubertal adolescent

boys and adult men, attractiveness seems to be positively influenced by facial markers of high testosterone levels, with a relative increment of the facial lower third (more prominent chin, less prominent lips).[6,9–10,12,18,20]

On the other hand, several studies demonstrated that secular trends and even the cultural background can influence the perception of beauty, at least for adult subjects.[4,13,15,17,21] In our society, the perception of attractiveness is extremely influenced by media. Television, cinema, advertisements, fashion industries, all enter in our life conveying facial "standards" that should portray perceptions of beauty, healthiness, fitness, mixed with feelings of social achievement, intelligence, richness, and happiness. Therefore, a beautiful face becomes the key to success.[10,21,22]

Furthermore, each human face is individually determined, carrying information that allows the identification of the single person. Even among attractive faces, there is a wide variety of facial characteristics that do not repeat the same standard.[2,3,15] Nevertheless, according to the previously mentioned theories and to the findings of preceding studies, the same general criteria should be used to judge the different faces, leading to similar results. In other words, attractive faces selected in different contests should always present some combination of those universally recognized cues.[1,2,6,10,11]

In the current investigation, the three-dimensional facial characteristics of adult women considered "attractive" (finalists in national beauty competitions) were measured noninvasively. The measurements were then compared to those obtained in healthy women of the same age and ethnicity, selected using criteria of dentofacial normality.[4,13,17] Data were collected in two separate national beauty competitions (2 different years), and the esthetic characteristics of the finalists of the two competitions were compared to find if their faces were consistent with the same esthetic criteria.

MATERIALS AND METHODS

Subjects

Ninety-five white, northern Italian women, age 18–30 years, were analyzed. A first group, "reference" women, comprised 71 healthy women. All women had normal dentofacial dimensions and proportions; they had no previous history of craniofacial trauma or congenital anomalies. These women were either staff or students at the University of Milan, and part of their data had already been published.[20,23]

A second group, "beautiful" or "attractive" women, comprised 24 women selected during two national beauty competitions that took place in 2006 and 2007. These women were those admitted at the relevant final
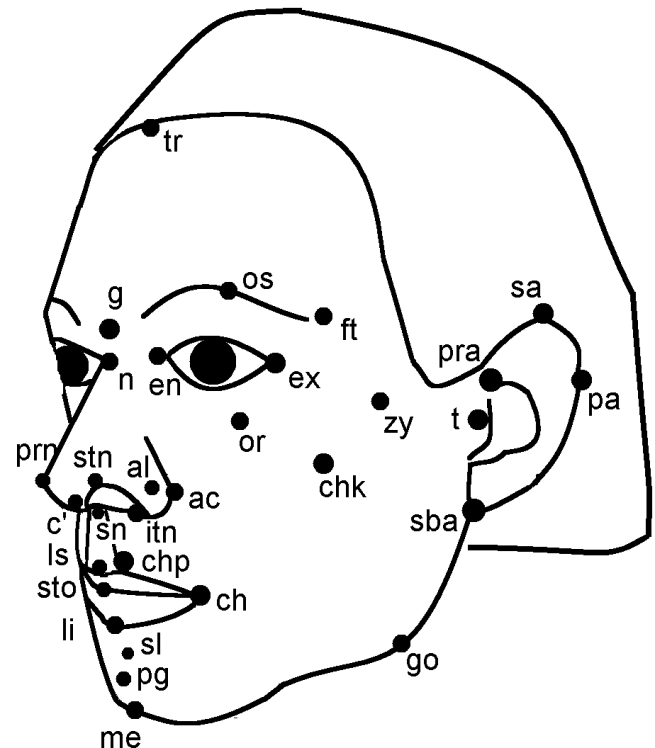

Figure 1. Digitized facial landmarks.

stages (12 for each event). The women were measured just before the semifinal stage of their competition; they were identified with numerical codes, and all subsequent calculations were made blindly to the result of the beauty competition. No woman participated in both competitions. Part of the 2006 data had already been published.[20]

All analyzed women gave their informed consent to the experiment. All procedures were noninvasive; did not provoke damages, risks, or discomfort to the subjects; and were preventively approved by the local ethics committee.

Data Collection and Analysis

The same procedure used in previous studies[8,16,20,23] was followed. For each woman, a single experienced operator located and marked 50 soft tissue landmarks by inspection and palpation[8] (Figure 1, Table 1). During landmark marking, the woman sat relaxed with a natural head position. For each person, this phase lasted less than 5 minutes.

Three-dimensional coordinates of the facial landmarks were obtained with a computerized electromagnetic digitizer (3Draw, Polhemus Inc, Colchester, Vt). During data collection, each woman sat in a natural head position in a chair with a backrest, with her head fixed by cephalostat. Each woman remained motionless, with closed eyes and the mandible in rest posi-

Table 1. Digitized Facial Landmarks

Midline		Paired	
tr	Trichion	ex	Exocanthion
g	Glabella	en	Endocanthion
n	Nasion	os	Orbitale superius
prn	Pronasale	or	Orbitale
c′	Columella	ft	Frontotemporale
sn	Subnasale	chk	Cheek
ls	Labiale superius	zy	Zygion
sto	Stomion	t	Tragion
li	Labiale inferius	al	Alare
sl	Sublabiale	ac	Nasal alar crest
pg	Pogonion	itn	Inferior point of the nostril axis
me	Menton	stn	Superior point of the nostril axis
		chp	Crista philtri
		ch	Cheilion
		go	Gonion
		pra	Preaurale
		sa	Superaurale
		pa	Postaurale
		sba	Subaurale

tion. The digitization of landmarks took approximately 1 minute. Duplicate data collections gave random errors corresponding to 1.05% of nasion-mid tragion distance. Files of the three-dimensional coordinates were obtained, and computer programs were used for all subsequent off-line calculations. The coordinates of the landmarks were used to estimate several linear distances, angles, areas, and facial volumes[7,22–24] (Table 2).

Statistical Calculations

Descriptive statistics (mean and standard deviation) were computed for each group of finalists (2006 and 2007 competitions) and reference women, and compared by one-way analysis of variance. Post hoc tests (Tukey's HSD) were made for significant differences. The level of significance was set at 5% for all comparisons.

RESULTS

In both beauty competitions, finalist women had a significantly larger upper facial third than reference women (analysis of variance, $P < .001$, Table 3). The difference was particularly evident for the finalists of the 2006 competitions, who also had a wider middle facial third.

Finalist women had more voluminous lips (a trend for lip volume; a significant difference for lip vermilion area, $P = .005$, Table 4) than reference women. In particular, the lower lip was significantly nearer to the

Table 2. Measurements Calculated From the Digitized Landmarks

	Unit	Measurement	Landmarks
Distances	mm	Anterior upper facial height	n-sn
		Anterior lower facial height	sn-pg
		Upper facial width	ex_r-ex_l
		Middle facial width	t_r-t_l
		Middle facial depth	sn-(t_r-t_l)
		Mouth width	ch_r-ch_l
		Upper lip to E-line distance	ls-(prn-pg)
		Lower lip to E-line distance	li-(prn-pg)
Angles	degrees	Facial convexity excluding the nose	n-sn-pg
		Upper facial convexity	ex_r-n-ex_l
		Maxillary prominence	sl-n-sn
		Nasolabial	prn-sn-ls
		Interlabial	sn-ls^sl-pg
Areas	cm²	Vermilion of the lip	ch_r, ls, ch_l, li
		Facial area	External cutaneous surface up to a line connecting tr, t_r, t_l, go_r, go_l
Volumes	mm³	Total facial volume	Facial structures from the external cutaneous surface up to a surface passing through tr, t_r, t_l, go_r, go_l
		Facial upper third volume	Forehead (between trichion and a quasi-horizontal plane passing through the tragi and the exocanthia)
		Facial middle third volume	Maxilla (between a plane passing through the tragi and the exocanthia, and a plane connecting the cheilion landmarks and the tragi)
		Facial lower third volume	Mandible (between a plane connecting the cheilion landmarks and the tragi, and a plane passing through pogonion and the gonia)
		Lip	ch_r, sn, ch_l, sl, sto
Ratios	%	Lower to upper facial height	sn-pg/n-sn × 100
		Forehead to total facial volume	Forehead/total facial volume × 100
		Maxilla to total facial volume	Maxilla/total facial volume × 100
		Mandible to total facial volume	Mandible/total facial volume × 100
		Mandible to maxilla	Mandible/maxilla × 100
		Facial surface area to volume	Facial area/total facial volume × 100

Table 3. Soft Tissue Facial Distances and Ratios Calculated in 24 Attractive and 71 Reference Women

	ex-ex, mm	t-t, mm	sn-(t-t), mm	sn-pg/n-sn, %	ch-ch, mm	ls-(prn-pg), mm	li-(prn-pg), mm
2006 Competition (12 finalists)							
Mean	95.2	136.2	103.8	104.0	49.2	4.4	2.4
SD	3.3	5.2	4.0	8.6	2.1	2.2	1.4
2007 Competition (12 finalists)							
Mean	92.5	130.8	100.5	100.2	48.2	4.0	1.7
SD	3.5	4.7	3.5	7.7	2.9	1.3	1.3
Reference women							
Mean	90.2	134.4	102.5	101.2	48.5	5.4	3.4
SD	3.8	5.7	4.8	8.4	3.5	2.2	1.7
Comparison*							
Global	<0.001	0.499	NS	NS	NS	NS	0.003
2006 vs 2007	NS	0.019	—	—	—	—	–
Attractive vs reference	<0.001	NS	—	—	—	—	<0.001

Comparison: Probability values from one-way analysis of variance, 2.92 degrees of freedom. Post hoc tests made by Tukey's HSD, 1.92 degrees of freedom. NS indicates not significant, $P > .05$.

Table 4. Facial Volumes, Areas, and Ratios Estimated in 24 Attractive and 71 Reference Women

	Forehead/ Total, %	Maxilla/ Total, %	Mandible/ Total, %	Mandible/ Maxilla, %	Surface/ Volume, %	Total Lip Volume, mm³	Lip Vermilion Area, cm²
2006 Competition (12 finalists)							
Mean	47.4	36.6	30.7	84.2	69.7	5.5	5.1
SD	3.0	2.3	2.2	7.1	2.0	1.0	0.7
2007 Competition (12 finalists)							
Mean	40.9	38.5	32.1	83.7	72.3	5.3	5.0
SD	6.1	2.2	2.4	7.1	2.6	0.9	0.7
Reference women							
Mean	37.1	37.8	34.6	92.4	75.1	4.9	4.4
SD	4.9	5.0	4.6	13.8	5.5	1.3	0.9
Comparison							
Global	<0.001	NS	0.005	0.019	0.002	NS	0.005
2006 vs 2007	0.002	–	NS	NS	NS	–	NS
Attractive vs reference	<0.001	–	0.001	0.005	<0.001	–	0.001

Comparison: Probability values from one-way analysis of variance, 2.92 degrees of freedom. Post hoc tests made by Tukey's HSD, 1.92 degrees of freedom. NS, not significant, $P > .05$.

esthetic line ($P = .003$) in the 24 beauties than in the reference women.

A different arrangement of facial thirds was observed in attractive women when compared with reference women. The forehead (facial upper third) occupied a significantly larger part of the face of attractive women in both competitions; the effect was particularly evident in the women of the 2006 event. In contrast, the mandible (facial lower third) occupied a smaller part of the face of attractive women. The mandible-to-maxilla volume ratio was significantly reduced in all attractive women. Attractive women had a more rounded face than reference women, with a significantly reduced surface to volume ratio.

In the finalists of the 2006 competition, the face was significantly flatter in the horizontal plane, with larger angles of upper face convexity (ex-n-ex, Table 5).

DISCUSSION

In the current investigation, two groups of women considered "beautiful" and "attractive," and selected for the final stage of two different beauty competitions were analyzed. All women came from northern Italy, and were admitted to this phase of the competitions after a series of selections. Therefore, they should represent what is currently considered "attractive," "positive," and "acceptable."[18] The selection was independently made by judges who were unaware that the women were to be measured in a scientific investigation.

Table 5. Soft Tissue Facial Angles Calculated in 24 Attractive and 71 Reference Women

	n-sn-pg	sl-n-sn	prn-sn-ls	(sn-lsl)-(li-pg)	ex-n-ex
2006 Competition (12 finalists)					
Mean	160.2	11.0	130.7	162.8	124.9
SD	5.0	2.3	6.4	8.0	3.5
2007 Competition (12 finalists)					
Mean	162.7	9.6	123.0	159.0	120.8
SD	4.6	2.7	8.3	7.7	4.2
Reference women					
Mean	160.4	10.9	127.2	166.4	120.2
SD	6.3	2.7	8.0	11.3	5.6
Comparison					
Global	NS	NS	NS	NS	0.019
2006 vs 2007	–	–	–	–	–
Attractive vs reference	–	–	–	–	0.035

All values are degrees. Comparison: probability values from one-way analysis of variance, 2.92 degrees of freedom; post hoc tests made by Tukey's HSD, 1.92 degrees of freedom. NS, not significant, $P > .05$.

The specialized opinions of surgical and dental professionals, therefore, were avoided. Indeed, they are often relatively more critical in their esthetic assessment than nonprofessionals,[4,18,24] even if different findings about plastic surgeons have been reported recently.[7] Additionally, it is felt that facial esthetics should be evaluated by laypersons, who actually seek (and finally judge) surgical and orthodontic treatments.[4,24]

The current procedure used for the selection of women made a rating among the participants to the beauty competition, using three-dimensional, lively stimuli. Similar procedures were followed in the past for both adult women[1,3,13,14,20,25] and children.[8,9] Therefore, the procedure differs from those commonly used in psychological investigations, where two-dimensional records are used.[11,12,22,26,27] Additionally, we tried to link measurements to ratings: even if the human visual system possesses a better sensitivity than the current measurement methods,[11,28] health professionals cannot rely only on perception, but they need objective data for their diagnosis and treatment.

Overall, both groups of attractive women analyzed in the current study shared several facial characteristics suggesting babyness,[6,10] even if they also presented several differences. Among the common characteristics was a relatively large forehead (facial upper third), with a relatively reduced mandible (facial lower third), and a rounded face, with a reduced surface to volume ratio. They had a more acute soft tissue profile, an increased upper facial width and middle facial depth, larger mouths, and more voluminous lips, than reference women. Among the differences, it should be noted that the 12 finalists of the 2006 competition had a larger face than the attractive women of the 2007 competition.

Current results, therefore, confirm that adult white women considered attractive by laypersons share some common facial features among those reported in previous investigations.[1,6,10,13,14,17–20] Overall, their faces resemble child faces that are characterized by relatively increased horizontal dimensions and reduced vertical development, together with relatively larger upper and middle parts of the face, and smaller lower part of the face.[10] Additionally, and confirming preceding investigations mostly focused on dentolabial characteristics, a great importance was given to lips: a large mouth, with prominent lips, has always been associated with positive feelings, conveying attractiveness and youthfulness.[7–9,14–17,20,21,26] The esthetic importance of lips seems to be widely shared by the public, with the considerable diffusion of cosmetic lip modifications and the industry of the various kinds of lip fillers.[21]

Among the limitations of the current study is the analysis of only one of the cues that people are thought to use to determine facial attractiveness.[1,2,6,10] Literature reports contrasting information on facial symmetry.[26,28] While theories of perceptual psychology underline the importance of a reduced fluctuating symmetry for esthetic appraisal,[10,11,26] actual measurements in living persons do not support the link between attractiveness and perfect symmetry, both for men and women.[2,3,7,25] The different experimental conditions (two- vs three-dimensional stimuli, original vs modified photographs) and methods (ratings vs two- or three-dimensional measures) may explain part of the discrepancies. A further study may assess symmetry in the current groups of attractive women, together with a wider set of angles and distances including other facial structures, including eyes and ears.[3,6,10,23]

As to the averageness hypothesis,[6,10] the topic was

not assessed in detail in the present study. Indeed, in a previous analysis of the women participating in the 2006 beauty competition, the winner (Miss No. 17) seemed the woman who differed the most from the population average,[20] but this aspect was not analyzed in the present study. A recent investigation from DeBruine et al[29] found that there are specific nonaverage facial characteristics that are particularly attractive.[26] Further investigations are necessary to obtain a deeper insight into the problem.

Sexual dimorphism, a further psychological cue for attractiveness,[10] was not a matter of separate analysis, but in women it approximately corresponds to the same characteristics found for neoteny: full lips, larger face, smaller mandible.[10,19,26,27] It could be interesting to assess three-dimensionally the faces of attractive adult men, a topic that apparently was analyzed only by Farkas[15] for North American white men with data published more than 10 years ago.

A further limitation of the present investigation is the assessment of only Italian attractive women. In a different ethnic/social context, different kinds of attractive faces might be preferred, even if the good accord between the current findings and literature makes the selected facial patterns sufficiently trustworthy.

CONCLUSIONS

- Both groups of attractive women had several facial characteristics suggesting neoteny/babyness, thus confirming current psychological theories.[1,2,6,10] Nonetheless, each group of women was characterized by a different development of these features.
- Esthetic guidelines can be useful tools for clinicians who can modify the facial appearance of their patients,[2–6,10] providing indications for the best kind, and timing and goals of surgical, orthodontic, and orthopedic treatments. They also offer information on the esthetic preferences of the general public,[6,18,21] and possibly about the wishes and desires of the patients.
- Accordingly, the guidelines should not be imposed on each face, or followed blindly, but should always consider the characteristics of individual faces. Even when the guidelines have been obtained on subjects of the same age, sex, and ethnic group of the patients, and updated considering the evolution of the esthetic canons within a given society,[10,13,21] they remain only a part of the treatment goals.

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