

Influence of Lip Projection and Chin Position on Facial Profile Preferences Among Various Layers of Polish Population. Part I

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Purpose: This study aims to evaluate how the extent of altering lip projection in women and chin position in men influences the 22-year-old Caucasian's facial profile attractiveness, in relation to respondents' sex, age and place of residence.

Materials and Methods: One female and one male orthognathic (SNA angle = 79–85°, Z angle = 75–78°) face profiles, with lips correctly positioned in relation to the E-line were photographed and digitally modified. This processing resulted in 30 photographs varying as for 1. the SNA angle determining orthognathic, prognathic (SNA angle >85°), or retrognathic (SNA angle <79°) profile and 2. lip projection/chin position: normal or protruded/retruded by 1 or 2 mm. The photographs were always shown in the same order to 418 respondents (306 women and 112 men) aged between 15 and 73 years, who provided their place of residence. The 11-point visual analogue scale (VAS) was used for the assessment of the facial profile attractiveness.

Results: All respondents found the prognathic profile with correct lip position in woman and correct chin position in man most attractive. Each major deviation from the norm resulted in a decrease in the scores awarded. Men ranked rethrogathic profiles significantly ($p < 0.05$) higher than women. The respondents under and over 25 years also differed ($p < 0.05$) in their evaluation: the older viewers were more critical regarding all female profiles with an exception of the retrognathic profile with 2 mm lips protrusion. The respondents' place of residence did not affect the rating.

Conclusion: 1 mm modification of lip projection and chin position significantly alter ranking the face profile attractiveness, thus any aesthetic medicine applied in this area requires extreme caution. Moreover, visualizing the results should be mandatory, especially in women older than 25 years of age, who are the most critical evaluators.

Keywords: profile attractiveness, lip projection, chin position, aesthetic medicine

Plain Language Summary

Attractiveness of face has a huge impact on shaping a social and personal relationships. Lips and chin which catch the most attention from the audience are the most important factor in the beauty of the face. The desire to improve facial and smile aesthetics is more and more frequently one of the most common reasons for patients to visit the orthodontist's office and the main motivating factor for treatment. Aesthetic preferences of patients are subjective and influenced by various factors such as sex, age and ethnicity, as well as new trends in fashion or cultural influences. Nowadays, the possibilities of the aesthetic medicine, orthodontics and oral surgery, as well as their accessibility are technically unlimited. More and more patients decide to undergo lip augmentation treatments and strive for a fuller face profile. Therefore, it is particularly important to determine a range of changes in order to maintain their support for attractiveness. In our study, all respondents found the profile with correct lip position in women and correct chin position in men most attractive. All profiles with deviations from the average obtained lower scores. Findings from this study may be used not only by orthodontists and oral surgeons to find a gold standard for treatment planning but also for patients to track whether their treatment goes into a desired direction, or to support their better awareness during the decision process whether to undergo an aesthetic treatment or not.

Introduction

Facial attractiveness, especially a beautiful smile, have a huge impact on the quality of psychosocial life and interpersonal relationships.^{1,2} People with nice facial features are automatically attributed with more desirable personality traits and they are considered as more likeable.³ It is not surprising that the desire to improve facial and smile aesthetics is more and more frequently one of the most common reasons for patients to visit the orthodontist's office and the main motivating factor for treatment, one of the most important goals of which is⁴ to achieve a harmonious, attractive profile.

The ancient Egyptians and Greeks already dealt with attractiveness and harmony of body and face. They preferred flatter and retrusive profiles as illustrated in the sculptures from their time.^{5,6} However, ideas and standards of beauty undergo constant changes. Nowadays, fuller convex profiles with protrusive lips are found to be more attractive.⁷⁻⁹ Some studies have been conducted and showed that female facial profile appearance is significantly affected by the eyes size and the lip position.¹⁰ Anthropometric studies show that wider and fuller upper lip, strongly define female attractiveness.^{11,12} Sometimes, during an orthodontic treatment, the lips are not appropriately supported despite restoration of an ideal occlusion, which compromises the appearance of the profile. In men, cheekbones and chin projection is one of the parameters responsible for facial aesthetics.^{3,13} Evaluation of this factor is particularly important for the patients whose medical treatment is a choice between surgery and orthodontic camouflage. Subjective perception of the facial profile attractiveness varies due to several factors such as age, sex and ethnicity.^{9,14,15} New trends in fashion or cultural influences frequently affect what is considered attractive and desirable.¹⁶ Therefore, when planning treatment, it is necessary to know patients' preferences and their perception of facial features aesthetics, which are not always coherent with physicians' personal opinion.

This study aims to evaluate how the Caucasian's facial profile attractiveness is influenced by the extent of altering lip projection in women and chin position in men, as well as by respondents' sex, age and place of residence.

Materials and Methods

Thirty 22-year-old individuals, 15 women and 15 men untreated orthodontically, without history of neither plastic surgery nor esthetic medicine treatment, with normal occlusion and orthognathic face profile (SNA angle = 79–85°, Figure 1) underwent the face profile analysis. The latter was made in the patients' photographs of their natural head

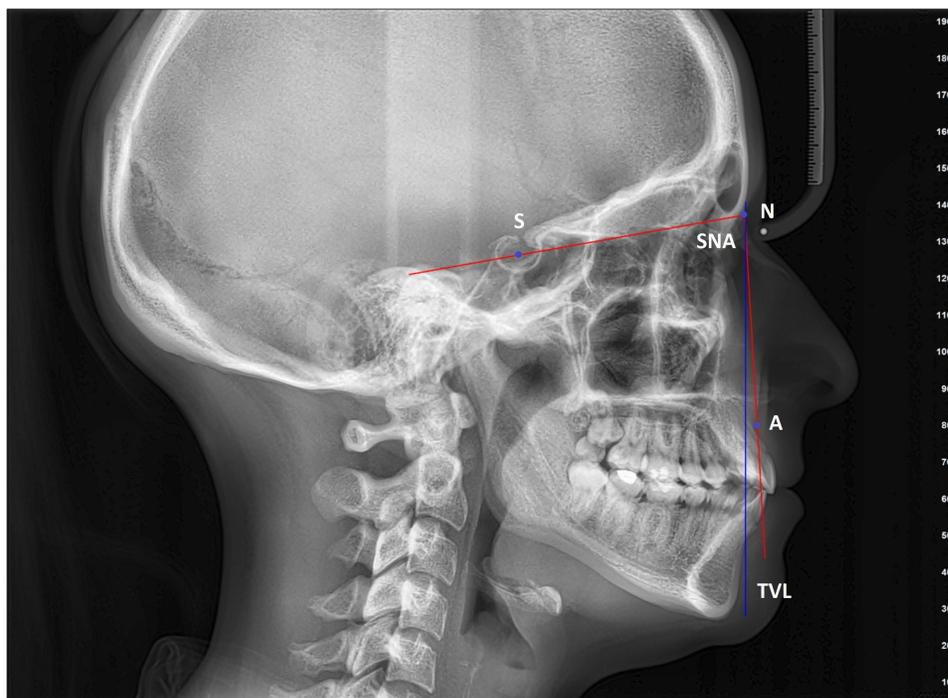


Figure 1 SNA angle: Retrognathic profile, SNA < 79°. Orthognathic profile, SNA = 79–85°. Prognathic profile, SNA > 85°. **Abbreviation:** TVL, true vertical line (through the Nasion).

posture, taken from a distance of 1 meter, under identical lighting conditions. Only the patients with the lips correctly positioned in relation to Ricketts' aesthetic E-line and with normal Z angle = 75–78° (Figure 2) were initially involved to the study. Subsequently the pictures of the two of them, a woman and a man were randomly selected for the processing with Adobe Photoshop software. To do so, the patient's cephalogram was superimposed on the face profile picture. Then, using the true vertical line (through the Nasion) as a reference, the segment extending from the tip of the nose to the Gnathion was shifted 3 mm forward (to obtain a prognathic profile, SNA > 85°) or backward (to obtain a retrognathic profile, SNA < 79°). It resulted in 3 female and 3 male photographs, in which the red zone of the lips or the Supramentale–Pogonion vertical segment, respectively, were shifted by 1 then by 2 mm forward or backward. All changes were registered as the separate pdf files, giving in total 30 photographs of different and digitalized face profiles: 15 female and 15 male ones (Figure 3).

Sticking to the order of the photographs demonstrated in Figure 3, they were shown to 418 respondents (306 women and 112 men) aged between 15 and 73 years, after being interviewed regarding their place of residence (Table 1). The 11-point visual analogue scale (VAS) was used for the assessment of the facial profile, enabling ranking it from 0 (“very unattractive”) to 10 (“very attractive”).

Statistical Analysis

The statistical analysis of the study results was performed using STATISTICA v. 13.3 (TIBCO Software Inc.). The concordance of the distribution of profile scores (on a scale from 1 to 10) with a normal distribution was verified with the Shapiro–Wilk test. Mean values (M), standard deviation (SD), median (Me), lower quartile (Q1), upper quartile (Q3) and extreme values, ie minimum (Min) and maximum (Max), were calculated for the quantitative variable (age). For parameters with a distribution significantly deviating from normal one or a distribution with heterogeneous variants, the significance of differences in terms of the mean values in two groups was verified using the Mann–Whitney *U*-test, while in the case of a larger number of groups – using the Kruskal–Wallis test. Size (n) and structure indicators (%) were calculated for nominal and ordinal qualitative variables (sex, place of residence). The Spearman's rho rank correlation coefficient was used for the assessment of the strength of the monotonic relationship (increasing or decreasing, not necessarily linear) between two characteristics (measured at least on an ordinal scale, however, with a distribution different from normal one). Multivariate regression was used for the assessment of the effect of predictors (independent

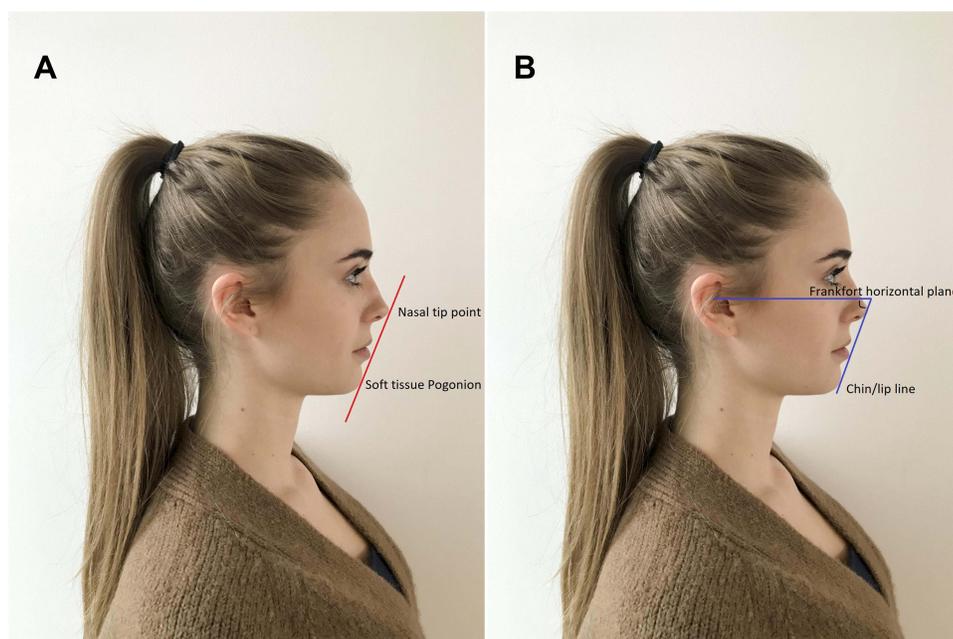


Figure 2 Diagram demonstrating aesthetic analysis. (A) Ricketts' aesthetic line – The tips of the lips did not protrude from the E-line. The lower lip is closer to the line. (B) Merrifield Z-angle – Ideal angle 75–78°.

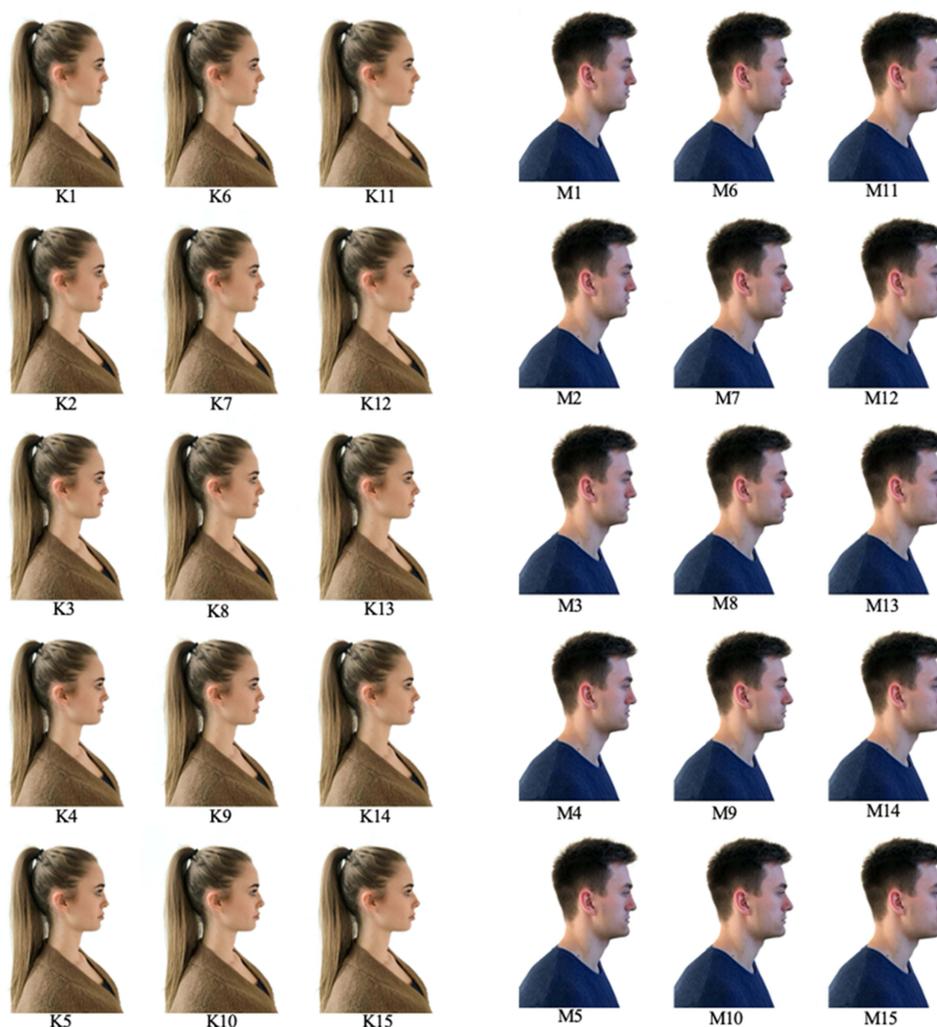


Figure 3 Modified photographs. Female (K8) and male (M8) straight orthognathic profiles and those obtained by repositioning the Subnasale point and displacements (expressed in mm) of the red zone of the lip or the Supramentale–Pogonion region: K1, M1: a retrognathic profile, 2 mm retraction; K2, M2: a retrognathic profile, 1 mm retraction; K3, M3: a retrognathic profile, 0 mm; K4, M4: a retrognathic profile, 1 mm protrusion; K5, M5: a retrognathic profile, 2 mm protrusion; K6, M6: an orthognathic profile, 2 mm retraction; K7, M7: an orthognathic profile, 1 mm retraction; K9, M9: an orthognathic profile, 1 mm protrusion; K10, M10: an orthognathic profile, 2 mm protrusion; K11, M11: a prognathic profile, 2 mm retraction; K12, M12: a prognathic profile, 1 mm retraction; K13, M13: a prognathic profile, 0 mm; K14, M14: a prognathic profile, 1 mm protrusion; K15, M15: a prognathic profile, 2 mm protrusion.

variables) on the dependent (described) variable. In multiple regression models, b_1 regression coefficients were standardised so that their values were independent of the extent to which the random variable associated with that coefficient varied (standardised beta regression coefficients that vary from -1 to $+1$ and they may be compared to one another for different random variables; the greater the absolute value of the standardised regression coefficient, the stronger the effect of this variable on the response variable). The same level of statistical significance, $p = 0.05$, was adopted for all statistical tests used.

Results

The rating of each profile by all respondents is shown in Figure 4.

All respondents found the prognathic profile with correct lip position (K13) in women and correct chin position in men (M13) most attractive. All female profiles with modified lip position (K1, K2, K4-K7, K9-K12, K14, K15) and male profiles with modified chin position (M1, M2, M4-M7, M9-M12, M14, M15) were rated lower than profiles with normal position of these structures (K3, M3, K8, M8, K13, M13). Each major deviation from the norm resulted in a decrease in the scores awarded by the respondents. Interestingly, the trend of awarding scores was very similar; however, female

Table 1 Distribution of Respondents

Trait (Variable)	Percentage Distribution
Sex:	
Women	306 (73.2%)
Men	112 (26.8%)
Age (years):	
Respondents aged ≤ 25	247 (59.1%)
Respondents aged > 25	171 (40.9%)
Place of residence:	
Rural area	56 (13.4%)
Small town (less than 20 thousand inhabitants)	32 (7.7%)
Medium city (20–100 thousand inhabitants)	105 (25.1%)
Big city (more than 100 thousand inhabitants)	225 (53.8%)

profiles modified in a similar way to male ones always received higher scores. Regardless of the position of the Subnasale point, the value of awarded scores decreased as the chin position or the position of the red zone of the lip deviated from the norm. This relationship was statistically significant and had weak strength (minimum absolute value of $\rho=0.17239$). The weak negative correlation means that the higher deviation from the norm and the higher lip/chin retraction or protrusion, the lower value of rating scores awarded by the respondents.

There were statistically significant differences between men and women in terms of the assessment of all retrognathic profiles (K1-K5, M1-M5), the male orthognathic profile with 2 mm chin retraction (M6), the female middle profile with 1 and 2 mm lip retraction (K6 and K7), the male profile with 2 mm chin protrusion (M15) and the female prognathic profile with 2 mm lip retraction (K11). All of these profiles were given higher scores by men than women, with the exception of the M15 profile. The variation in profile rating scores according to respondents' sex is shown in Table 2.

The evaluation of the profiles according to the age of the respondents is shown in Table 3. With the exception of the K5 profile, younger respondents always rated female profiles higher and they preferred the K13 profile. Rating scores of male profiles were more varied, however, older respondents awarded mostly higher scores; M13 was the most highly rated profile. Only M5 and M10 profiles were rated higher by younger respondents. The differences in terms of rating scores between respondents aged under or over 25 years were statistically significant for all female profiles with 2 mm lip retraction (K1, K6, K11), female orthognathic profiles with 1 mm lip retraction (K7), female prognathic profiles with

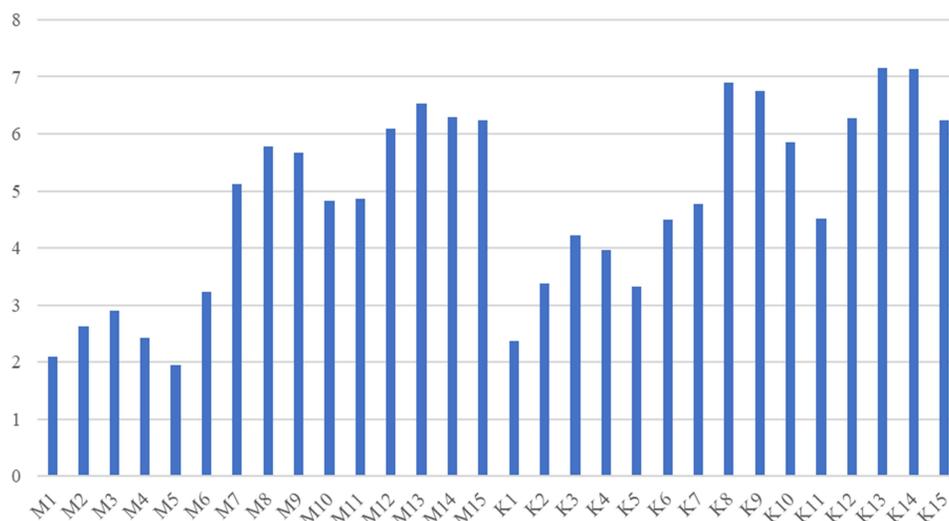
**Figure 4** The assessment of facial profile attractiveness by all respondents.

Table 2 Respondents' Rating Scores of Facial Profiles According to Sex and the Results of Statistical Comparisons

Facial Profile		Women N = 306	Min-Max	Me	Men N = 112	Min-Max	Me	p
Retrognathic	M3	2.8 ± 2.0	0-10	2	3.3 ± 1.7	0-8	3	0.003*
	M2	2.5 ± 1.6	0-7	2	3.1 ± 1.7	0-8	3	< 0.001*
	M1	1.8 ± 1.5	0-8	2	2.8 ± 1.6	0-7	3	< 0.001*
	M4	2.3 ± 1.7	0-8	2	2.9 ± 1.8	0-8	3	0.002*
	M5	1.7 ± 1.5	0-7	2	2.6 ± 2.0	0-9	2	< 0.001*
	K3	4.0 ± 2.3	0-10	4	4.8 ± 2.0	1-10	5	0.001*
	K2	3.1 ± 1.8	0-9	3	4.2 ± 2.0	0-10	4	< 0.001*
	K1	2.1 ± 1.7	0-9	2	3.1 ± 1.9	0-9	3	< 0.001*
	K4	3.7 ± 2.1	0-9	4	4.7 ± 2.1	0-9	5	< 0.001*
	K5	3.1 ± 2.2	0-10	3	3.9 ± 2.2	0-9	4	0.002*
Orthognathic	M8	5.8 ± 1.9	0-10	6	5.6 ± 1.8	0-10	6	0.353
	M7	5.0 ± 2.0	0-10	5	5.4 ± 1.8	1-10	5	0.093
	M6	3.1 ± 2.0	0-10	3	3.6 ± 2.0	0-9	4	0.024*
	M9	5.7 ± 2.0	0-10	6	5.6 ± 1.9	0-10	5	0.502
	M10	4.8 ± 2.1	0-10	5	4.9 ± 2.1	0-10	5	0.535
	K8	6.8 ± 1.9	0-10	7	7.1 ± 1.8	2-10	7	0.390
	K7	4.5 ± 2.1	0-10	4	5.4 ± 2.1	1-10	5	< 0.001*
	K6	4.3 ± 2.0	0-10	4	5.1 ± 1.8	1-9	5	< 0.001*
	K9	6.6 ± 2.1	0-10	7	7.0 ± 1.7	3-10	7	0.154
	K10	5.8 ± 2.1	0-10	6	6.0 ± 2.2	0-10	6	0.273
Prognathic	M13	6.7 ± 2.2	0-10	7	6.2 ± 2.0	0-10	6	0.027*
	M12	6.1 ± 2.2	0-10	6	5.9 ± 2.1	0-10	6	0.434
	M11	4.9 ± 2.3	0-10	5	4.9 ± 2.2	0-10	5	0.808
	M14	6.4 ± 2.2	1-10	7	6.0 ± 2.1	0-10	6	0.067
	M15	6.4 ± 2.3	0-10	7	5.8 ± 2.1	1-10	6	0.007*
	K13	7.1 ± 2.0	0-10	8	7.2 ± 1.8	2-10	7	0.843
	K12	6.2 ± 2.1	0-10	6	6.5 ± 2.1	2-10	7	0.111
	K11	4.3 ± 2.3	0-10	4	5.0 ± 2.1	0-10	5	0.008*
	K14	7.1 ± 2.0	0-10	8	7.1 ± 1.9	2-10	7	0.772
	K15	6.2 ± 2.3	0-10	7	6.3 ± 2.0	2-10	6	0.978

Table 3 Respondents' Rating Scores of Facial Profiles According to Age and the Results of Statistical Comparisons

Facial Profile		≤ 25 Years of Age N = 247	Min-Max	Me	> 25 Years of Age N = 171	Min-Max	Me	p
Retrognathic	M3	2.9 ± 1.9	0-10	3	2.9 ± 1.8	0-8	3	0.936
	M2	2.5 ± 1.7	0-7	2	2.8 ± 1.7	0-8	3	0.075
	M1	2.1 ± 1.6	0-8	2	2.1 ± 1.6	0-7	2	0.497
	M4	2.4 ± 1.8	0-7	2	2.4 ± 1.7	0-8	2	0.457
	M5	2.0 ± 1.7	0-9	2	1.9 ± 1.6	0-7	2	0.200
	K3	4.3 ± 2.1	0-10	4	4.1 ± 2.3	0-10	4	0.248
	K2	3.4 ± 2.0	0-10	3	3.3 ± 1.8	0-8	3	0.236
	K1	2.5 ± 1.9	0-9	2	2.2 ± 1.7	0-7	2	0.029*
	K4	4.1 ± 2.1	0-9	4	3.8 ± 2.2	0-9	4	0.086
	K5	3.3 ± 2.3	0-9	3	3.4 ± 2.2	0-10	3	0.252
Orthognathic	M8	5.7 ± 1.9	0-10	6	5.8 ± 1.8	0-10	6	0.264
	M7	5.1 ± 1.9	0-10	5	5.2 ± 2.0	1-10	5	0.422
	M6	3.1 ± 2.0	0-10	3	3.4 ± 2.0	0-9	3	0.084
	M9	5.7 ± 2.0	0-10	6	5.7 ± 1.9	0-10	6	0.944
	M10	4.9 ± 2.2	0-10	5	4.7 ± 1.9	0-9	4	0.099

(Continued)

Table 3 (Continued).

Facial Profile		≤ 25 Years of Age N = 247	Min-Max	Me	> 25 Years of Age N = 171	Min-Max	Me	p
Prognathic	K8	6.9 ± 1.9	0–10	7	6.8 ± 1.9	1–10	7	0.244
	K7	5.0 ± 2.2	0–10	5	4.4 ± 2.1	1–9	4	0.002*
	K6	4.7 ± 2.0	0–10	5	4.2 ± 1.9	1–10	5	0.040*
	K9	6.8 ± 1.9	0–10	7	6.7 ± 1.9	1–10	7	0.263
	K10	5.9 ± 2.2	0–10	6	5.7 ± 2.0	0–10	6	0.067
	M13	6.4 ± 2.2	0–10	7	6.8 ± 1.9	1–10	7	0.026*
	M12	5.9 ± 2.3	0–10	6	6.3 ± 1.9	0–10	6	0.028*
	M11	4.7 ± 2.2	0–10	5	5.0 ± 2.2	1–10	5	0.079
	M14	6.2 ± 2.2	0–10	6	6.5 ± 2.1	1–10	7	0.071
	M15	6.2 ± 2.3	0–10	6	6.3 ± 2.2	1–10	6	0.305
	K13	7.3 ± 2.0	0–10	8	7.0 ± 1.9	0–10	7	0.097
	K12	6.4 ± 2.1	0–10	7	6.2 ± 2.1	0–10	6	0.103
	K11	4.7 ± 2.3	0–10	5	4.3 ± 2.3	0–10	4	0.027*
	K14	7.2 ± 1.9	0–10	8	7.1 ± 2.0	1–10	7	0.289
	K15	6.5 ± 2.2	0–10	7	5.9 ± 2.2	0–10	6	0.003*

2 mm lip protrusion (K15), as well as male retrognathic profiles with a correctly positioned chin (M13) and male profiles with 1 mm chin retraction (M12). When it comes to facial profiles with lowest scores, the respondents were unanimous in choosing profiles M5 and K1.

Rating scores of all profiles according to respondents' place of residence are shown in Table 4. The respondents' place of residence did not affect the facial profile attractiveness rating, except for the orthognathic male profile with a correctly positioned chin (M8) with chin retraction (M7) and 1 mm chin protrusion (M9).

The results of the univariate correlation analysis showing the effect of respondents' age, sex, and place of residence on the assessment of the facial profiles are shown in Table 5. Men rated facial profiles higher than women by an average

Table 4 Respondents' Rating Scores of Facial Profiles According to Place of Residence and the Results of Statistical Comparisons

Facial Profile		Big city N = 225	Min- Max	Me	Medium City N = 105	Min- Max	Me	Small Town N = 32	Min- Max	Me	Rural Area N = 56	Min- Max	Me	p
Retrognathic	M3	2.9 ± 1.8	0–8	3	2.9 ± 2.1	0–9	3	2.5 ± 2.1	0–10	2	2.9 ± 1.8	0–7	3	0.439
	M2	2.6 ± 1.7	0–7	3	2.6 ± 1.8	0–8	3	2.5 ± 1.5	0–8	3	2.7 ± 1.6	0–7	3	0.902
	M1	2.1 ± 1.5	0–6	2	2.1 ± 1.7	0–8	2	1.8 ± 1.8	0–7	1	2.2 ± 1.6	0–6	2	0.508
	M4	2.4 ± 1.6	0–7	2	2.4 ± 1.9	0–8	2	2.3 ± 2.0	0–8	2	2.5 ± 1.5	0–7	2	0.813
	M5	1.9 ± 1.6	0–9	2	2.1 ± 1.8	0–7	2	1.6 ± 1.5	0–6	1	1.9 ± 1.6	0–7	2	0.610
	K3	4.3 ± 2.3	0–10	4	4.2 ± 2.2	0–10	4	3.9 ± 2.3	0–10	4	4.1 ± 2.1	0–9	4	0.688
	K2	3.3 ± 2.0	0–10	3	3.6 ± 2.0	0–9	3	3.6 ± 1.6	1–7	3	2.5 ± 2.0	0–9	3	0.391
	K1	2.3 ± 1.7	0–7	2	2.5 ± 1.9	0–9	2	2.2 ± 1.8	0–6	2	3.2 ± 1.9	0–9	3	0.637
	K4	4.0 ± 2.1	0–9	4	4.0 ± 2.3	0–9	4	4.4 ± 2.2	0–7	5	3.7 ± 2.1	0–9	4	0.311
	K5	3.4 ± 2.3	0–9	3	3.2 ± 2.3	0–10	2	3.7 ± 2.1	0–8	4	3.3 ± 2.0	0–8	3	0.646
Orthognathic	M8	5.9 ± 1.8	0–10	6	5.8 ± 1.8	1–10	6	4.8 ± 2.2	0–9	5	5.5 ± 2.1	0–10	6	0.024*
	M7	5.3 ± 1.9	1–10	5	5.3 ± 2.0	0–8	3	4.4 ± 1.9	0–10	4	4.7 ± 1.8	1–8	5	0.017*
	M6	3.1 ± 2.0	0–10	3	3.4 ± 2.0	0–9	3	3.0 ± 2.0	0–8	2	3.7 ± 2.0	0–8	4	0.113
	M9	5.8 ± 1.9	1–10	6	5.8 ± 2.1	0–10	6	4.9 ± 2.0	0–10	5	5.1 ± 1.7	0–9	5	0.006*
	M10	4.9 ± 2.0	0–10	5	4.8 ± 2.1	0–10	5	4.9 ± 2.3	0–10	5	4.4 ± 2.1	0–8	4	0.469

(Continued)

Table 4 (Continued).

Facial Profile		Big city N = 225	Min- Max	Me	Medium City N = 105	Min- Max	Me	Small Town N = 32	Min- Max	Me	Rural Area N = 56	Min- Max	Me	p
Prognathic	K8	7.0 ± 1.8	1-10	7	6.8 ± 1.9	2-10	7	6.5 ± 2.3	0-10	7	4.1 ± 2.3	0-10	4	0.676
	K7	4.8 ± 2.1	0-10	5	5.9 ± 2.2	0-10	5	5.3 ± 1.9	0-8	4	4.6 ± 2.3	0-10	5	0.645
	K6	4.6 ± 2.0	0-10	5	4.6 ± 2.0	0-9	4	4.1 ± 2.2	0-8	4	6.6 ± 2.0	0-10	7	0.722
	K9	6.8 ± 1.9	1-10	7	6.8 ± 1.9	2-10	7	6.6 ± 2.2	1-10	7	6.5 ± 2.1	0-10	7	0.756
	K10	5.8 ± 2.2	0-10	6	5.9 ± 2.0	2-10	6	6.0 ± 2.4	1-10	6	5.8 ± 1.9	0-10	6	0.962
	M13	6.7 ± 1.9	0-10	7	6.4 ± 2.4	1-10	7	6.3 ± 2.5	0-10	7	5.9 ± 2.0	0-10	6	0.624
	M12	6.1 ± 2.0	0-10	6	5.9 ± 2.3	0-10	6	6.6 ± 2.2	0-10	7	6.2 ± 2.2	0-10	6	0.366
	M11	4.9 ± 2.1	0-10	5	4.9 ± 2.4	0-10	5	5.1 ± 2.5	1-9	5	4.7 ± 2.2	0-10	5	0.860
	M14	6.4 ± 2.1	1-10	7	6.2 ± 2.4	1-10	7	6.2 ± 2.5	1-10	7	5.9 ± 2.0	0-10	6	0.331
	M15	6.4 ± 2.2	0-10	7	6.0 ± 2.3	0-10	6	6.0 ± 2.5	0-10	6	6.1 ± 2.2	0-10	6	0.580
	K13	7.2 ± 1.9	0-10	7	7.2 ± 2.0	2-10	8	6.8 ± 2.3	0-10	7	7.2 ± 2.1	0-10	8	0.799
	K12	6.3 ± 2.2	0-10	7	6.5 ± 1.9	2-10	7	5.8 ± 2.2	1-9	6	6.1 ± 2.0	0-10	6	0.310
	K11	4.5 ± 2.3	0-10	4	4.6 ± 2.3	0-10	5	4.4 ± 2.5	0-9	5	4.5 ± 2.5	0-10	4	0.949
	K14	7.2 ± 1.9	1-10	8	7.1 ± 2.0	2-10	8	7.2 ± 2.1	1-10	8	6.9 ± 2.3	0-10	7	0.837
	K15	6.2 ± 2.2	0-10	7	6.3 ± 2.1	0-10	6	6.3 ± 2.2	3-10	7	6.3 ± 2.5	0-10	6	0.971

Table 5 The Spearman’s Rank Correlation Coefficient Values of Facial Profile Attractiveness Rating Scores and Socio-Demographic Characteristics of the Viewers – the Univariate Analysis

Rated Facial Profile	Characteristic of the Viewers		
	Age	Sex	Place of Residence
Male retrognathic, 0 mm	-0.017	0.148*	0.029
Male retrognathic, -1 mm	0.069	0.186*	-0.009
Male retrognathic, -2 mm	0.029	0.270*	-0.000
Male retrognathic, +1 mm	0.013	0.154*	-0.003
Male retrognathic, +2 mm	-0.044	0.186*	0.019
Female retrognathic, 0 mm	-0.067	0.166*	0.052
Female retrognathic, -1 mm	0.021	0.219*	-0.005
Female retrognathic, -2 mm	-0.040	0.220*	-0.026
Female retrognathic, +1 mm	0.010	0.210*	0.020
Female retrognathic, +2 mm	0.049	0.152*	-0.004
Male orthognathic, 0 mm	-0.013	-0.050	0.126*
Male orthognathic, -1 mm	-0.048	0.071	0.097*
Male orthognathic, -2 mm	0.043	0.110*	-0.087
Male orthognathic, +1 mm	-0.043	-0.036	0.125*
Male orthognathic, +2 mm	-0.054	0.034	0.068
Female orthognathic, 0 mm	-0.046	0.049	0.077
Female orthognathic, -1 mm	-0.087	0.183*	0.034
Female orthognathic, -2 mm	-0.133*	0.175*	0.052
Female orthognathic, +1 mm	0.011	0.086	0.061
Female orthognathic, +2 mm	-0.053	0.047	-0.010
Male orthognathic, 0 mm	0.045	-0.108*	0.073
Male prognathic, -1 mm	0.075	-0.042	-0.033

(Continued)

Table 5 (Continued).

Rated Facial Profile	Characteristic of the Viewers		
	Age	Sex	Place of Residence
Male prognathic, -2 mm	0.085	0.001	0.015
Male prognathic, +1 mm	0.022	-0.090	0.080
Male prognathic, +2 mm	0.012	-0.132*	0.057
Female prognathic, 0 mm	-0.030	0.010	0.025
Female prognathic, -1 mm	-0.111*	0.071	0.044
Female prognathic, -2 mm	-0.057	0.131*	-0.001
Female prognathic, +1 mm	0.003	-0.002	0.048
Female prognathic, +2 mm	-0.121*	0.020	-0.016

of 0.54 points. Facial profile scores were lower on average by 0.26 pts as the age of the respondents increased by 10 years.

Discussion

The most commonly used parameter for the assessment of aesthetics of the lips is their position in relation to the Ricketts' aesthetic line.^{7,9} According to the literature, facial profiles in which the lips are positioned slightly behind the E-line are considered the most attractive, while progressive lip retraction behind this line decreases the perception of attractiveness.⁷ This conclusion has been proved in this study: all respondents found the female prognathic profile with correctly positioned lips in relation to the Ricketts' aesthetic line and the male prognathic profile with a correctly positioned chin to be the most attractive. Orthognathic and prognathic profiles were rated higher than retrognathic profiles. Profiles with correct lip and chin position were the most highly rated. As retraction or protrusion of the lips or chin increased, the scores decreased. One study¹⁷ obtained slightly different results. According to them, although orthognathic profiles are the most attractive in men, lip retraction is more appealing in women. In another study, facial profiles with less convexity were also more preferred.¹⁸ According to other authors, slight lip retraction is also considered more attractive, and this retraction should deepen as the convexity of the facial profile decreases.^{19,20}

Attractiveness is a multifactorial concept. Its perception is affected by i.a. age, sex, ethnicity, culture.^{7,14,15,17,21,22} The significance of respondents' sex for the survey results can be interpreted in different ways in various reports. The present study proved that the assessment made by men and women was statistically significantly different only in some cases. This was true for retrognathic profiles which were rated higher by men. Usually, women were more critical because they awarded lower scores for both male and female facial profiles. This is in contrast to the results obtained by one study¹⁸ where authors found that although there were no significant differences in the perception of the role of facial convexity and lip position in profile aesthetics between men and women, men were more critical; this conclusion was also demonstrated by another study.²³ On the other hand, there are also quite a few reports that indicate that there is no difference in terms of aesthetic perception between men and women.²⁴⁻²⁷

There were statistically significant differences between the rating scores of respondents aged under and over 25 years, mainly in the case of "extreme" facial profiles (K1, K6, K11, K7, K15 and M12, M13). The statistical analysis also showed that younger respondents were less critical of facial profiles and the scores awarded by respondents decreased as their age increased. These results are consistent with studies conducted by other authors.^{8,26} Nonetheless, reports showing different results can also be found. Some of the authors proved that younger respondents were more likely to choose the facial profile representing the norm²⁷ as their most preferred profile while older respondents were less critical of facial profiles.^{24,27} This result is partially consistent with the results obtained in this study, where older respondents were less critical only of male facial profiles.

The present study did not show any effect of the respondents' place of residence on the assessment of facial profile attractiveness. This may be due to the fact that all respondents were of European descent and they lived in Poland.

Indeed, lip position can be assessed differently according to the descent of viewers and the viewed. One study²² found that lip retraction was more attractive to Americans of Hispanic and Japanese descent than to respondents of African descent. Respondents' preferences may also depend on the descent of assessed patients.²² According to several studies, aesthetically pleasing male profiles should be neither concave nor convex and they should have slightly retracted lips,^{7–9} a pronounced chin is also desirable.⁸ These results are similar to those obtained in this study, as male facial profiles with a chin in the biometric field or a slightly protruding chin were the highest ranked on the VAS.

Limitations of the Study

This study has limitations in the form of several factors.

The study was conducted as an online survey. Therefore, it was not possible to standardise screens on which respondents viewed the photographs. Also, no time limit was set regarding the amount of time spent on viewing individual photographs. Only two faces were assessed. However, the use of more faces could result in the rating being affected by other factors and facial elements that alter the perception of overall facial attractiveness, such as nose size, hairstyle or clothing. Although additional factors affecting the beauty of rated photographs could not be eliminated and the absolute scores of individual photographs varied, this had no effect on the results of conducted analyses. The comparisons were made only by changing the position of analysed elements of one and the same face: male and female.

Conclusions

Despite the indicated limitations of this study, the following conclusions can be drawn regarding the assessment of the facial profile attractiveness of Caucasian representatives. The lowest scores awarded to the extreme facial profiles indicate that aesthetic profiles are considered to be those that fall within the average range, ie, they are harmonious, in accordance with orthodontic nomenclature. Men are more accommodating – they generally rate higher both female and male profiles, while women are more critical. Bearing in mind that the motivation to undertake orthodontic treatment or to apply aesthetic medicine procedures is not only the patient's self-esteem, but also the desire to look attractive, particular attention should be given to significant differences in terms of aesthetic preferences of women and men, where the latter tend to strongly disapprove prominent lips, as well as to the age of the older viewers who are more critical than the younger ones. Summing up, since 1 mm modification of lip projection and chin position significantly alter ranking the face profile attractiveness, any aesthetic medicine applied in this area requires extreme caution. Moreover, visualizing the results should be mandatory, especially in women older than 25 years of age, who are the most critical evaluators.

Ethics Approval and Informed Consent

To our best knowledge the approval of the ethics committee is not required regarding this study. The informed consent from the study participants was obtained. The authors obtained also a parental informed consent for participants under 18 years of age. Participants of the study provided us with a permission for publication of their images. The guidelines outlined in the Declaration of Helsinki were followed.

Disclosure

The authors declare no potential conflicts of interest with respect to the research, authorship, and publication of this article.

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