Original Article

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Agreement on facial profile characteristics between Orthodontic Patients and Orthodontists

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Objectives: The aim was to assess the agreement on facial profile classification and acceptance between orthodontic patients and orthodontists.

Materials and methods: A panel of experienced orthodontists (n = 6) and new orthodontic patients who were 18-40 years old (n = 251) participated in the study. All eligible participants were invited to complete a questionnaire. For the patient group, the questionnaire comprised general information, 26 silhouettes with incrementally constructed facial contour angle (FCA) with ±1SD to ±3SD and facial profile self-evaluation. The questionnaire for the orthodontists comprised the constructed incremental silhouettes and patients' profile silhouettes. Each silhouette was asked for classification (concave, straight or convex) and acceptance (acceptable or unacceptable).

Results: Orthodontists classified -1SD silhouettes as straight profile while patients classified norm and -1SD silhouettes as straight. The orthodontists accepted profile silhouette in the range -1SD to norm while patients accepted -1SD to +1SD. Orthodontic patients' perceptions on facial profiles were slightly different from orthodontists' perceptions. Kappa value for agreement on facial profile classification and facial profile acceptance were 0.082 and 0.180, respectively.

Conclusions: Slight agreement on facial profile perception between orthodontic patients and orthodontists was identified. Patients had more tolerance on facial profile severity than orthodontists. Normative values of FCA of the Thai population were perceived as slightly convex profiles by orthodontists while the patients perceived them as straight profile.

Keywords: acceptable facial profile, facial profile agreement, facial profile diagnosis, facial profile perception

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Introduction

Nowadays, orthodontic diagnosis and treatment planning have shifted to the soft tissue paradigm [1]. Many authors have created soft tissue profile analysis with recommended normative values which are applicable to clinical practice [2-5]. In these analyses however, perception is not given weight and there has not been an established gold standard for facial profile aesthetics because it is influenced by many factors such as ethnicity, race, sex, age, profession and modernization [6-10]. Moreover, aesthetics is likely to be perceived differently by individuals. Even a high standard of professional treatment may fail to achieve patient satisfaction [11]. Disagreements on the diagnosis of orthodontic problems is very prevalent among orthodontists despite efforts to standardize the classification of malocclusions [12].

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Regarding perception as a complex interaction between behaviour and sensory inputs [13-15]. Patient-orthodontist communication is essential since patients have their own reasons for orthodontic treatment need (OTN). Therefore, the perception on facial profile between orthodontists and patients may be different. Thus, the aim of this study was to assess the agreement on facial profile perception between orthodontic patients and orthodontists in terms of facial profile classification and acceptance.

Materials and methods

The study was approved by the Ethical Committee at Faculty of Dentistry and Faculty of Pharmacy, Mahidol University MU-DTPY-IRB 2016/DT057. Inform consent were obtained from all the participants.

The samples consisted of 6 orthodontists and 251 orthodontic patients. They voluntarily answered questionnaire related to facial profile perception. All experienced orthodontists were working as faculty members at Faculty of Dentistry, Mahidol University at least 7 years or diplomated Thai Board of Orthodontics. The orthodontic patients were new patients, 18-40 years old, and not employed in the hospitals or related to facial esthetics. Forty-nine patients (19.52%) dropped out due to an inconvenience in repeating the questionnaire. Seven patients (2.79%) could not complete the questionnaire. The remaining of 195 patients were included for analysis.

The questionnaire comprised of general information, two sets of facial profile silhouettes constructed from a 20-year-old Thai female and a 25-year-old Thai male with a well-balanced face, Class I skeletal relationship and normal vertical configuration. Facial contour angle (GlSnPg'), Nasolabial angle and E-line were within normal ranges. The examination was confirmed by three orthodontists (N.T., S.B., and S.L.). Consent forms were signed by the models and high-resolution standard facial profile photos were obtained [16, 17]. Adobe Photoshop CC 2018 (version 19.1.0, Adobe Systems Inc., San Jose, CA, USA) was used to manipulate the model images and generated silhouettes mimicking variations of the upper and lower parts of the lower face, with 4.5 x 6 inches and 300 dpi resolution. The upper part of the lower face representing maxilla was determined by subnasale to lowest point of upper lip, while the lower part of the lower face representing mandible was determined by the highest point of the upper lip to the soft tissue menton. The silhouettes were manipulated such that the upper and lower parts of the lower face were changed to increments of the standard deviation of FCA as follows: -3SD, -2SD, -1SD, +1SD, +2SD, and +3SD. The normative values of facial contour angle (FCA) for Thai females and males were 9 ± 5 degrees and 9 ± 4 degrees, respectively [18]. The 26 silhouettes were prepared randomly in an album for the first part of the questionnaire for both orthodontist and patient groups (Figure 1). The author (P.B.) explained the instructions of the questionnaire to the individuals clearly before answering the questionnaire.

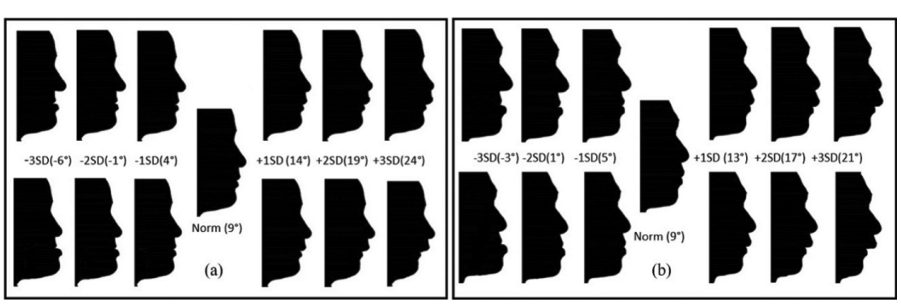

Figure 1 The increment of female (a) and male (b) silhouettes by upper part simulation (upper row) and lower part simulation (lower row).

The second part of the questionnaire for the orthodontist group consisted of silhouettes that converted from the images of the patients photographed in the standard lateral profile position, The FCA of all the subjects were measured twice via Image-Pro Plus v.7.0, Media Cybernetics Inc., Rockville, MD, USA to minimize errors. For the patient group, the second part of the questionnaire comprised of (1) the general information, (2) self-evaluation by choosing the silhouettes representing their facial profile (concave, straight or convex), and (3) self-evaluation of facial profile acceptance (acceptable or unacceptable).

Regarding the first and the second part of the questionnaire, each silhouette consisted of two questions. First, the participants were asked to classify the facial profile into concave, straight or convex. Second, they were asked to choose either "acceptable" or "unacceptable" facial profile depending on whether they perceived that the facial profile should be changed or not. The perception on the patient's profile evaluated by orthodontists and self-profile evaluation by the patient were investigated.

Intra-observer reliability of each participant was evaluated by repeating the questionnaire 2 weeks later. The participants with substantial reliability (Kappa > 0.61) were selected for further statistical analysis. To avoid confusion on wordings of the questionnaire, all participants were clearly given the instructions before answering. Reliability of the researchers on the measurement of FCA was conducted twice. Pair t-test and linear regression analysis were conducted to assess systematic error; Bland-Altman Plot was used to verify possible errors between the measurements.

Statistical analysis

Cohen's Kappa coefficient (k) was used to evaluate agreement between the two groups. Normality of data was test by Kolmogorov Smirnov test. The one-way ANOVA was used for comparing the mean of FCA among 3 facial profile types classified by orthodontists and patients. Mcnemar's test was used to compare the acceptance on the silhouette profiles between patients and orthodontists. Data analysis was carried out by using PASW software (version 18.0; SPSS Chicago Ill); the significance level set at 0.05.

Results

The Kappa coefficients of all orthodontists were above 0.738, showing an adequate intra-rater reliability. From the remaining of 195 patients, only 140 patients (71.79%) who had adequate Kappa value were included. Regarding the reliability of the FCA measurement by P.B., Bland-Altman plots showed a good agreement between the two measurements (Figure 2). The correlation coefficient was -0.04 and no statistically significant difference was found (P = 0.606), indicating no proportional bias. The result of the paired t-test showed no statistically significant difference (P = 0.063)

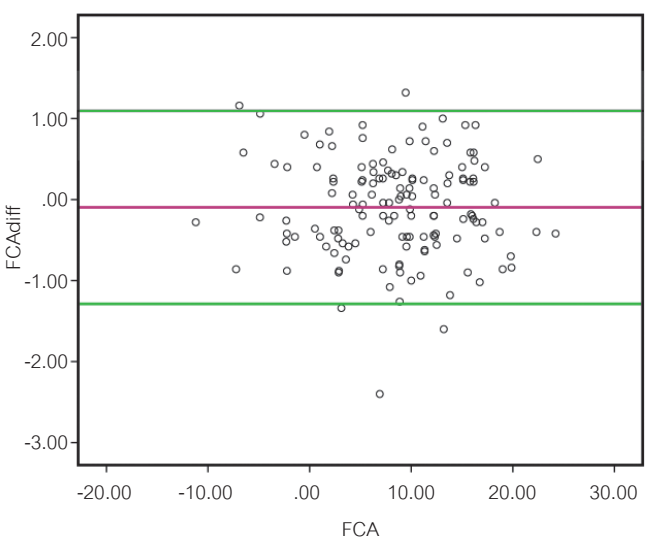

Figure 2 Bland-Altman plot of means difference between first and second FCA measurement

Total sample consisted of 140 patients, with 99 females (70.7%) and 41 males (29.3%), with an average age of 24.96 ± 5.97 and 24.78 ± 6.72, respectively. Mean ± SD of FCA classified by orthodontists and patient self-classification was showed in Table 1. The data indicated normal distribution of FCA among three types of facial profile.

Perception on 26 simulated facial profile silhouettes

Facial profile classification by orthodontist group

The silhouettes with -1SD of FCA tended to be classified by orthodontists as straight profile (Table 2). The silhouettes with normative value tended to be classified as convex profile and the results were more obvious with increasing the deviation or severity. Silhouettes with -2SD tended to be classified as concave profile and were more discernible with increasing severity. Silhouettes with -3SD and +1SD to +3SD were perfectly classified as concave profile and convex profile (green color), respectively.

Facial profile acceptance by orthodontist group

Norm and -1SD silhouettes were absolutely agreed by orthodontists as acceptable profiles while -2SD and +1SD silhouettes had some disagreements (orange and red color) and tend to be unacceptable when increasing facial profile severity. Silhouettes with -3SD, +2SD and +3SD were absolutely agreed as unacceptable profile (Table 3).

Facial profile classification by patient group

Patients perceived that the norm silhouettes were mostly agreed as straight profile followed by -1SD silhouettes but some disagreements (orange color) were presented in the silhouettes with lower part simulation. Silhouettes with -2SD tended to be classified as concave profile and tended to be more obvious with increasing severity. Silhouettes with -3SD, +2SD and +3SD were generally classified as concave profile and convex profile, respectively (Table 4).

Table 1 Comparison of FCA values (degrees) among three facial types classified by orthodontists and by patient self-evaluation.

Classification by	Concave	Straight	Convex	*P*-value
Orthodontists	-2.21 ± 5.15	2.46 ± 3.87	11.47 ± 4.84	< 0.001†
Patient self-evaluation	6.49 ± 8.54	8.45 ± 6.50	9.37 ± 5.98	0.253

†*P* < 0.001 by ANOVA

Table 2 Consensus of facial profile type classified by 6 orthodontists towards the images with different FCA.

Sex	Part	-3SD	-2SD	-1SD	Norm	+1SD	+2SD	+3SD
Female	Upper	Concave (6)	Straight (4)	Straight (6)	Straight Convex (3:3)	Convex (6)	Convex (6)	Convex (6)
	Lower	Concave (6)	Concave (6)	Straight (5)		Convex (6)	Convex (6)	Convex (6)
Male	Upper	Concave (6)	Concave (6)	Straight (6)	Convex (4)	Convex (6)	Convex (6)	Convex (6)
	Lower	Concave (6)	Concave (4)	Straight Convex (3:3)		Convex (6)	Convex (6)	Convex (6)

Upper = photos constructed by moving the upper half of lower face (measured from subnasale to the lowest point of upper lip).
Lower = photos constructed by moving the lower half of lower face (measured from the uppermost point of lower lip to submenton).
Green color =perfect agreement, Orange color = mostly agreement, Red color = 3 agreement-3disagreement.

Table 3 Consensus of facial profile acceptance by 6 orthodontists towards the images with different FCA.

Sex	Part	-3SD	-2SD	-1SD	Norm	+1SD	+2SD	+3SD
Female	Upper	U (6)	A (5)	A (6)	A (6)	A (6)	U (6)	U (6)
	Lower	U (6)	A/U (3:3)	A (6)		A/U (3:3)	U (6)	U (6)
Male	Upper	U (6)	A/U (3:3)	A (6)	A (6)	A (4)	U (6)	U (6)
	Lower	U (6)	U (4)	A (6)		A/U (3:3)	U (6)	U (6)

A = Acceptable facial profile, U = Unacceptable facial profile
Upper = photos constructed by moving the upper half of lower face (measured from subnasale to the lowest point of upper lip).
Lower = photos constructed by moving the lower half of lower face (measured from the uppermost point of lower lip to submenton).
Green color =perfect agreement, Orange color = mostly agreement, Red color = 3 agreement-3disagreement.

Table 4 Consensus of facial profile type classified by 140 patients towards the images with different FCA.

Sex	Part	-3SD	-2SD	-1SD	Norm	+1SD	+2SD	+3SD
Female	Upper	Concave (132)	Concave (72)	Straight (100)	Straight (135)	Straight (114)	Convex (125)	Convex (136)
	Lower	Concave (140)	Concave (135)	Straight (77)		Convex (105)	Convex (134)	Convex (140)
Male	Upper	Concave (137)	Concave (132)	Straight (98)	Straight (120)	Convex (94)	Convex (137)	Convex (137)
	Lower	Concave (140)	Concave (120)	Straight (82)		Convex (86)	Convex (139)	Convex (140)

Upper = photos constructed by moving the upper half of lower face (measured from subnasale to the lowest point of upper lip).
Lower = photos constructed by moving the lower half of lower face (measured from the uppermost point of lower lip to submenton).
Green color = Majority > 2 folds, Orange color = Majority < 2 folds

Facial profile acceptance by patient group

Most patients accepted the norm silhouettes followed by -1SD and +1SD silhouettes, respectively. Silhouettes with ±2SD had some disagreements (orange color) and tended to be unacceptable when increasing facial profile severity. Silhouettes with ±3SD were evidently agreed as unacceptable facial profiles (Table 5).

Perception of orthodontists on the patients' profile vs patients' self-perception

From Figure 3, comparison of the orthodontists' perception with the patients' self-profile classification to revealed that 10 of 20 (50.0%) patients with straight profile classified themselves as straight. The accuracy of convex profile classification was 43.9% (43 of 98), while in the concave group was only 18.2% of the subjects (2 of 11). The overall percent accuracy of facial profile classification was 39.3% (55 of 140). A consensus among the orthodontists could not be made for 11 of 140 patients. The Kappa value for agreement on facial profile classification was 0.082.

Table 5 Consensus of facial profile acceptance by 140 patients towards the images with different FCA.

Sex	Part	-3SD	-2SD	-1SD	Norm	+1SD	+2SD	+3SD
Female	Upper	U (111)	A (101)	A (127)	A (134)	A (123)	A (78)	U (110)
	Lower	U (137)	U (101)	A (115)		A (116)	U (87)	U (124)
Male	Upper	U (124)	U (86)	A (121)	A (131)	A (102)	U (97)	U (129)
	Lower	U (136)	A (86)	A (126)		A (110)	U (86)	U (131)

A = Acceptable facial profile , U = Unacceptable facial profile
Upper = photos constructed by moving the upper half of lower face (measured from subnasale to the lowest point of upper lip).
Lower = photos constructed by moving the lower half of lower face (measured from the uppermost point of lower lip to submenton).
Green color = Majority > 2 folds, Orange color = Majority < 2 folds

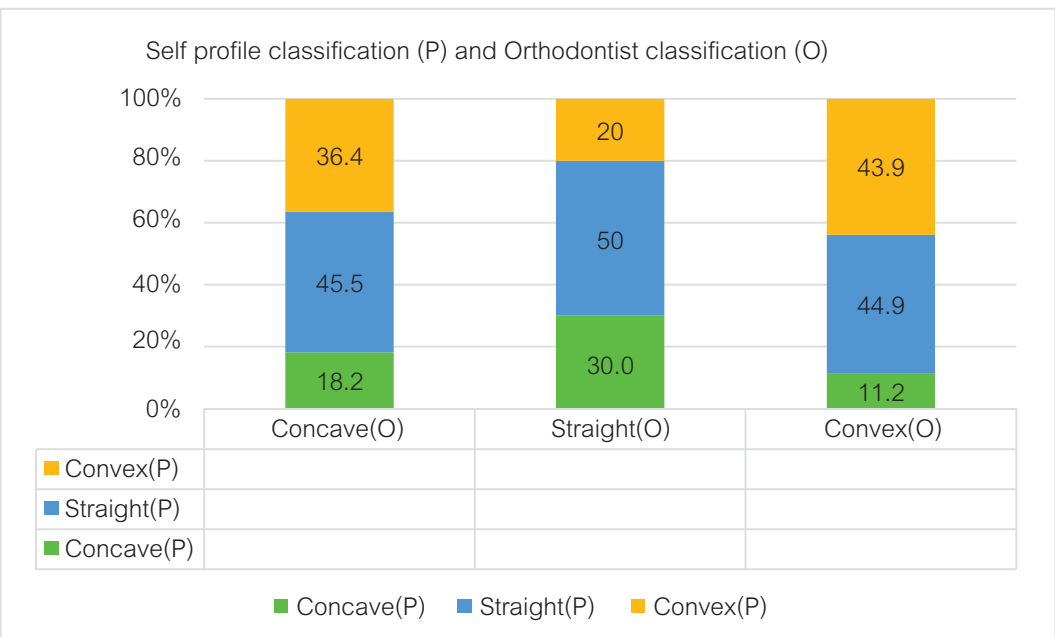

Figure 3 The distribution of facial profile classification by patient self-evaluation (P) and by orthodontists (O).

The degree of agreement on acceptable profiles was 74.2% (69 of 93) while for unacceptable profiles was 44.4% (16 of 36) (Figure 4). The overall percent accuracy of facial profile acceptance was 60.7% (85 of 140). A consensus among the orthodontists could not be reached for 11 out of 140 patients. However, there was no significant difference in facial profile acceptance between the orthodontist and patient groups at $\alpha = 0.05$ ($P = 0.652$). The Kappa value for agreement on facial profile acceptance was 0.180.

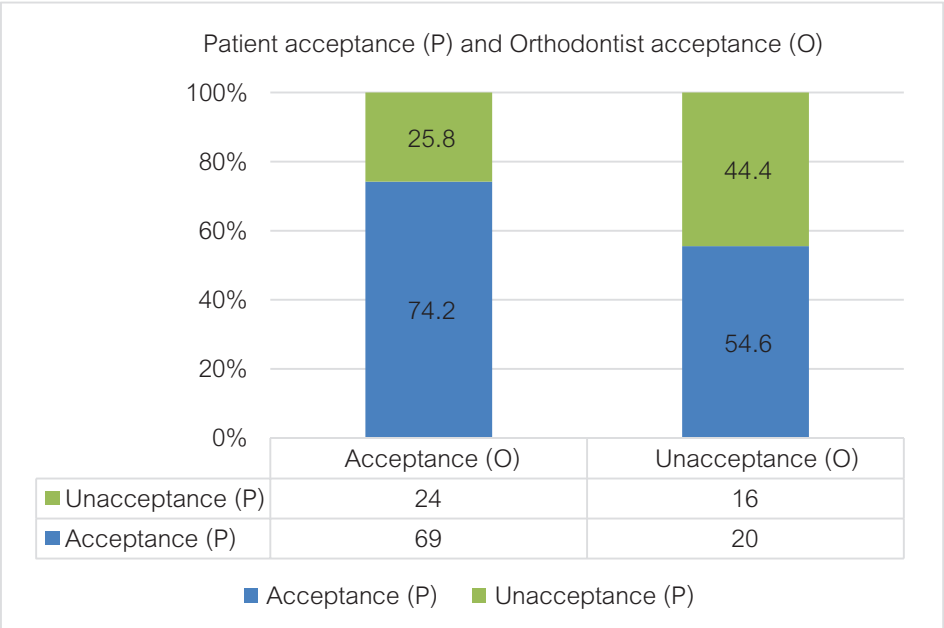

Figure 4 The distribution of facial profile acceptance by patient self-evaluation (P) and by orthodontists (O).

Discussion

The data showed that the patient group had a wider range of perception of straight facial profiles and a wider range of facial profile acceptance compared to the orthodontist group. The straight profiles are in the range of acceptance. It is apparently due to the fact that patients have more tolerance to facial profile deviations, resulting in higher profile acceptance than orthodontists (Table 2-5). These results agreed with several previous studies [9, 19, 20]. The difference in acceptance of profile perception between orthodontists and patients may reflect the influence of education and training of the orthodontists to achieve ideal facial profiles resembling Caucasian features [19]. The mean FCA of the straight profile group was 2.46 ± 3.87 degrees which was consistent with the -1SD silhouettes. Therefore, Thai normative values of FCA [18] were perceived by orthodontists as slightly convex profiles.

Another factor that might influence facial profile perception is the diverse racial or ethnic norms. Several other studies also supported this finding [21-23]. The cross-cultural effect on facial profile preference may differ depending on their ethnic norms [7]. The dominant Western culture may sway the global preference towards a flatter profile, instead of the norm of their own ethnicity. Our study demonstrated that both Thai orthodontists and patients prefer flatter facial profiles which were classified as straight profiles. However, orthodontists prefer more flatter profile than patients.

We also found that the ±2SD silhouettes presented the most disagreement in the patient group which were regarded as the borderline facial profiles. Therefore, orthodontists should always consider the patient's preferences before establishing individual treatment plans and avoid basing decisions on set rules of thumb for ethnicity-related facial morphology.

Our study also showed slight agreement for facial profile classification and acceptance between orthodontists and patients. A previous study [22] has reported that young patients were inaccurate in self-profile classification where only 35% of their study participants could correctly

identify their facial profile type. In this study, patients with straight profiles had the most accurate self-evaluation (50.0%) while the concave group had the least accurate self-judgement (18.2%) (Figure 3). It can be explained that these patients may have higher tolerance to the facial profile severity or concern the different parts on facial profile compared to orthodontists. The statistical analysis supports this finding as the means of the FCA in different facial profiles classified by orthodontists were significant different in contrasted to the patient group (Table 1). The strength of agreement on profile acceptance was also mild, as shown by the degree of agreement of acceptance (53.5%) and of unacceptance (12.4%). Interestingly, 20 of 69 patients (29%) who accepted their facial profile were judged by orthodontists as unacceptable profiles. Thus, orthodontists may detect the deviation and inform to the patients. In contrast, 16 of 40 patients (40%) judged by orthodontists as acceptable profiles stated that they did not accept their own facial profile. Consequently, orthodontists should be aware of this disagreement that may lead to misunderstanding and patient dissatisfaction (Figure 4).

Our research was conducted with several important considerations. Firstly, we only recruited participants with intra-rater Kappa values of at least 0.61, hence the majority of our participants (71.8%) were of at least substantial reliability levels while some other studies accepted participants as low as 0.41[9, 24]. Secondly, our study included both constructed silhouettes to standardize the data collection and real patient silhouettes to mimic the clinical situation. Studies based on profile silhouettes can provide adequate information on gender and profile severity, but most importantly avoiding confounding factors which may influence the perception such as hairstyles, eye color, skin, and make-up. Thirdly, the upper and lower parts of the lower face were manipulated to imitate the various types of facial deformity where different severities of either maxillary or mandibular discrepancies are encountered. Interestingly for the patients' perception, the female silhouettes with upper part simulation showed the widest zone of acceptability (Table 5). Previous study had similar result supporting our finding [19]. It is possible that mandible has more influence on patients' perception than maxilla.

Evidently, it is crucial for orthodontists to perform careful evaluation when encountering each individual patient. Some patients have more esthetic demands and desires for facial profile alteration, while others are content with their original facial profile even if they were more deviated from the standard norm. The future study might focus on the personal attitudes of patients and their perception on facial profile.

Conclusions

- Orthodontic patients' perceptions on facial profiles were slightly different from orthodontists' perceptions.
- Normative values of FCA of the Thai population were perceived as slightly convex profiles by orthodontists while the patients perceived them as straight profile.
- Most orthodontists and patients accepted -1SD and Norm silhouettes.

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