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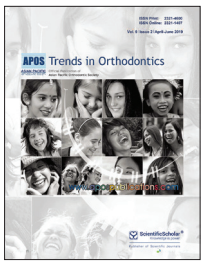

Original Article

Age-related perceptions of laypeople on Class II facial profile alterations

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ABSTRACT

Objectives: The treatment plan for young patients with skeletal abnormalities is often selected by their parents. However, the treatment outcome should correspond with the patient's preference to reduce the treatment need in the future. This study aimed to investigate the influence of post-treatment facial profiles in a skeletal Class II female subject on esthetic perceptions by laypeople of different age groups.

Material and Methods: Seven digitally adjusted profile images of predetermined nasolabial angle (NLA) and facial contour angle (FCA) were obtained from a female with skeletal Class II. These profile images were evaluated by 180 laypeople and were stratified according to three age groups (12–15, 22–32, and 44–54 years) using a visual analog scale and ranking order.

Results: The slightly convex profile with normal NLA (11° FCA and 91° NLA) was the most preferred by all age groups. The convex profile with the largest NLA (17° FCA and 115° NLA) was the least preferred by age group 12–15 and 44–54 years and the convex profile with normal NLA (17° FCA and 91° NLA) was the least preferred by age group 22–32 years. Sex was found to be significantly related to the rating score with females rated higher scores.

Conclusion: The most attractive profile for all three age groups was a mandibular advancement-simulating profile. The least attractive profile for age groups 12–15 and 44–54 years was a most camouflage-simulating profile, while the least attractive profile for age group 22–32 years was an untreated most pronounced Class II profile.

Keywords: Esthetics, Perception, Class II, Facial profile, Age

INTRODUCTION

The clinical examination, diagnosis, and treatment planning in the orthodontic field have changed throughout the years. At present, in addition to looking at the functional outcome, orthodontists also evaluate whether there is an enhancement to facial esthetics. The latter can lead to better patient satisfaction. In the clinical context of mandibular retrognathism, individuals can be offered a treatment plan that uses dental compensation to camouflage their skeletal abnormalities. Alternatively, orthognathic surgery can be undertaken to correct this skeletal Class II relationship. Nevertheless, both treatment modalities have different outcomes, particularly in terms of facial esthetics.[1,2]

The decision to undergo orthodontic treatment in adolescents (12–17 years) depends on the patient's motivation. Internal motivation arises from the inner drive of children towards seeking treatment, while the parent's decision to commit to orthodontic treatment on

behalf of their children relates to the external motivation phenomena.[1] Individuals often receive orthodontic treatment in early childhood (<8 years).[1,3] However, written informed consent must be obtained from the child's parents or guardians before starting any treatment in minors below 20 years of age, according to the legal framework.[4] Therefore, parents or guardians play a major role in selecting the treatment plan for their children. Conversely, young adults (20 and above) can freely decide to receive orthodontic treatment on their own premises if they find a need to improve their dental and/or facial esthetics.

Reports regarding the influence of age on esthetic perceptions are controversial. For example, certain studies have found that the age of evaluators does not affect esthetic perception,[5-7] while other studies reported that age influenced such perception.[8-13] According to Howe and Strauss and generational theory,[14,15] people in society are categorized into different social generations. Generation X was born between 1961 and 1981, Generation Y between 1982 and 2004, and Generation Z between 2005 and the present time. Some researchers have further reported that each generation constructs a different personality in addition to other social categories such as sex, religion, race, or even age.[14,15] As a result, there are differences in personalities, values, needs, preferences, and behaviors among each generation.[14-17] Consequently, dental clinicians should take into consideration all these social factors during the assessment of facial esthetic perceptions.

Yet, no esthetic perception study has categorized the age of participants according to their generation's expectations and beliefs. Thus, this study aimed to investigate the influences of skeletal Class II facial profile corrections on esthetic perception at different generational age groups.

MATERIAL AND METHODS

Ethics approval

This is a cross-sectional study comparing different generational age groups. The Human Research Ethics Committee at the Faculty of Dentistry, Chulalongkorn University approved this research protocol under certificate number HREC-DCU 2020-117. Individuals over 20 years of age gave written informed consent to participate in this study. Parents or legal guardians of individuals below 20 gave written informed consent on behalf of their children.

Sample

The estimated sample size was calculated by the G*power software version 3.1.9.6 with the input data from the study of Yüksel *et al*.[2] The participants consisted of 180 Thai laypeople, categorized into three groups based on their generations: Generation Z (12–15 years old), Generation Y (22–32 years old), and Generation X (44–54 years old) as defined by Howe and Strauss.[14,15] Each age group was randomly assigned to have a 1:1 male to female ratio. Inclusion criteria and exclusion criteria are displayed in the flowchart in [Figure 1].

Photo album

A photograph in the right non-smiling profile view was obtained from a female with the following conditions: untreated skeletal Class II relationship with the orthognathic maxilla, retrognathic mandible, straight nose dorsum, and normal mandibular plane angle.[18] The subject was positioned five feet from the camera with the head in a natural posture.

The profile picture was first altered using Adobe Photoshop 2020 (Adobe Systems Inc., San Jose, CA, US) to emphasize the mandibular retrusion by increasing the facial contour angle (FCA) (by 2 SD), using the FCA norm of 9° ± 4° as reported by the previous study.[18] The nasolabial angle (NLA) was also adjusted using the NLA norm of 91° ± 8°. Therefore, the "base image" that will be used for the alterations was the profile with 17° FCA and 91° NLA which represented the largest sagittal interlabial step.

The "base image" was used in Photoshop to create six additional alteration images with the changes in the anteroposterior plane and maintaining the vertical proportion. Three of the additional images were altered by sequentially advancing the soft-tissue Pogonion point (Pg' point) to decrease by 1.0, 1.5, and 2.0 SD the FCA parameter. Thus, the FCA for the three additional images was 13°, 11°, and 9°, respectively.[18-20]

For the other three additional images, the "base image" was altered, using the same software, by sequentially retruding the Labrale superius point (Ls point) to increase the NLA by 1.0, 2.0, and 3.0 SD. Thus, the NLA for

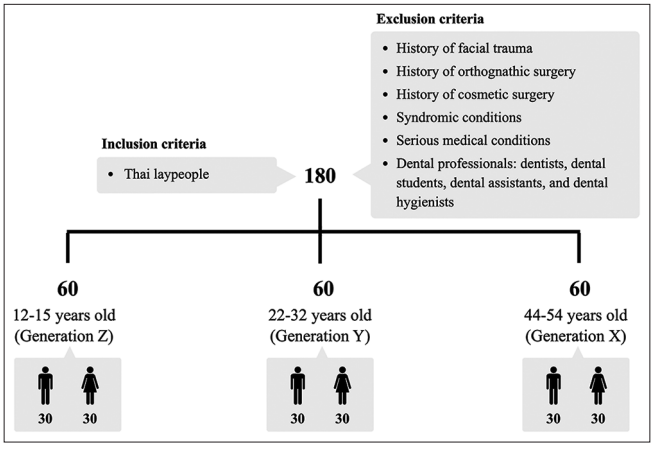

Figure 1: Inclusion and exclusion criteria.

another three additional images was 99°, 107°, and 115°, respectively.[18,21,22]

In summary, seven altered profiles [Figure 2] comprising of one most pronounced Class II division 1 characteristic and the largest sagittal interlabial step with 17° FCA and 91° NLA (Image D), three simulating a more protruded mandibular position (Image E, F, and G generated from the "base image"), and three simulating a more retruded upper lip position (Image A, B, and C generated from the "base image"). Afterward, all these seven altered profile images were converted to black and white. The subject granted permission to take a photo, adaptation of the image, and online publishing.

The first page of the photo album was displayed according to [Figure 2]. Pages 2–9 consisted of one altered image per page. One of the images was identical to one randomly selected image to assess the reliability of the participants. The images were randomly arranged. Pages 1–9 were used to complete Part II of the questionnaire. Page 10 was identical to Page 1 (seven profile images placed alongside each other). Page 10 was used to answer Part III of the questionnaire.

Questionnaire

Part I of the questionnaires collected demographic data from participants. The detailed information consists of age, sex, level of education, and income. For the second and third parts of the questionnaires, the photo album was presented to the participants using the Keynote application on iPad Pro 10.5-inch (Apple Inc., Cupertino, CA, US).

To complete Part II, participants were asked to view the first page of the photo album for 60 s. After that, the 2–9 pages of the photo album were rated. Participants were asked to rate each image in terms of facial attractiveness using a visual analog scale (VAS). Participants marked a position along 100-mm VAS; the left end (0) represented the least attractive face, and the right end (100) represented the most attractive face. The participants were asked not to turn back to the previous page and were given 30 s to rate each image.

To complete Part III, participants were asked to rank the profile images in terms of facial attractiveness on a scale from 1 to 7 (least to most attractive) by evaluating Page 10 of the photo album. The participants were asked not to assign the same rank to more than one image and were given 120 s to complete the third part of the questionnaire.

Statistical analysis

Statistical analysis was performed using SPSS version 22.0 for Mac (IBM, Chicago, IL, USA). Intraparticipants and intraexaminer reliabilities were determined by calculating intraclass correlation coefficients. Differences in VAS scores among the three age groups were analyzed using One-way ANOVA (Image B, C, D, F, and G) or the Kruskal–Wallis test (Image A and E) with Mann–Whitney test. The relationship of the VAS score with other factors (sex, level of education, and income) was analyzed using one-way MANOVA. The level of statistical significance was set at 0.05 for all tests.

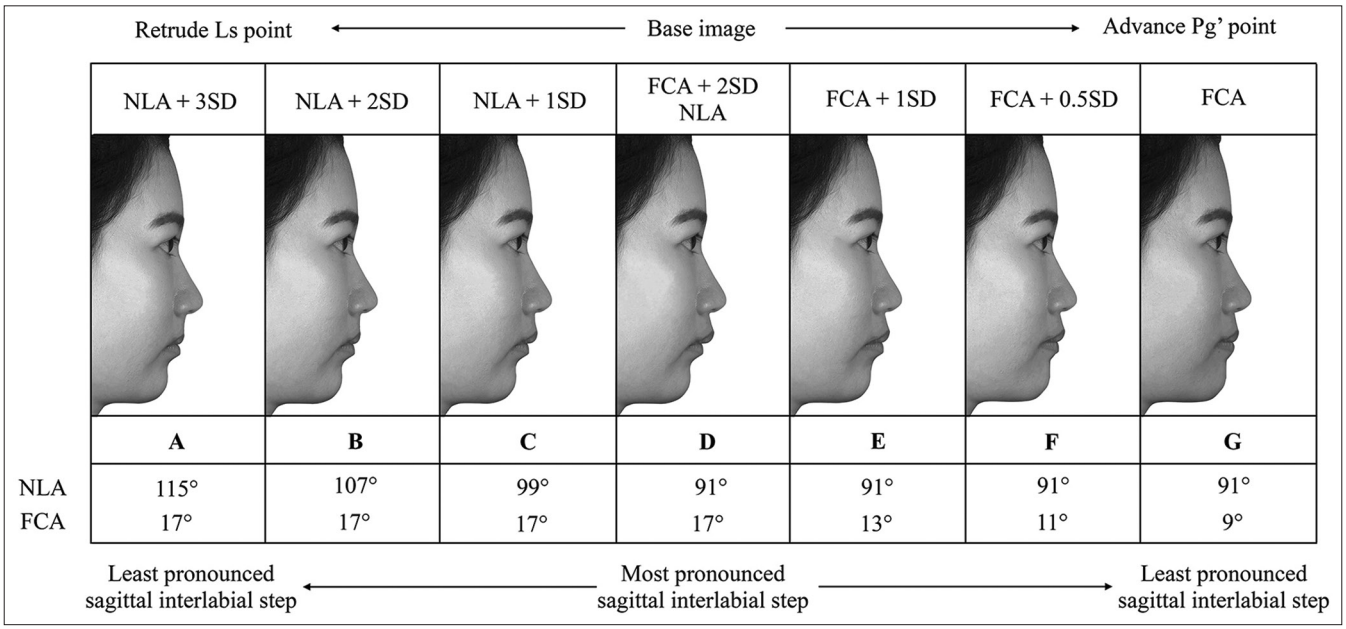

Figure 2: Seven altered profiles consisted of three images simulating a more retruded upper lip position (A, B, and C), one "base image" (D) with the largest sagittal interlabial step, and three images simulating a more protruded mandibular position (E, F, and G).

RESULTS

Demographic data

A total of 180 participants were stratified into three groups, each age group had a 1:1 male to female ratio. Baseline data of the three age groups are presented in [Table 1]. Each age group had varying levels of education and income.

Differences in VAS scores among the age groups

Differences in VAS scores among age groups are presented in [Figure 3]. The significant difference was only found in Image A between the age group 22–32 years and 44–54 years after *post hoc* multiple comparisons (Significant at 0.016 with Bonferroni correction).

Differences in VAS scores between images within each group of participants

Differences in VAS scores between images within each group of participants are presented in [Tables 2-4]. The significant differences between images were found similarly in the age group 12–15 years and 44–54 years.

Ranking order in each age group

The ranking order in each age group is presented in [Table 5]. Image F was perceived to be the most preferred by all age groups, while Image A was considered to be the least preferred by age groups 12–15 years and 44–54 years and Image D was considered to be the least preferred by age groups 22–32 years.

Reliability coefficients of intraparticipants and intraexaminer

The intrarater reliability of the participants and examiner was satisfactory (0.652) and excellent (1.000), respectively.

The relationship of VAS score with other factors

The relationship of the VAS score with other factors was found in some images. Sex was found to be related to

Table 1: Baseline data of the three age groups.

	Age group (%)		
	12–15 year	22–32 year	44–54 year
Age (Mean±SD)	14.32±1.15	25.88±3.45	49.11±3.34
Level of education (*n*)			
Non-graduate	60 (100)	10 (16.7)	9 (15)
University graduate		50 (83.3)	51 (85)
Income (*n*)			
<300 USD	60 (100)	6 (10)	2 (3.3)
300–1,500 USD		48 (80)	30 (50)
>1500 USD		6 (10)	28 (46.7)

Table 2: Differences in visual analog scale scores between images in age group 12–15 years.

Image	Mean (SD)	Significant differences
A	45.39 (23.93)	B, E, F
B	54.55 (19.24)	A
C	50.31 (22.89)	-
D	48.19 (23.63)	F
E	58.03 (19.58)	A
F	58.71 (18.60)	A, D
G	58.54 (23.69)	-

Significant at $P<0.002$ with Bonferroni correction

Table 3: Differences in visual analog scale scores between images in age group 22–32 years.

Image	Mean (SD)	Significant differences
A	55.41 (19.30)	-
B	59.73 (16.93)	D
C	53.07 (19.81)	D
D	48.52 (19.90)	B, C, E, F
E	60.17 (18.98)	D
F	58.99 (16.74)	D
G	53.12 (21.68)	-

Significant at $P<0.002$ with Bonferroni correction

Table 4: Differences in visual analog scale scores between images in age group 44–54 years.

Image	Mean (SD)	Significant differences
A	43.15 (23.01)	B, E, F
B	54.16 (21.51)	A
C	50.29 (21.52)	-
D	44.22 (21.73)	F
E	56.63 (20.56)	A
F	59.63 (21.59)	A, D
G	54.91 (23.96)	-

Significant at $P<0.002$ with Bonferroni correction

Table 5: Ranking order in each age groups.

	Ranking order		
	Age group 12–15 year	Age group 22–32 year	Age group 44–54 year
A	1	3	1
B	2	6	3
C	3	4	5
D	4	1	4
E	6	5	6
F	7	7	7
G	5	2	2

The ranking order is shown, with 1 the least attractive and 7 the most attractive

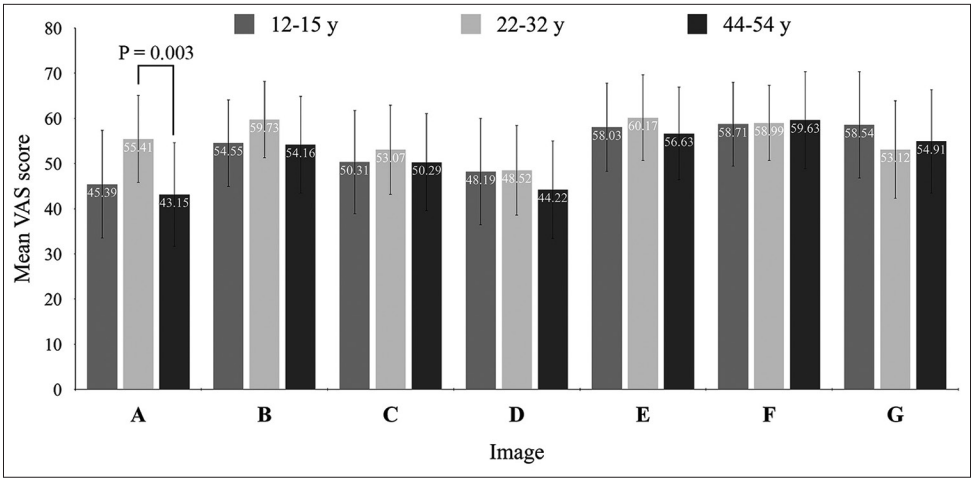

Figure 3: Difference in visual analog scale score among the age groups.

the rating score in Image G in the age group 22–32 years (P = 0.043) and Image B in the age group 44–54 years (P = 0.045). Females rated higher scores in all images that were found significantly related. The level of education and income of the participants were not related to the rating esthetic scores.

DISCUSSION

Esthetic preference among different generational age groups was similar. Image F with normal NLA (11° FCA and 91° NLA) was the most attractive profile for all three age groups. There were differences in the outcomes of the least attractive profile; Image A with the largest NLA (17° FCA and 115° NLA) was the least attractive profile for age groups 12–15 and 44–54 years while Image D (17° FCA and 91° NLA) was the least attractive profile for the age group 22–32 years. These findings are supported by Suphatheerawatr and Chamnannidiadha[23] study. Their report found that assessors preferred a normal (9° FCA) or slightly convex profile with a slightly retrognathic mandible (13° FCA) and an extremely concave profile with the extremely prognathic mandible (−11° FCA) was the least preferred profile. Moreover, the same authors published another study[24] while they reported that perceived treatment needs in normal (9° FCA) or slightly convex profile (13° FCA) obtained the lowest scores. Like our study, Yüksel *et al*.[2] observed that the most Class II characteristic profile and the profile with the largest NLA were the least attractive. Ribas *et al*.[7] also found that the pre-treatment profile (Class II, division 1 malocclusion with severe mandibular retrusion) obtained the lowest esthetic scores. The scores improved by orthodontic treatment and the highest scores were obtained by the mandibular advancement-simulating profile.

The esthetic preference tendency in the age group 12–15 and 44–54 years showed that the correct position of the chin and normal NLA is also important factors in esthetic perception by laypeople. Therefore, the esthetic scores were high in Image F and low in Image A. While the age group 22–32 years paid more attention to the sagittal interlabial step as well as the harmonious beauty of the face. As a result, the esthetic score was high in Image F, possibly because the FCA was close to the norm.[18] In Image D, the esthetic score was low probably due to the largest sagittal interlabial step. These findings indicate that treating Class II patients with dental compensation or orthognathic surgery can affect facial esthetics according to laypeople. At present, orthodontic miniscrews are highly accepted by both orthodontists and laypersons[25] and have been widely used for total maxillary arch distalization in the nonsurgical correction of a Class II malocclusion.[26] Treating Class II patients with dental compensation to camouflage the skeletal discrepancy could increase the NLA to 115° (Image A), which could potentially result in less satisfaction in two age groups, the 12–15 and 44–54 years. This may be due to changes in soft tissues that commonly occur with aging, which result in a more retruded lip position with an obtuse NLA. Nevertheless, this finding contradicts some previous studies[10,27] which found that older evaluators preferred a more retruded lip position with an obtuse nasolabial angle than younger evaluators. Johnston *et al*.[11] found that the older subjects were less happy with their dental and facial appearance than the young subjects. These observations may be related to changes in soft tissues with age, resulting in a reduction in the happiness of their dental and facial appearance. From our study, we can assume that the age group 12–15 and 44–54 years do not prefer extremely retruded lip position which appears to look more aging, whereas the age group 22–32 years does not prefer the large sagittal interlabial step. In general, all age groups prefer images with slightly retrognathic mandible or slightly increased FCA from the norm.

Furthermore, the VAS scores between images within each group of participants also had the same trend as ranking order in each age group. In the age group 22–32 years, the VAS score of Image D, which was the least attractive profile in ranking order, was the least and significantly different from Images B, C, E, and F. The VAS score trend in the age group 12–15 years and 44–54 years was the same. The VAS score of Image A was the least and the VAS score of Image F was the most. Image A was significantly different from Images B, E, and F. These VAS score results coincided with the ranking score results.

Although Image G, which had 9° FCA and 91° NLA, was the profile with the norm of the previous study,[18] our study found that the preferred images were the images with retrognathic mandible or slightly increased FCA from the norm. This esthetic perception indicated the need for adjustment of the treatment planning from the past, which used the skeletal norm as a standard for diagnosis and treatment planning. Using a skeletal norm for patient treatment might not correspond with the patient's esthetic preference and might not increase the patient's satisfaction after the treatment.

This study intended to eliminate other factors in the image that can affect esthetic perception. Therefore, all seven facial profiles were adjusted to obtain normal vertical proportion[28] and straight nose dorsum. A previous study found that a skeletal Class II facial profile with a different nose shape affected the esthetic perception, a straight nose dorsum was esthetically more pleasing.[29] Hence, skeletal Class II patients with different characteristics, such as different vertical proportions and different nose shapes, may result in different esthetic preferences from this study. Treatment planning for the orthodontic patient also uses considerable data in the process, such as incisor display, gingival display, tooth proportion, gingival shape and contour, and tooth shade. The data from this study should be only part of the information, according to other various information, aiding in the treatment planning process.

The aim of the alteration of the profile images in this study was to create different NLA and FCA in each image. These also created changes in soft tissue in other parts of the face, especially a sagittal interlabial step. All six additional images that were altered from the "base image" contained different amounts of sagittal interlabial steps that were less than the base image. Yüksel *et al*.[2] found that correction of the large amount of sagittal interlabial step by increasing NLA could increase the satisfaction of the assessors more than the image that contained the largest sagittal interlabial step. However, the results from this study were different from our study which found that the least preferred profile in the age group 12–15 years and 44–54 years was Image A with 115° NLA (largest NLA). Moreover, the previous studies found that post-operative surgery changes in the Pg' point and mentolabial sulcus are related to the change of the underlying hard tissue by approximately a 1:1 ratio.[19,20,30] Therefore, in the alteration process of Images E, F, and G, the mentolabial sulcus was adjusted according to the previous studies.

Due to the aim of this study, the age of the participants was the main factor that we want to investigate. Therefore, the data collection was focusing on age groups without controlling the other factors. The results found a relationship of the VAS score with only the sex factor. Sex was found to be related to the rating score in some images of age groups 22–32 years and 44–54 years. Females were found to rate higher scores in all images that were found significantly related. Burcal *et al*.[31] found that recognition of the facial profile changes in females was better in all groups of assessors. Hence, it is likely to be associated with a higher score – rating than males in some of the images. The other factors that were not related to the rating esthetic score might be because of the relatively small sample size of this study. Therefore, it was difficult to control the amount of the sample size of the other factors. To study the other factors, we recommend the future studies to collect more samples and equally distribute the samples with the same factors into groups. However, esthetic perception is a trend that can change over time. Hence, the results from this study might not correspond with the patient's perception in the future. Moreover, this study collected data from participants of the same ethnicity to control the contributing factor. Further studies can collect samples from different ethnicities for more interesting results.

CONCLUSION

The most attractive profile for all three age groups was a mandibular advancement-simulating profile. The least attractive profile for age groups 12–15 and 44–54 years was a most camouflage-simulating profile, while the least attractive profile for age group 22–32 years was an untreated most pronounced Class II profile. Sex was found to be related to the rating esthetic score. Based on the results, orthodontists and patients can use this information in treatment planning and decision-making process for successful treatment results.

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Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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