



Nasolabial Angle in Profiles Perceived as Attractive: A Scoping Review

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Abstract

Context: The nose and lips area play an important role in facial appearance and nasolabial angle (NLA) can be considered as a determinant factor for attractiveness. The perception of beauty and attractiveness is vastly influenced by media and thus, can change with trends over time. The aim of this study was to conduct a systematic review of literature on NLA in faces perceived as attractive over time and in different ethnic groups.

Evidence Acquisition: This study was performed following preferred reporting items for systematic reviews and meta-analyses extension for Scoping Reviews (PRISMA-ScR) guideline. We conducted an electronic search using PubMed, Scopus, and Embase databases with the employment of MeSH and free text terms "beauty"[MeSH], "esthetics"[MeSH], "soft tissue", "nasolabial angle", "attractive" and "cephalometric analysis". The inclusion criteria were studies that indicated facial attractiveness by a panel of at least 10 judges, evaluated the soft tissue profile characteristics, and reported the preferred NLA.

Results: The search results revealed 271 related articles, of which 21 studies investigated NLA as a conducive factor in profile attractiveness and were included in the review. The range of preferred NLA was 86° to 107° for men and 84° to 123.12° for women.

Conclusions: The most pleasing lip position and subsequently NLA is influenced by variables including the observer and subject's gender, and their ethnic background as well as time. Over all, NLA in faces perceived as attractive is more obtuse in women than men. Compared to white norms, NLA is more acute among Chinese and African-Americans, while amongst Iranian women, it is not distinctly far from North American Caucasians. Over the course of time, preferred NLA has significantly changed in women but has been unwavering in men.

Keywords: Beauty, Esthetics, Soft Tissue, Nasolabial Angle, Cephalometry

1. Context

One major motivating factor for patients seeking orthodontic treatment is enhancing their facial and dental appearance (1). In common belief, facial beauty predominantly represents trustability, intelligence, better socioeconomic condition and having a better chance to be hired for a job position (2). Evidently, facial esthetic improvement can also lead to more self-confidence, and psychological well-being (1).

Through the years, as seen in many well-known artworks, the study of facial attractiveness has always drawn man's attention, even in prehistoric times (3). The nose, being the center compartment of the face, considerably affects the perception of one's appearance (4). It not only builds up the character of midface but also has fundamental emotional, social, cultural and functional importance (5). Therefore, nasal esthetic and reconstructive surgery history tracks back to 2700 BC (5). Nasolabial angle (NLA) is

one of the nasal esthetic subunits. In profile view, the NLA is formed between the upper lip and the base of nasal columella (5). Nasal morphology extensively correlates with ethnic background (6). Thus, while planning treatment goals, clinicians should consider maintaining ethnic features as well as refining the nasal appearance to meet patient expectations (5).

From the 20th century, organized studies have focused on the objective evaluation of attractiveness (7). Over the past decades, researches for attractiveness have become a common interest in different areas of social and medical sciences, including orthodontics, oral and maxillofacial surgery, psychology, and plastic surgery (8). In today's society, due to the globalization and mass media, our perception of beauty changes with time (9). Furthermore, attractiveness standards are modified by various factors such as social, ethnic, cultural, and religious beliefs (9).

Many researchers have studied NLA as a measurable soft tissue value and attractiveness indicator from differ-

ent viewpoints (10-13). The aim of this study was to conduct a systematic review of literature on NLA in faces perceived as attractive over time and in different ethnic groups.

2. Evidence Acquisition

2.1. Protocol and Registration

This review was completed according to preferred reporting items for systematic reviews and meta-analyses extension for scoping reviews (PRISMA-ScR) protocols (14).

2.2. Eligibility Criteria

The main purpose of our study was to determine the most preferred NLA as perceived by different ethnical, professional and sexual panels of raters.

The inclusion criteria were as follows: (1) studies including facial attractiveness assessment; (2) attractive subjects identified by the judgment of evaluators; (3) studies in which at least 10 judges participated.

And the subsequent exclusion criteria were as mentioned below: (1) case report or case series studies; (2) review articles; (3) studies for which the full texts were not available.

2.3. Information Sources and Search Strategy

A comprehensive search of electronic databases was performed using PubMed, Embase, and Scopus search engines. Different combinations and arrangements of the following keywords were applied: "attractive", "esthetic" [MeSH], "soft tissue", "profile", "cephalometry/methods" [MeSH], nasolabial angle, "beauty" [MeSH]. The search query employed in each database is listed in We We imposed no limitation on publication year and only studies published in English were taken into consideration. The electronic search was enhanced by scanning the reference list of relevant studies and related review articles. Results up to September 2021 were examined.

2.4. Selection of Sources of Evidence

All related records were exported to EndNote X9 (Clarivate Company, Philadelphia, USA) and duplicated entries were removed. Two reviewers screened the title and abstracts revealed in the electronic search. Then the full texts were obtained for potentially relevant publications. In case of inter-examiner disagreement, reviewers discussed the competency of the study.

2.5. Data Items and Data Charting Process

The main data items, identifying the methods used and study information (publication year, subjects' age, subjects' gender, publication/ethnicity, judges, material and used analysis) were extracted. Subsequently, every available reported NLA value according to the subject group and panel of judges was extracted exclusively. Data extraction was performed by two reviewers independently. Any disagreement was resolved by discussion.

2.6. Data Synthesis

Considering the extension of influential factors such as subjects' and raters' age, sex, education, and variety of methods used, we exerted a qualitative assessment of the extracted data.

3. Results

3.1. Selection of Sources of Evidence

From 271 records identified by electronic search, a total of 146 studies were retrieved for screening after duplication removal. Via title and abstract screening, 40 records appeared to be potentially relevant. Acquired full texts were screened for eligibility and 19 studies were excluded for not including the nasolabial measurement or being review articles. Finally, 21 studies were included in data extraction (Figure 1).

3.2. Study Characteristics

3.2.1. Judges

Overall, 1249 raters had given their opinion and perception of attractiveness. Among them, 203 were orthodontists, 713 laypeople who did not specialize in any area of dentistry or beauty related professions, 270 students, 20 plastic or oral and maxillofacial surgeons, 43 artists, and 6 studies had chosen their subjects from beauty contest winners, fashion magazines or internet database (Table 2) (12, 13, 15-18).

3.2.2. Subjects and Material

Following ethnicities and populations were assessed: (1) Chinese, (2) African American, (3) Japanese, (4) Caucasian and (5) white, Iranian and Ivorian. Most of the studies (n = 8) used photographs as their material for the judgement of attractiveness (10, 12, 13, 23, 28-31). The second most used material was silhouettes (n = 7), either constructed from photos, to eliminate the distracting factors, or cephalograms (11, 20, 22, 24-27). Two studies utilized soft tissue outline of the lateral cephalograms (19, 21), one study used 3D scans of attractive subjects (15), and 3 studies had obtained photos from leading fashion magazines (16-18).

Table 1. The Search Query and Keywords Used in Each Search Engine

Search Query	Keywords
PubMed	(attractive* OR "beauty" [Mesh] OR "esthetics" [Mesh] OR "esthetic") AND ((profile AND ("soft tissue" OR "facial" OR face OR lateral OR jaw OR mandible OR maxilla)) OR "cephalometry/methods"[Mesh] OR "cephalometric analysis") AND "nasolabial angle"
Embase	(attractive* OR 'esthetics'/exp OR 'esthetics' OR esthetic OR 'beauty'/exp OR beauty) AND (('face profile'/exp OR 'face profile' OR ('soft tissue' NEAR/O 'profile')) AND (('face'/exp OR 'face' OR facial OR soft) AND ('tissue'/exp OR tissue) OR lateral OR 'jaw'/exp OR jaw OR 'mandible'/exp OR 'mandible' OR 'maxilla'/exp OR 'maxilla') OR 'cephalometry'/exp OR 'cephalometry' OR 'cephalometric* analysis') AND 'nasolabial angle'
Scopus	(KEY (attractive* OR "beauty" OR "esthetics" OR "esthetic") AND (KEY ((profile OR "soft tissue" W/O profile) AND ("soft tissue" OR "facial" OR face OR lateral OR jaw OR mandible OR maxilla)) OR "cephalometry" OR "cephalometric* analysis")) AND "nasolabial angle"

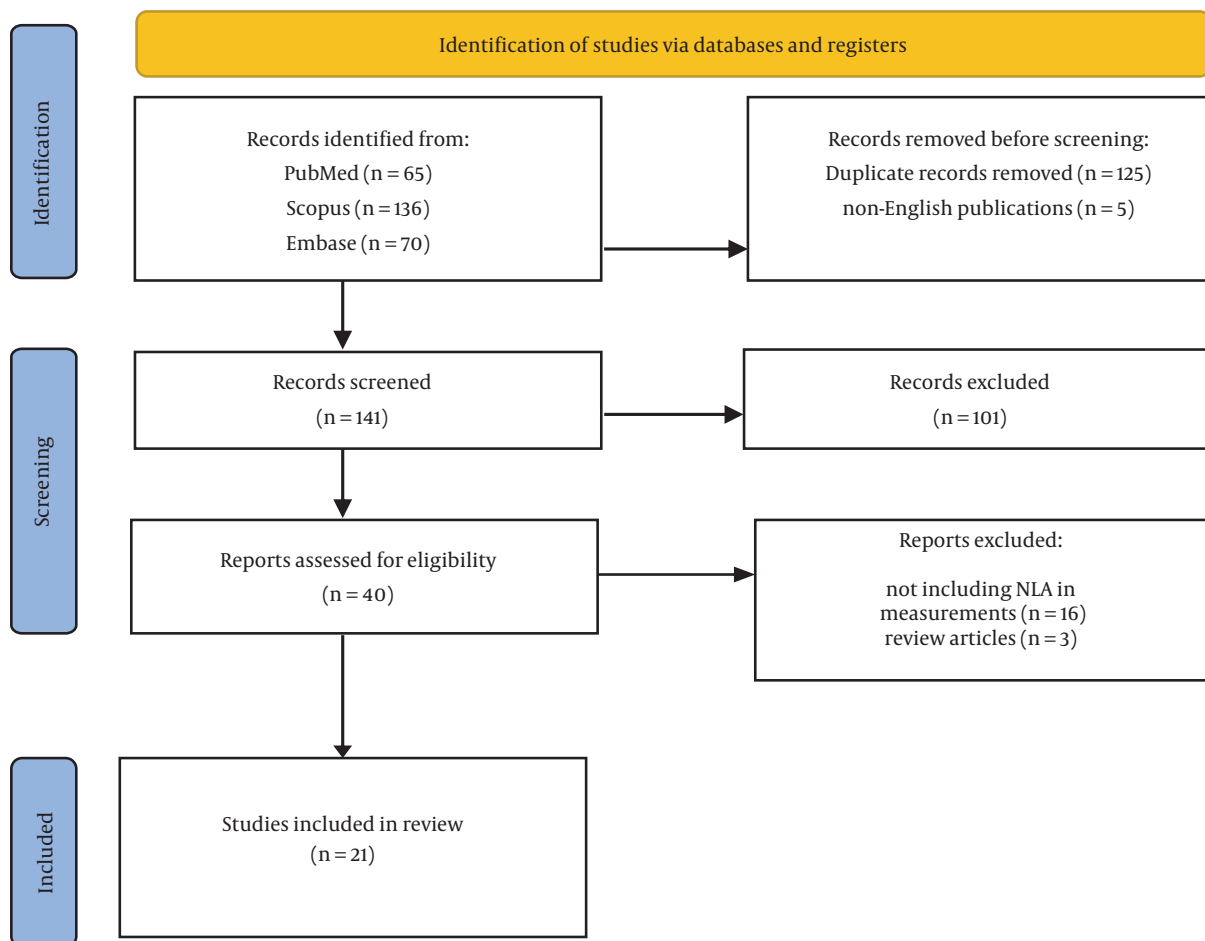


Figure 1. Record identification and screening flow diagram

3.3. Result of Individual Studies

The results showed that the most preferred NLA (NLA) is 84 to 123.12 degrees. A broader range was reported for women compared to men. The minimum value for Caucasian subjects was 98° whereas it was 94° for African-American (black) subjects, which suggests a more protruded lip profile. The most preferred NLA for Japanese ethnicity was 99.29°, which is amidst the Caucasian range and

close to the minimum. Attractive subjects in Ivorian population, while being of African origin, had an NLA range of 86° to 92.25° (30). Comparing with the reported range for African-Americans, Ivorians seem to prefer a sharper NLA, hence, more protruded or fuller lips.

From evaluators' point of view, Caucasian raters preferred 94° to 115.91°, while African-American raters seemed to accept a broader range (84° to 117°) as attractive. Iranian

Table 2. Summary of Study Characteristics

Author: (Publication Year)	Raters' Specifications	Material	Subjects	Preferred Nasolabial Angle (Degree)
Lew et al. (1992) (19)	N = 12 4; clinicians (choosing subjects) 8 lay person (rating)	Tracing lateral cephalograms	Chinese 18 to 24 years -72 initially (36men, 36 women)- 48 (25 females, 23 males) selected	95 ± 3
Thomas (1979) (10)	N = 86; male orthodontists (58 white, 28 black)	B&W Photographs	153 women 18 to 41 years - (North American black women)	White judges: 94; Black judges: 94
Polk et al. (1995) (20)	N = 150; African-Americans, 85 males and 65 females of varying ages with diverse social and educational backgrounds; Ages: male: 10 to 42 years); female: 9 to 50 years).	Silhouette; originated from Deloach's research on soft tissue facial profile of North American blacks N = 10	-	Male: 92; Female: 84
Nomura et al. (1999) (21)	N = 40; (20 males, 20 female) 20 student of dental college ,20 orthodontists	Lateral cephalograms (traces of external profile line)	Japanese: 88 orthodontic patients; 60 persons (30 male, 30 female) with normal occlusion	99.29 ± 7.58
Galantucci et al. (2016) (15)	Beauty contest (Miss Italia 2010)	3D digital models	66 women- Caucasian	123.12 ± 9.53
Ioi et al. (2007) (22)	N = 91; Japanese; 41orthodontists (20 males, 21 females); 50 dental students (29 males, 21 females)	Silhouette	15 male and 15 female; Japanese; 22 - 26 years	Japanese orthodontist for men: 93 - 95; Japanese orthodontist for women: 100 - 102; Japanese student for men: 93 - 95; Japanese student for women: 100 - 103
Iglesias-Linares et al. (2011) (16)	100 most beautiful people during the previous 10 years from People magazine's	Lateral photographs	80 women (40 white, 40 black)	White subjects: 102.13 ± 8.55; Black subjects: 98.28 ± 3.32
Mafi et al. (2005) (23)	N = 61; 8 plastic surgeons, 10 sculptors, 12 hairdressers, 16 painters, 15 individuals from the general population	Sketches (obtained from photographs)	100 Iranian women-16 to 40 years	110.4 ± 12.46
Hall et al. (2000) (24)	N = 78; 18 African American orthodontists, 20 white orthodontists, 20 African American laypersons, 20 white laypersons	Silhouettes (from cephalometric radiographs)	30 African American, 30 white; 7 to 17 years	White layperson for white: 113.86 ± 6.87; Black layperson for white: 115.5 ± 12.02; White orthodontist for white: 115.12 ± 8.02; Black orthodontist for white: 113.9 ± 8.22; White layperson for Black: 115.8 ± 11.71; Black layperson for Black: 114.1 ± 14.77; White orthodontist for Black: 115.91 ± 11.42; Black orthodontist for Black: 107 ± 21.76
Yehezkel and Turley (17) (2004)	119 Photographs from leading African American fashion; magazines of the 20th century		119 women	1940-1949: 103.6 ± 7.4; 1950-1959: 108.1 ± 12.5; 1960-1969: 100.2 ± 12.3; 1970-1979: 101 ± 7.9; 1980-1989 95.4 ± 9.9; 1990-1999 95.8 ± 10.1
Ioi et al. (2008) (25)	N = 98; 46 Korean dental students, 52 Japanese dental students	Silhouette (constructed from cephalometric radiographs)	Japanese; 15 men, 15 women; 22 to 26 years	Korean students for men: 94.0 - 96.0; Korean students for women: 100.0 - 102.0; Japanese students for men: 94.0 - 96.0; Japanese students for women: 100.0 - 102.0
Shimomura et al. (2011) (26)	N = 150; 150 Japanese orthodontic patients 15 years of age or older	Silhouette (constructed from cephalometric radiographs)	Japanese; 15 men, 15 women; 22 to 26 years	Men: 104.0 - 107.0; Women: 109.0 - 115.0
Ghorbanyjadpour and Rakhshan (2019) (11)	N = 10 laypersons; Persian	Silhouettes (converted from lateral cephalograms)	Persian; 35men, 35 women; 20-29 years	105.8 ± 9.21
Nguyen and Turley (1998) (18)	leading fashion magazines published after 1930-1995	Photographs	Caucasian - male; estimated 18 -35 years	109.6 ± 10.81
Park et al. (2012) (27)	N = 35; Korean; Three age groups: young adult (20 - 39 years), middle-aged (40 - 54 years), senior (55 - 70 years).	Silhouette	10 females; 10 males	Young adult for men: 95 ± 1.8; Young adult for women: 99.3 ± 1.8; Middle age for men: 98.8 ± 2.2; Middle age for women: 102.1 ± 3.4; Senior for men: 101.5 ± 3.1; Senior for women: 103.6 ± 4
Penna et al. (2015) (12)	N = 250; voluntary raters through an Internet presentation	Photographs	88 females, 88 males; 18 - 30 years; Caucasians	Men: 101.7; Women: 98
Khosravanifard et al. (2013) (28)	N = 20; Iranian; 2 orthodontists, 2 maxillofacial surgeons, 2 visual artists, 14 laypersons	Photographs	30 males; 30 females; 18 - 28 years	Men: 101 ± 9.83; Women: 105.8 ± 6.44
Sinno et al. (2014) (29)	N = 98; Caucasian; Asian; Black; Native American Other; Online survey (high school, college, and medical students)	Photographs	1 male, 1 female	Men: 97 ± 6.3; Women: 104.9 ± 4
Beugre et al. (2016) (30)	N = 40; 2 art-school students, 2 art teachers, 2 orthodontists, 2 dental students, 1 beauty consultant/hairdresser and 1 anthropologist, 30 non-experts	Black and white Photographs	29 females; and 28 males; Ivorian	Men: 86 ± 1.41; Women: 92.25 ± 9.82
Berneburg et al. (2010) (13)	Internet film databases searched for attractive men and women	Profile photographs	200 males; 200 females; White	Men: 104 ± 11.2; Women: 105.6 ± 10.3
Fortes et al. (2014) (31)	N = 30; 10 orthodontists, 10 plastic surgeons, 10 laypeople	Photographs	150 dental students; 75 males; 75 females; 17- 32 years; Caucasian	Men: 103.47 ± 7.02; Women: 105.27 ± 7.61

raters perceived 101 to 105.8° NLA as attractive (11, 28).

4. Discussion

Demands towards esthetic and cosmetic procedures continue to grow and involve various ethnical and age groups (32). NLA, as one of the measurable soft tissue char-

acteristics, is a concurrent guide in orthodontics and plastic surgery. Moreover, there is a positive association between NLA and facial attractiveness (11, 15). The aim of the current study was to review studies evaluating the preferred NLA and the results showed a wide range of acceptable values. Due to the effect of various confounding factors, performing a meta-analysis was not feasible.

It has been previously stated that the range of NLA values accepted in the literature are $100^\circ \pm 12^\circ$ for men and $105^\circ \pm 10^\circ$ for women (33). The results of our study showed that a range of 86° to 107° was preferred for men, and 84° to 123.12° for women. This is a relatively broad range and our detailed investigations revealed that there are a number of influencing factors regarding esthetic preferences, including the raters and subjects' gender and ethnicity, as well as time.

Several studies showed that a more obtuse NLA is preferred for women compared to men (13, 29-31). Among white people, Khosravanifard et al. (28) reported the mean NLA of 105.80° for attractive Iranian women and 101° for men. In Fortes et al. (31) study, sexual dimorphism was identified in NLA and the values for pleasant female and male profiles were $105.27^\circ \pm 7.61^\circ$ and $103^\circ \pm 7.02^\circ$, respectively. Sinno et al. (29) found the most pleasing NLA from the perspective of students with different levels of education to be $104.9^\circ \pm 4^\circ$ for women and $97^\circ \pm 6.3^\circ$ for men. In addition, Korean raters preferred greater NLA values for women (99.3° to 103.6°) than for men (95° to 101.5°) (27). Loi et al. (25) indicated that both Korean and Japanese raters preferred 100° to 102° for Japanese women and 94° to 96° for men. Likewise, in the study of Shimomura et al. (26), the preferred NLA range for women (109° to 115°) was greater than that for men (104° to 107°). For black people, Beugre et al. (30) concluded that attractive women have a significantly greater NLA ($92.25^\circ \pm 9.82^\circ$) than men ($86^\circ \pm 1.41^\circ$). On the contrary, Penna et al. (12) found that attractive Caucasian women have a significantly sharper NLA compared to men. Also, Polk et al. (20) reported that 84° NLA for black female subjects and 92° for black male subjects perceived as attractive by African-Americans.

The ethnical background of raters and subjects revealed to be an important factor. When two ethnical groups of white and black attractive women were compared during the early decades of the 21st century, the two groups shared some similar features in lower face and neck area, nonetheless, NLA was significantly different (16). Sharper NLA was noted in black women as ensued by more protruded lips. Application of Legan and Burston (34) analysis for Chinese population showed that NLA in a Chinese profile is less obtuse than white norms (19). On the other hand, Mafi et al. (23) concluded that NLA in beautiful young Iranian women was not distinctly apart from north American Caucasians studied by Farkas (33). Khoranavifard et al. (28) found NLA to be a determinant factor for attractiveness in Iranian profiles regardless of gender and greater in attractive compared to nonattractive subjects. In addition, the ethnicity of raters seems to be a predictor of the most preferred male NLA (29). African-Americans and Native Americans chose the 90° NLA to be most esthetic, and

Asians preferred 90° and 100° (29). However, Thomas (10) revealed no difference among black and white raters' preferred NLA.

Olds (35), by observing the artworks from past 5000 years, suggested that ideals for esthetics have not changed with time; although longitudinal studies show a change in attractiveness trends and perception of beauty. It has been demonstrated that the NLA value among attractive African-American women in the 20th century has changed significantly with time. The results of Yehezkel and Turley's study (17) showed a trend toward more acute NLA and fuller lips. Fullness of lips changed more in African-American models from 1940s to 1970s. NLA was measured 102.3° in 1940 and 96.6° in 1990 models. According to Berneburg et al. (13), NLA has undergone significant changes among attractive white women from 1940 to 2008. A decrease in NLA was observed in both sexes over a 70-year period; however, the change was only significant in women. Iglesias-Linares et al. (16) compared white and black attractive women during the course of 10 years and one outstanding result related to the white models was the changes in lip area, including a decrease in NLA. Results of their study implies a convergent trend in beauty features between white and black women (16). Study of soft tissue parameters in attractive white men depicted in 20th century fashion magazines (after 1930) revealed a significant change in lip area measurements except for NLA, which supports Berneburg's findings (13, 18). By assessing 3D scans of attractive Italian women (Caucasian) in 2010, who were beauty contest winners, in comparison with "normal" faces, some parameters appeared to be different and have an influence on the facial attractiveness (15). Among angular measurements, NLA and convexity angle were statistically different between the two groups. In the 2010 attractive group, NLA was more obtuse than the standard norms in the literature.

The current review showed preferred NLA in different populations and genders. However, as Sinno et al. concluded, an increasing urge for esthetic improvement is observed amongst minority ethnicities (29), it is important to consider the differences and take them into account for each individual. The most pleasing NLA for each patient should be assessed considering gender, ethnicity and other aspects of facial profile.

We faced some limitations in our study. Only English literature was screened, however we tried to expand our search in order to reduce the risk of publication bias. Furthermore, the material used in the included studies to identify the attractive profiles was not homogenous, and some influencing factors might distract the raters or interfere with their judgement. There is no standard tool for the assimilation of the circumstances of rating. Although converting a photo into a silhouette can eliminate other super-

ficial or sexual traits, rating these photographs leaves less of the perception to imagination (36). Due to the discrepancy of the methods, such as different materials and systems for rating, performing a meta-analysis was not possible. Also, the use of different methods of soft tissue analysis and identifying the landmarks by the operator may add to the diversity of methods.

5. Conclusions

Attractiveness, rather than being merely the standard or normal values accepted in the literature, is the perception of patient seeking any esthetic procedure. The perception of attractiveness is influenced by different elements such as gender, ethnical background, age, and media. Greater NLA values are more favored for attractiveness in women's profile than men. More acute NLA is preferred for African-American women than Caucasian women. While in the Chinese population, a less obtuse NLA than the white norm is considered more attractive, NLA in attractive Iranian women is closer to North American norms. Accepted and favorable NLA has changed with time and is significantly detectable in women's profile. Though we cannot point an exact trend for NLA changes, it seems that sharper angles and fuller lips are perceived as more attractive. Hence, it is important for orthodontists and surgeons to consider the treatment goals according to each patient's expectation and perceptions.

Footnotes

Authors' Contribution: Study concept and design, S.R.M; Acquisition of data, S.M; Analysis and interpretation of data, S.R.M and S.M; Drafting of the manuscript, S.M; Critical revision of the manuscript for important intellectual content, S.R.M; Statistical analysis, S.R.M; Administrative, technical, and material support, L.E; Study supervision, S.R.M and L.E.

Conflict of Interests: There is no conflict of interest.

Data Reproducibility: The data presented in this study are openly available in one of the repositories or will be available on request from the corresponding author by this journal representative at any time during submission or after publication. Otherwise, all consequences of possible withdrawal or future retraction will be with the corresponding author.

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