

# Facial Structures and Their Impact on Visual Perception of Beauty and Youthfulness: Parallelism

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## Introduction

Facial aesthetic standards vary across cultures and time, yet elements like symmetry and harmony remain universally significant in defining beauty. The proportions, lines, metrics, and angles of facial characteristics are examined in aesthetic face assessment. Although cultural and social media influences shape beauty ideals, certain characteristics like symmetry, harmony, averageness, youth (neoteny), and perception of health are universally appealing. Several mathematical rules have been devised to identify these “patterns of beauty”. Measurements, angles, and proportions aid doctors in the facial aesthetic assessment process.<sup>1</sup>

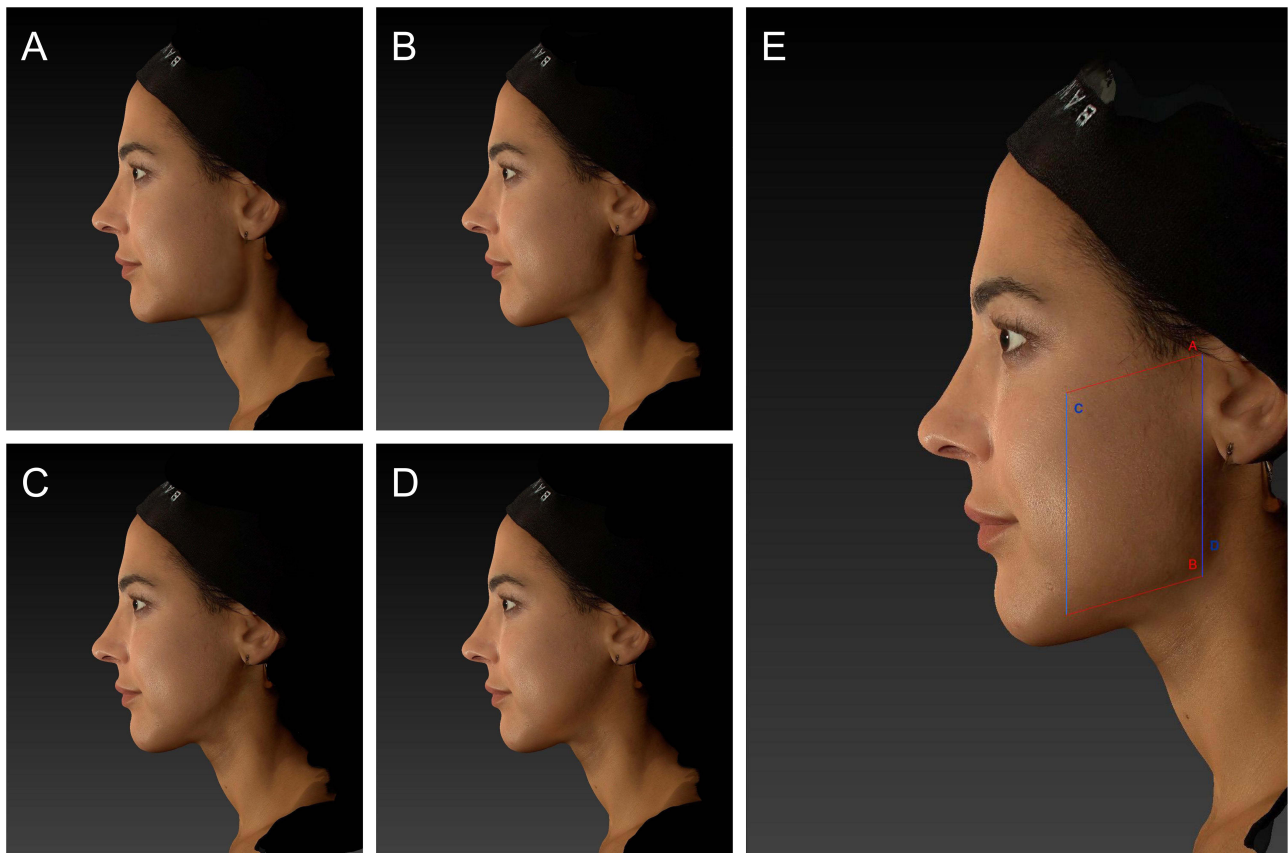
There are many parameters that evaluate medial structures from both frontal and lateral views, but for lateral structures, we have tools that assess them from a frontal view, with little available for evaluation from a lateral view. In the frontal view, the size and location of medial structures (forehead, eyes, nose, lips and chin) can be assessed using the rule of fifths (transverse) and the rule of thirds (vertical). In lateral view, medial structures can be illustrated by measuring facial angles of the lateral face’s silhouette, Goode’s ratio, and Ricketts’ aesthetic line. Silhouette analysis may include the nasofrontal, nasofacial, nasomental, nasolabial, mentocervical, columellar facial, and maxillofacial angles. For lateral structures, apart from the mandibular angle, and bizygomatic-bigonial ratio, there are limited assessments.<sup>1</sup>

Traditional aesthetic evaluations often focus on central facial features. However, lateral structures, such as the zygomatic arch and mandibular outline, also play crucial roles in overall facial harmony. The mandibular angle considers the position of the mandibular border relative to the mandibular ramus but does not account for the position of the mandibular border in relation to other structures that are not part of the mandible itself, such as the zygomatic arch. Ageing is associated with structural changes such as mandibular bone resorption, soft tissue volume loss, and an increase in gonial angle obtuseness, all of which can affect the perception of facial harmony and youthfulness.

The primary objective of this study is to quantitatively evaluate how the angular relationship between two lines on the face, referred to as “angle G”, affects the perception of beauty and youthfulness. Angle G is defined by two facial lines: one connecting the helix crus to the upper edge of the zygomatic arch (line A), and the other linking the gonion to the insertion of the mandibular ligament (line B). This novel approach may provide deeper insights into aesthetic evaluations and offer new guidelines for cosmetic interventions.

## Materials and Methods

An analytical study was conducted involving women aged between 25 and 60 years, seeking their initial consultation at a private aesthetic center in Buenos Aires from March 1st to April 20th, 2024. Exclusion criteria included a history of facial trauma, facial deformity, severe psychological conditions, or prior facial aesthetic procedures. Participants were asked to choose the most harmonious and youthful image among four digital profile images of a Caucasian patient with different angle G values (−15°, 0°, +15°, and +30°) modified with Photoshop (Figure 1). Line A remained constant, and



**Figure 1** Profile images of a patient with different angle G values. (A)  $-15^\circ$ , (B)  $0^\circ$ , (C)  $+15^\circ$ , (D)  $+30^\circ$ . (E). Angle G parallelism. In image (E), line (A) connects the helix crus to the upper edge of the zygomatic arch; line (B) links the gonion to the insertion of the mandibular ligament; line (C) extends from the helix crus to the gonion; line (D) starts at the upper edge of the zygomatic arch at its maximum anterior projection to the insertion of the mandibular ligament.

only line B was modified to generate these four angles. Images with a well-defined mandibular border were used to avoid influencing overall beauty perception. Informed consent was obtained from the model patient.

The four images were displayed simultaneously and randomly on a digital screen in a  $2 \times 2$  display, and participants were instructed to choose the image they perceived as the most harmonious and the image they regarded as most youthful separately. Observers were seated in a quiet and calm environment. Each image was life-sized to prevent size perception from influencing beauty judgments.

All women in the analytical study were caucasians and provided informed consent to participate. The study received approval from the Clinical Research Ethics Committee at Stambouliau, Ciudad Autónoma de Buenos Aires, under protocol number 2126/146/2023. Data were collected and archived by individuals not involved in the research, who also conducted the data analysis. Descriptive statistics were calculated, and group comparisons were performed using chi-square tests or Fisher's exact test where appropriate. A  $p$ -value  $< 0.05$  was considered statistically significant. SPSS Statistics 26 was used for statistical analysis.

## Results

### Perception of Harmony and Youthfulness Among Caucasian Women

The responses of 132 women were evaluated, with a median age of 48.7 years (interquartile range 37.5–58.8). Table 1 illustrates the perception of harmony and youthfulness among participants. The angle G perceived as the most harmonious was  $0^\circ$  and the angle perceived as the youngest was  $-15^\circ$ .

**Table 1** Comparative Analysis of Perceived Harmony and Youthfulness in Caucasian Women Under and Over 40 Years of Age

	Total (n=132)		Equal to or Less Than 40 Years (n=41)		Over 40 Years (n=91)		p Value <sup>a</sup>
	No (%)	95% IC	No (%)	95% IC	No (%)	95% IC	
Perception of Harmony							
-15°	31 (23.5)	16.2–30.8	6 (14.6)	3.3–25.9	25 (27.5)	18.1–36.8	0.032
0°	53 (40.2)	31.7–48.6	24 (58.5)	42.8–74.3	29 (31.9)	22.1–41.6	
+15°	27 (20.5)	13.5–27.4	7 (17.1)	5–29.1	20 (22)	13.3–30.7	
+30°	21 (15.9)	9.6–22.2	4 (9.8)	0.3–19.2	17 (18.7)	10.5–26.8	
Perception of Youthfulness							
-15°	49 (37.1)	28.7–45.5	18 (43.9)	28–59.8	31 (34.1)	24.1–44	0.388 <sup>b</sup>
0°	33 (25)	17.5–32.5	9 (22)	8.7–35.2	24 (26.4)	17.2–35.6	
+15°	24 (18.2)	11.5–24.9	9 (22)	8.7–35.2	15 (16.5)	8.7–24.3	
+30°	26 (19.7)	12.8–26.6	5 (12.2)	1.7–22.7	21 (23.1)	14.3–31.9	

**Notes:** <sup>a</sup>The p-value is calculated to compare patients younger or equal to 40 years and patients older than 40 years. <sup>b</sup>For the comparative analysis of G angle categories between patients younger and older than 40 years, the chi-square test was employed. Upon post-hoc analysis using the Bonferroni correction and considering a significance threshold of  $p < 0.00625$ , only the G angle 0° exhibited a statistically significant difference with a p-value of 0.004. The respective p-values for the other categories were: -15° ( $p = 0.125$ ), +15° ( $p = 0.643$ ), +30° ( $p = 0.214$ ).

**Abbreviation:** 95% IC, 95% confidence interval.

## Perception of Harmony and Youthfulness Among Young and Older Women

Significant differences in facial harmony perception were found between the two age groups. Participants aged 40 or younger ( $n=41$ ) displayed a marked preference for the 0° angle (58.5%), in contrast to those aged over 40 ( $n=91$ ), who chose it 31.9% of the time, with a p-value of 0.004. Regarding the perception of youthfulness, no statistically significant differences were observed between the age groups. Participants over 40 years of age seemed to exhibit a more consistent pattern of choice for angles related to both harmony and youthfulness (Table 1).

## Discussion

This study provides valuable insights into how the angular relationship between lateral facial structures influences harmony and youthfulness perceptions. An angle G close to 0° suggests a higher perception of facial harmony, likely because facial line parallelism is perceived as an indicator of balance and symmetry. In contrast, an angle G close to -15° appears to convey a higher perception of youthfulness, possibly due to angular jawlines often being associated with strong dental occlusion and youthful facial contours.<sup>2,3</sup>

Research attempts to determine the optimal or ideal position of the mandibular border, whether relative to the mandibular ramus (mandibular angle) or the Frankfort plane (Frankfort-mandibular plane angle, FMA).<sup>2,4,5</sup> The FMA is formed by the intersection of the Frankfort horizontal plane and the mandibular plane, with an FMA of  $25 \pm 5$  degrees considered within the normal range.<sup>2</sup> While studies attempt to define the normal range for the FMA and associate it with dental occlusion patterns, their impact on aesthetic perception or the range perceived as most youthful or harmonious is rarely evaluated.

Regarding the mandibular angle, defined as the angle formed between the axis of the ascending mandibular ramus and the mandibular body, it has been observed that the mandibular angle increases significantly with age in both male and female patients. For women, the mean values were 119.9 degrees for those under 40 and 125.8–132.0 degrees for those over 40.<sup>6</sup> This finding aligns with our observation that more acute angle G values are perceived as younger, likely because the mandibular angle becomes more obtuse with age.

The perception of beauty concerning the mandibular and Frankfort angles has been evaluated in a Chinese population. Attractive Chinese women had a mean mandibular angle of 123.9 degrees and an FMA of 27 degrees, whereas “healthy” women had a mandibular angle of 116.4 degrees and an FMA of 19.6 degrees, with statistically significant differences between the groups.<sup>5</sup> These findings suggest that these parameters impact the perception of harmony, attractiveness, and youthfulness, but it is unclear if these numbers or ranges are applicable to the Caucasian population. In a survey among a Caucasian population, gonial angle in profile of 125.5° was considered attractive while 129.1° was regarded as non-attractive. However, these results were not statistically different ( $p = 0.28$ ).<sup>7</sup>

It is important to recognize that the perception of beauty and harmony is inherently subjective and can be influenced by multiple factors, including cultural and personal preferences. The focus of this study on Caucasian women aimed to minimize cultural and gender variability, allowing for a more controlled examination of angular relationships. While the 0° angle was overall preferred for facial harmony, younger participants exhibited a significant preference for this angle, reflecting contemporary aesthetic standards that favor specific facial balances. In contrast, participants older than 40 years displayed a more homogeneous choice for angles related to harmony, rather than a particular inclination of preference. The absence of a clear preference among older participants suggests that older individuals may have a more nuanced and varied perception of facial beauty, possibly influenced by a broader range of experiences and exposure to evolving beauty ideals over time.

These findings underscore the importance of considering age in facial aesthetic evaluation as facial beauty is perceived differently across age groups, highlighting the need for personalized approaches in aesthetic treatments. The sample was divided at age 40 to reflect potential generational differences (eg generation X vs Y) in aesthetic perception and to ensure balanced subgroup sizes for statistical analysis. However, future research could explore more granular age stratifications (eg, 20–30, 31–40, >40 years) to assess more subtle shifts in perception across the aging continuum, particularly in relation to biological factors such as bone maturation and lifestyle influences.

Furthermore, the study highlights the importance of the angular relationship between lateral facial structures in achieving desired aesthetic outcomes. Professionals can use angle G parallelism as a guide for filler applications in the lower third face. Considering the natural shortening of the mandibular ramus and the decrease in alveolar density with age, which result in a narrowing of the distances between lines A and B, it is advisable to ensure that the gonion is positioned aligned the upper lip plane or below it.<sup>6,7</sup> This approach helps maintain a youthful appearance and facial harmony, addressing the effects of bone resorption and changes in facial structure over time.

This approach could serve as a complementary tool alongside traditional frontal and volumetric evaluations. Clinically, the 0° angle may be targeted in treatments aimed at enhancing facial harmony, while the –15° angle could be preferred in rejuvenation strategies for younger-looking contours, depending on patient characteristics and aesthetic goals.

We propose further exploration of the concept of harmony by adding vertical parallel lines: a line “C” starting at the upper edge of the zygomatic arch at its maximum anterior projection to the insertion of the mandibular ligament, and another preauricular line “D” parallel to line “C”. This configuration creates a parallelogram image. With expected bone resorption during aging and changes such as the gonion shrinking in a superomedial direction and mandibular ramus shortening, these lines could be aesthetically modified using fillers, taking into account the marking of these lines to shape a “new gonion”. These lines would serve as visual guides ([Figure 1](#)).

High G prime hyaluronic acid fillers are recommended to achieve these modifications. The use of cannulas is suggested to distribute the hyaluronic acid in the subcutaneous plane. The goal is to place the filler below the mandibular border, creating an illusion of a “new gonion” posterior and/or inferior to the original gonion. This is achieved with an entry point at the jowl (without filling the jowl itself), placing the cannula below the mandibular border and reaching behind and/or below the gonion. Subsequently, a bolus is placed in that area, followed by retrograde placement of the filler. Thus, it is possible to replace the bone resorption that occurs over the years with filler and achieve parallelism with the zygomatic arch line. To support the clinical feasibility of this technique, two representative cases demonstrating filler placement to modify angle G are provided in [Figure S1](#).

These findings offer valuable insights for practitioners and patients; however, several limitations should be noted. The study’s single-center design, exclusive focus on females aged 25 to 60 of Caucasian descent, and reliance on 2D imaging limit the generalizability of the results. There was also limited variability in angle G values and in the inclination of line A. Future research should aim to include a more diverse participant pool in terms of ethnicity, gender, and age range, expand the range of

angle measurements, and incorporate 3D imaging techniques to enhance the accuracy and applicability of the findings. Furthermore, clinical studies are needed to validate the proposed technique in real patients, addressing its long-term outcomes, feasibility in practice, and potential risks associated with filler use in this anatomical region.

## Conclusion

This study highlights the relevance of angle G in the perception of facial harmony and youthfulness, proposing a new geometric reference between the zygomatic arch and the mandibular border. Our findings suggest that parallelism between these lines enhances perceived harmony, while more acute angles are associated with youthfulness. This concept may serve as a practical guide in aesthetic procedures involving the lower third of the face. Future studies should validate this approach in diverse populations using 3D imaging and clinical outcomes.

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## Disclosure

The authors report no conflicts of interest in this work.

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