



Cone-Beam Computed Tomography-Based Anatomic Mapping of Maxillofacial Foramina: Development of a Novel Proportional Guide for Facial Aesthetic Procedures

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Objective: Anatomic safety and aesthetic harmony are of critical importance in facial aesthetics and surgical procedures. This study aims to evaluate whether the distance ratios among the supraorbital, infraorbital, and mental foramina conform to the golden ratio ($\phi = 1.618$).

Methods: In this retrospective study, cone-beam computed tomography (CBCT) scans of 88 patients aged 18 to 33 years (42 males and 46 females) were analyzed. The distances between the supraorbital foramen/notch (SOF), infraorbital foramen (IOF), and mental foramen (MF) (SOF-IOF, IOF-MF, and SOF-MF) were measured bilaterally. The conformity of the SOF-MF/SOF-IOF ratio to the golden ratio (1.618) was statistically assessed using (SPSS version 26.0; IBM Corp., Armonk, NY).

Results: In our study, the distance between SOF and IOF was 45.40 ± 2.81 mm on the right side and 45.47 ± 3.11 mm on the left side. In addition, the distance between IOF and MF was 66.01 ± 5.01 mm on the right side and 65.21 ± 5.14 mm on the left side. The SOF-MF/SOF-IOF ratio was 1.522 on the right side and 1.418 on the left side in men; in women, it was 1.400 on the right side and 1.402 on the left side. In addition, the overall average was 1.459 on the right side and 1.440 on the left

side. All measurements showed a significant difference compared with the golden ratio (1.618) ($P < 0.05$).

Conclusion: This study provides morphometric data on distance ratios between the supraorbital, infraorbital, and mental foramina, which may serve as a reference for anatomic planning and localization of neurovascular structures in aesthetic and surgical procedures. The findings suggest that these proportional relationships could contribute to safer, more predictable facial interventions; however, larger-scale studies are required to validate these ratios across diverse ethnic groups and populations.

Key Words: Cone beam computed tomography, facial anatomy, facial foramina, golden ratio, infraorbital foramen, mental foramen, morphometric analysis, supraorbital foramen

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In classic anatomic literature, it is generally accepted that the supraorbital foramen/notch (SOF), the infraorbital foramen (IOF), and the mental foramen (MF) are aligned along the same vertical line.^{1,2} According to this definition, the SOF is located at the junction of the lateral 2/3 and medial 1/3 of the superior orbital margin on the frontal bone; the IOF is situated ~1 cm inferior to the inferior orbital margin on the maxilla and over the fossa canina; and the MF lies on the same vertical axis as these structures.² However, some studies report that the IOF and MF are not located on the same vertical line as the SOF.^{1,3,4} This contradicts the standard anatomic literature, which states that all of them lie on the same vertical plane.

The geometric arrangement of craniofacial landmarks serves as a fundamental skeletal reference for both functional biomechanics and facial aesthetics.^{5,6} The supraorbital foramen/notch (SOF), infraorbital foramen (IOF), and mental foramen (MF) represent the exit points of the 3 main trigeminal nerve branches (V1, V2, and V3) and act as stable anatomic markers of embryonic development.^{7–9} Reflecting evolutionary adaptations for masticatory force absorption and craniofacial load distribution,^{10–12} these foramina maintain their structural stability despite age-related soft tissue changes. Consequently, this bony configuration is theoretically expected to form a biometric reference triangle that exhibits a stable mathematical relationship, potentially aligning with the golden ratio (1.618).

A precise understanding of these skeletal landmarks is essential to minimize neurovascular complications during clinical interventions.¹³ Particularly in the maxillofacial region, the nerve branches emerging from these foramina are of critical

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This retrospective study was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Committee for Non-Interventional Clinical Research at Istanbul Aydin University (Decision No: 26, dated March 6, 2023).

Patient-informed consent was waived due to the study's retrospective design and the use of fully anonymized radiographic data.

The authors report no conflicts of interest.

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anatomic importance for both regional anesthesia and minimally invasive aesthetic procedures, such as dermal fillers, botulinum toxin injections, and thread lifts.^{13,14} While the role of symmetry and proportion in facial aesthetics is well documented,⁵ existing research has primarily evaluated the relationships between these 3 landmarks through pairwise comparisons (SOF-IOF and IOF-MF), focusing solely on isolated linear distances.^{1,4,14–19} To the best of our knowledge, no study has systematically evaluated the three-way proportional relationships of these foramina in the context of the golden ratio (1.618). This study is the first to analyze the conformity of the SOF-MF/SOF-IOF ratio to the golden ratio using 3-dimensional cone-beam computed tomography (CBCT) data in a Turkish cohort, aiming to provide a more stable, ratio-based biometric reference for facial aesthetic and surgical planning.”

METHODS

Study Design and Protocols

This retrospective morphometric investigation was designed to comprehensively evaluate the anatomic and geometric characteristics of the supraorbital foramen/notch (SOF), infraorbital foramen (IOF), and mental foramen (MF), and to analyze the vertical and horizontal proportional relationships among them (Supplemental Table 1, <https://links.lww.com/SCS/J955>). To ensure reproducibility, craniofacial landmarks and morphometric parameters were mapped in accordance with standardized anthropological and craniometric guidelines.²⁰ High-resolution 3-dimensional (3D) digital reconstructions were utilized to perform all linear measurements.²¹

Sample Size Calculation

The sample size was calculated using (G*Power Software version 3.1.9.7; Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany). Based on the statistical analyses planned for this study, a minimum of 30 participants was required to achieve a medium effect size of 0.25 ($d = 0.30$), with a 5% margin of error ($\alpha = 0.05$) and 95% power ($1 - \beta = 0.95$).^{22–24}

Patient Selection

CBCT images were obtained from the archive of the Department of Oral and Maxillofacial Radiology at [Blinded for Review] University Faculty of Dentistry, covering the period from January 2019 to January 2023. The study population consisted of individuals aged 18 to 33 years who underwent CBCT of the entire skull for diagnostic purposes. Patients meeting the inclusion criteria were consecutively selected from the archive. Only scans with a field of view (FOV) of 170×120 mm that allowed clear visualization of the SOF, IOF, and MF were considered for inclusion. Inclusion criteria required the absence of maxillofacial pathology and no developmental, metabolic, or inflammatory jaw diseases that could potentially affect the dimensions of these foramina. Images with insufficient resolution for accurate measurements, or in which the notch and/or foramen could not be clearly identified, were excluded. When cases were excluded, additional patients meeting the inclusion criteria were selected through continued retrospective review of the archive until the required sample size was achieved. Based on these criteria, CBCT images of 88 patients (46 females and 42 males) were included in the final analysis.

Image Acquisition and Analysis

CBCT images were obtained using a (Morita 3D Accuitomo 170; Morita, Kyoto, Japan) with a standard acquisition protocol (90 kV, 5 mA, 30.8 s) with patients positioned in the standard head position. Three-dimensional volumetric images were prepared for each patient and examined on a DELL U3014 Ultrasharp monitor (30-inch, 2560×1600 pixel resolution) in a darkened room using (i-Dixel Software version 2.0; Morita, Kyoto, Japan). The SOF, IOF, and MF were bilaterally assessed on all images. All evaluations were performed by a single experienced oral and maxillofacial radiologist who was blinded to patient demographics during image analysis. Volumetric data were subsequently transferred to (ImageJ Software; US National Institutes of Health, Bethesda, MD) for morphometric measurements.

Reliability Assessment

To assess intraobserver reliability, 10 randomly selected CBCT scans were re-evaluated by the same radiologist after a 2-week interval. Intraclass correlation coefficient (ICC) values were calculated for all measurements and ranged from 0.92 to 0.97, indicating excellent reliability.

Statistical Analysis

All statistical analyses were performed using (SPSS version 26.0; IBM Corp., Armonk, NY). Normality of the data distribution was assessed using the Kolmogorov-Smirnov and Shapiro-Wilk tests, along with evaluation of skewness and kurtosis. The majority of variables demonstrated P -values exceeding 0.05, while all skewness and kurtosis coefficients remained within the ± 3 range, confirming normal distribution of the data. For bilateral comparisons of measured parameters, paired sample t tests were used. Sex-based comparisons were performed using independent-sample t tests. The relationship between measured variables and participants' ages was examined using the Pearson correlation analysis. Effect sizes (Cohen d) and their corresponding 95% CIs were calculated for the sex-based comparisons (Supplemental Table 3, <https://links.lww.com/SCS/J955>) and for the 1-sample comparisons of the SOF-MF/SOF-IOF ratios against the theoretical golden ratio (Supplemental Table 6, <https://links.lww.com/SCS/J955>), to complement the P -values with estimates of the magnitude and precision of the observed differences. Statistical significance was defined as $P < 0.05$ throughout the study.

RESULTS

A total of 88 individuals were enrolled in this study, comprising 46 females (52.3%) and 42 males (47.7%). The overall mean age was 26.43 years ($SD = 6.50$ y). The overall mean and standard deviation of the measurements are presented in Supplemental Table 2, <https://links.lww.com/SCS/J955>. Statistically significant differences between the sexes were found for most of the measured variables (Supplemental Table 3, <https://links.lww.com/SCS/J955>, Fig. 1, $P < 0.05$). The mean values of these measurements were higher in males. The left SOF diameter, the bilateral transverse and vertical diameters of the IOF, the intersupraorbital distance, the interinfraorbital distance, the bilateral IOF-ANS distances, the intermental foramen distance, and the bilateral MF-Gonion/Pogonion distances were found to be significantly larger in males ($P < 0.05$). In addition, the IOF-MF distance was significantly higher in men on both sides ($P < 0.05$). In contrast, no significant difference was found between the sexes regarding the right and left SOF-nasion distances ($P > 0.05$). Similarly, bilateral SOF-IOF distances did not show statistically significant differences

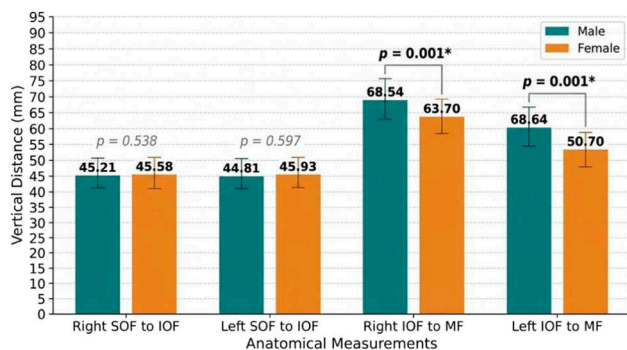


FIGURE 1. Comparative analysis of bilateral vertical craniofacial distances between Male (Teal) and Female (Amber). Data are expressed as mean ± SD (represented by error bars). Brackets indicate statistically significant differences between the cohorts ($P=0.001^*$). Nonsignificant parameters ($P>0.05$) are labeled with their respective P -values without brackets. IOF indicates infraorbital foramen; MF, mental foramen; SOF, supraorbital foramen.

between the sexes (Supplemental Table 3, <https://links.lww.com/SCS/J955>, $P>0.05$). Effect sizes for these sex-based comparisons ranged from negligible to large (Cohen $d=-0.13$ to 1.10 ; Supplemental Table 3, <https://links.lww.com/SCS/J955>); the largest effects were observed for the right IOF-MF distance ($d=1.10$, 95% CI: $0.65-1.55$) and the left MF-Gonion/Pogonion distance ($d=0.96$, 95% CI: $0.51-1.40$), whereas the non-significant comparisons corresponded to small-to-negligible effect sizes (eg, right SOF diameter, $d=0.37$, 95% CI: -0.05 to 0.79 ; bilateral SOF-IOF distances, $d=-0.13$ and 0.11), indicating that the statistically significant differences also reflected clinically meaningful magnitudes. Bilateral comparisons of the measured parameters revealed statistically significant asymmetries in many measurements (Supplemental Table 4, <https://links.lww.com/SCS/J955>). The left supraorbital diameter was found to be significantly larger than the right ($P<0.05$). Similarly, the transverse diameter of the left infraorbital foramen exceeded that of the right side ($P<0.05$). In contrast, the right-side measurements for the distance from the supraorbital foramen to the nasion, the distance from the mental foramen to the Gonion/Pogonion, and the distance from the infraorbital foramen to the mental foramen were found to be significantly greater (Fig. 2, $P<0.05$). No statistically significant differences were observed between the right and left sides for the vertical diameter of the infraorbital foramen, the diameter of the mental foramen, the distance from the infraorbital foramen to the anterior nasal spine, and the distance from the supraorbital foramen to the infraorbital foramen ($P>0.05$). A Pearson correlation analysis was performed to examine the relationship between participant age and the measured parameters (Supplemental Table 5, <https://links.lww.com/SCS/J955>). Weak positive correlations were found between age and the left supraorbital diameter ($r=0.226$, $P<0.05$) and between age and the vertical diameter of the right infraorbital foramen ($r=0.226$, $P<0.05$). In contrast, weak negative correlations were observed between age and the intersupraorbital distance ($r=-0.305$, $P<0.001$) and between age and the distance from the right supraorbital foramen to the nasion ($r=-0.278$, $P<0.001$) (Supplemental Table 5, <https://links.lww.com/SCS/J955>, Fig. 3). The SOF-MF/SOF-IOF ratio was compared with the golden ratio (1.618) in all participant groups (Supplemental Table 6, <https://links.lww.com/SCS/J955>, Fig. 4). None of the calculated ratios reached the golden ratio ($P<0.05$). In men, the average ratios

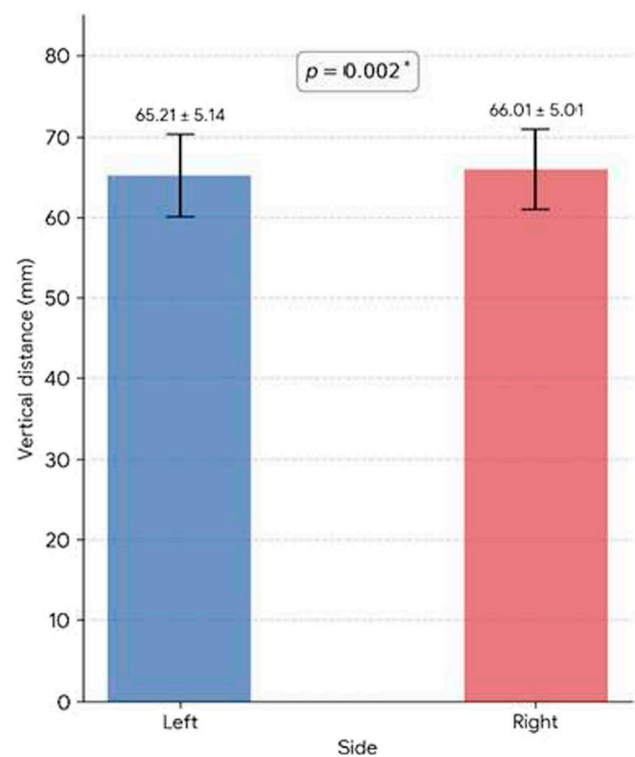


FIGURE 2. Comparison of the vertical distance between the infraorbital and mental foramina on the right and left sides. Data are presented as mean ± SD. The difference between the 2 sides is statistically significant ($P=0.002^*$).

were 1.418 (left), 1.522 (right), and 1.502 (bilateral combined). Women showed slightly lower values: 1.402 (left), 1.400 (right), and 1.400 (bilateral combined). When the entire cohort was analyzed, the overall average ratios were 1.440 (left), 1.459 (right), and 1.449 (bilateral combined). All measured ratios remained significantly below the theoretical golden ratio of 1.618 and did not reach this ideal ratio ($P<0.05$). The magnitude of these deviations appeared to be consistently large across subgroups, as reflected by the corresponding effect

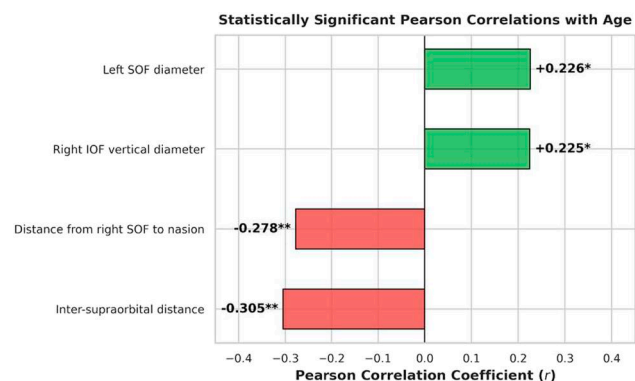


FIGURE 3. Bar chart illustrating the statistically significant Pearson correlation coefficients (r) between age and craniofacial morphometric parameters. Green bars indicate positive correlations, while red bars represent negative correlations. Statistical significance levels are denoted as follows: * $P<0.05$ and ** $P<0.01$. IOF indicates infraorbital foramen; SOF, supraorbital foramen.

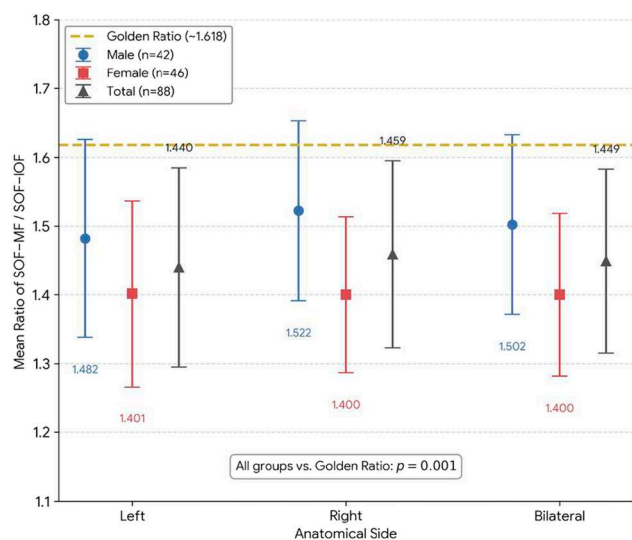


FIGURE 4. Comparison of the mean SOF-MF/SOF-IOF vertical ratios against the theoretical Golden Ratio across different anatomic sides. The gold-dashed horizontal line represents the Golden Ratio value. Data points indicate the mean ratios for Male ($n=42$, blue circles), Female ($n=46$, red squares), and Total ($n=88$, grey triangles) cohorts, while the vertical error bars represent the standard deviations ($\pm$ SD). Statistical analysis indicates that the mean ratios of all examined groups and sides are significantly lower than the Golden Ratio ($P=0.001$).

sizes (Cohen d ranging from -0.73 to -1.93 ; Supplemental Table 6, <https://links.lww.com/SCS/J955>). The deviation seemed most pronounced in females (eg, right ratio, $d=-1.93$, 95% CI: -2.42 to -1.44) and comparatively smaller, though still substantial, in males (eg, right ratio, $d=-0.73$, 95% CI: -1.07 to -0.39), suggesting a relatively consistent departure from the theoretical golden ratio in both sexes that may carry clinical relevance, pending confirmation in larger and more diverse cohorts.

DISCUSSION

The spatial relationships among craniofacial foramen structures are gaining importance both in morphometric analyses and, particularly in recent years, in medical aesthetic applications. Mathematical approaches to defining facial proportions are also frequently used to assess aesthetic balance and harmony. In this context, the present study evaluated the SOF, IOF, and MF in the same individuals using CBCT and analyzed the proportional relationships among these structures. The findings revealed that the calculated ratios in both female and male individuals were statistically significantly lower than the golden ratio. However, the limited distribution of measurements within the 1.44 to 1.50 range indicates a consistent proportional pattern among these structures. While these results suggest that the golden ratio does not directly align with craniofacial anatomy, we believe they highlight alternative ratio-based approaches grounded in anatomy and offer a new perspective on the literature in this area.

Accurate determination of the positions of the SOF, IOF, and MF is essential to preserve neurovascular structures during medical aesthetic procedures and regional nerve blocks. In the literature, the absolute distances of these foramina from reference points such as the Nasion (midline), Anterior Nasal Spine (ANS), and Gonion/Pogonion are reported. In our study, distance measurements for the SOF-midline, IOF-ANS, and

MF-Gonion/Pogonion were obtained from a Turkish population. These findings were largely consistent with the data reported by Msibi et al¹⁶ for a white population. These findings indicate that the Turkish population exhibits craniofacial features similar to those of the white population and that these individual distances can serve as clinical references. However, considering individual differences in age, sex, and skeletal size, using proportional relationships among the foramina rather than relying solely on absolute millimeter distances may be a more clinically reliable and universal approach.

One of the key observations in our study is that, although the SOF-MF/SOF-IOF ratio does not reach the theoretical golden ratio (1.618), it remains within a narrow range of 1.44 to 1.50 (overall average ~ 1.45) across both sexes and sides. This consistent proportional pattern is hypothesis-generating and could conceptually serve as a foundation for developing simplified mathematical guides in outpatient settings where advanced imaging is unavailable. For instance, a clinician might theoretically estimate the vertical distance from the SOF to the mental foramen (MF) by multiplying the clinically palpated SOF-IOF distance by a factor of 1.45. However, we must emphasize that this proposed 1.45 ratio is strictly a preliminary, hypothesis-generating finding rather than a definitive clinical rule. Rigorous external validation in larger, independent, and ethnically diverse patient cohorts is required before this proportional guide can be safely and routinely implemented for locating the mental nerve in clinical practice.

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In medical aesthetic procedures and the planning of regional nerve blocks and open/endoscopic surgical approaches, the accurate identification of the positions of the SOF, IOF, and MF not only facilitates the planning process but also contributes to the preservation of neurovascular structures, thereby reducing the risk of complications and enhancing clinical safety.^{13,14,25,26} SOF is widely recognized as one of the primary neurovascular landmarks in frontal region surgery and medical aesthetic procedures;^{25,26} Although the localization and variations of skulls have been described in detail in different populations using cadavers and 3D CT scans, the number of CBCT-based studies remains relatively limited.^{1,3,4,16-18,27-29} Msibi et al¹⁶ reported that the SOF-midline distance is located more laterally in the Black population than in the White population; in our study, the SOF-midline distances in the Turkish population were largely consistent with those in the White population. This suggests that the SOF-midline placement in the Turkish population may exhibit a similar anatomic distribution to the values reported in the white population in terms of craniofacial morphology. The infraorbital nerve (IOF) serves as a critical anatomic reference point in midface medical

aesthetic procedures, such as botulinum toxin injections and filler treatments, as well as in maxillofacial trauma and orbital floor surgery. It is essential for preserving the infraorbital nerve and vessels and for determining safe surgical margins.^{13,14,30,31} Although the location and variations of the IOF have been described in detail in the literature using skulls, cadavers, and 3D CT images from various populations, the number of CBCT-based studies remains relatively limited.^{1,3,4,17–19,27,32} For example, while Bahşi et al³¹ used the nasal septum as a reference in the coronal plane, our study used the distance between the anterior nasal spine and the infraorbital foramen; these differences in measurement planes and reference points partially limit the direct comparability of the results. While Msibi et al¹⁶ reported that the IOF-ANS distance varies between white and Black populations, the fact that the IOF-ANS distances in our study's Turkish population largely align with data from white populations supports the notion that this distance can be used as a reliable anatomic reference in clinical practice within the Turkish population. Accurate and reproducible information regarding the location and dimensions of the mental foramen is clinically critical for safe procedures and for preventing neurovascular injuries during surgical interventions in the mandibular premolar region and mental nerve blocks.^{13,14} The location and variations of the mental foramen have been described in detail using skulls, cadavers, and 3D CT images from various populations; however, the number of CBCT-based studies remains relatively limited.^{1,3,4,33} Msibi et al¹⁶ reported that both the right and left MF-Gonion distances are located more laterally in the Black population compared with the White population; in our study, however, the MF-G distances in the Turkish population were largely consistent with those in the White population. This supports the notion that this distance can serve as a reliable anatomic reference in clinical practice among the Turkish population.

The literature contains various studies evaluating the SOF-IOF distance in samples from the Turkish population and different ethnic groups. In a study by Acikgoz on 41 skulls of unknown age and sex from the Turkish population, the average SOF-IOF distances were reported as 43.56 ± 2.86 mm on the right side and 43.90 ± 2.70 mm on the left side.¹⁹ In our study, the SOF-IOF distance was determined to be 45.40 ± 2.81 mm on the right side and 45.47 ± 3.11 mm on the left side. We believe this difference may be related to the possibility that this distance decreases with age, given that the ages of the skulls examined are unknown.^{34,35} We also believe that differences in the measurement methods used may have contributed to the observed divergence.³⁶ In their study using CBCT images, Msibi et al¹⁶ reported the right SOF-IOF distance as 44.55 mm in white women and 46.41 mm in white men; 44.75 mm in Black women and 46.60 mm in Black men. On the left side, the SOF-IOF distance was reported as 45.24 mm in white women and 47.01 mm in white men; 44.73 mm in Black women and 47.28 mm in Black men.¹⁶ Overall, while the SOF-IOF values obtained from our CBCT data for the Turkish population are somewhat higher than those derived from local data based on dry skulls, they fall within a range similar to the values reported for white populations in other countries.

A comparison of our findings on the IOF-MF distance with values reported in the literature reveals significant differences, particularly by sex and ethnicity. In their study, Msibi et al¹⁶ reported the right IOF-MF distance as 59.86 mm in white women and 65.47 mm in white men; 63.53 mm in Black women and 66.17 mm in Black men. The left IOF-MF distance was reported as 59.61 mm in white women, 64.91 mm in white men,

63.44 mm in Black women, and 66.02 mm in Black men.¹⁶ In our study, the IOF-MF distance was found to be 63.70 mm on the right side and 63.23 mm on the left side in women; in men, it was 68.54 mm on the right side and 67.38 mm on the left side. Overall, the IOF-MF distances obtained in our study fall within a range similar to that reported for the white population, although higher average values were observed in male subjects. This finding is thought to be consistent with the larger linear dimensions reported in the literature for craniofacial and mandibular structures in males, as well as the sex dimorphism described in measurements around the infraorbital and mental foramen.¹⁵

The SOF, IOF, and MF may not lie on the same straight line in every case.^{1,3,4} Furthermore, the variations observed among individuals indicate that these foramen structures should be considered not as fixed points but within specific morphologic ranges. In particular, anatomic differences at the orbital margin, infraorbital region, and mandibular body level may vary depending on age, sex, craniofacial structure type, and population characteristics. These variables highlight the importance of evaluating the proportional relationships between these structures rather than their absolute distances. A ratio-based approach can provide a more comparable and generalizable geometric framework among these critical reference points, despite positional variability across different individuals. In this context, our study quantitatively demonstrates, for the first time using a CBCT-based sample from the Turkish population, that the SOF-MF/SOF-IOF ratio approaches the golden ratio. The SOF-MF/SOF-IOF ratio was 1.522 on the right side and 1.418 on the left side in men; in women, it was 1.400 on the right side and 1.402 on the left side. In addition, the overall average was 1.459 on the right side and 1.440 on the left side. This finding emphasizes the necessity of individual anatomic assessment in addition to standard reference values during surgical planning.

In the current literature, most studies examining the relationship between craniofacial structures and aesthetic proportions focus on the soft-tissue components of the face or on superficial aesthetic lines. In contrast, this study stands out for being based on anatomic reference points directly embedded in bony structures. In this regard, it makes a unique contribution to the literature not only from the perspective of facial aesthetics but also by providing new data for the scientific documentation of anatomic variations and for planning related to neurovascular structures. Furthermore, it suggests that such proportions should be given greater consideration in applied fields such as craniofacial surgery, medical aesthetic practices, and forensic anthropology.

Limitation

When evaluating the results of this study, certain methodological, technical, and conceptual limitations must be taken into account. Basic methodological shortcomings include the possibility that patients' histories of aesthetic, orthodontic, or trauma procedures may be missing from archival records due to the study's retrospective design, and that measurements were performed by a single researcher, precluding an interobserver reliability test. In addition, the generalizability of our findings is fundamentally constrained by the demographic profile of our study cohort, which consisted exclusively of Turkish individuals aged 18 to 33 years. Consequently, these results exhibit limited applicability to other age cohorts—such as pediatric populations undergoing active craniofacial development or geriatric populations experiencing senile bone resorption and structural remodeling of facial bones—as well as

to other ethnicities and ancestry groups with distinct craniofacial morphotypes. This limited generalizability highlights the critical need for future prospective, multicenter, and multi-ethnic studies with larger, stratified cohorts to evaluate and validate these proportional relationships across more diverse global populations. From a technical perspective, factors such as patient positioning during CBCT imaging, device resolution, and slice thickness can affect measurement accuracy. Finally, the fact that the analysis was conducted solely based on bone structures while disregarding soft tissue components—which are the primary determinants of facial aesthetics—and the reliance on the concept of the “golden ratio,” which is based on a subjective perception that can vary culturally and individually, limits the direct translation of the derived mathematical ideal into clinical and holistic aesthetic practice.

In conclusion, this study has demonstrated that the ratios between SOF, IOF, and MF show only limited alignment with the golden ratio. In our study, the proportional relationships among SOF, IOF, and MF were evaluated; although these ratios did not fully align with the golden ratio, consistent ratios between 1.4 and 1.5 were identified. These findings suggest that ratio-based analyses between structures, rather than fixed linear measurements, may offer a more meaningful and generalizable approach in craniofacial morphometric evaluation. We believe the ratios obtained provide potential reference values that could contribute to safer, more predictable localization of maxillofacial neurovascular bundles, particularly in medical aesthetic procedures such as dermal fillers, botulinum toxin injections, and thread lifts. It is believed that these reference values could also serve as a guide for surgeons and clinicians in localizing, protecting, and effectively applying nerve blocks to the relevant nerves. These findings require further support through larger-sample, multicenter studies, particularly in the fields of medical aesthetics and craniofacial surgery.

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