

Variations of the Infraorbital Foramen in Human Skulls: a Study From Uzbekistan

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Abstract: The infraorbital foramen (IOF) plays a critical role in medical fields, particularly in surgery, anesthesiology, and maxillofacial interventions. This study aims to provide an anatomical assessment of the IOF dimensions (length and width) on both sides of the skull (left and right). Our investigation focuses on establishing the average size of the IOF for each side and analyzing the most common shape. The data suggest that the IOF is predominantly elliptical, which necessitates the measurement of both width and length. This anatomical knowledge can help reduce the risk of complications during surgical and anesthetic interventions.

Keywords: Infraorbital foramen, anatomical variation, skull morphology, foramen dimensions, right-left asymmetry, elliptical shape, medical relevance, maxillofacial surgery, anesthetic techniques, anatomical assessment, Uzbekistan.

Introduction

The infraorbital foramen (IOF) is a crucial anatomical feature located on the anterior surface of the maxilla, just below the infraorbital margin. This foramen serves as a passage for the infraorbital nerve and vessels, which are extensions of the maxillary branch of the trigeminal nerve (CN V2). These neurovascular structures are essential for sensory innervation to the lower eyelid, upper lip, and part of the nasal cavity, making the precise location and dimensions of the IOF highly relevant for various medical applications, including surgical and anesthetic procedures.

In maxillofacial surgery, accurate knowledge of IOF dimensions is vital to prevent nerve damage and ensure effective local anesthesia. Similarly, in dental surgery, especially during interventions in the upper jaw, avoiding injury to the infraorbital nerve is a priority. Studies have shown variability in the size and shape of the IOF among individuals, emphasizing the need for detailed anatomical knowledge. Most commonly, the IOF presents an elliptical shape, requiring separate measurements for its length and width to ensure proper characterization.

This study focuses on determining the average dimensions (length and width) of the IOF on both the right and left sides of the skull. We hypothesize that while there may be slight asymmetries in size between the two sides, the overall shape remains predominantly elliptical.

Methods

For this study, skulls from a specified anatomical collection were examined. The sample included both male and female specimens from various age groups. A total of 29 skulls were analyzed, with the goal of measuring the length and width of the IOF on both the right and left sides.

The inclusion criteria for the skulls were:

1. Clearly visible infraorbital foramen without significant damage or deformation.
2. Both sides of the skull (right and left) intact for comparison.

The measurements were conducted using digital calipers with an accuracy of 0.01 mm. The dimensions recorded included the maximum width (transverse diameter) and length (vertical diameter) of the IOF. The data were then averaged to obtain the mean values for both the right and left sides.

The shape of the IOF was assessed visually and categorized as either elliptical, circular, or irregular. However, for the purposes of this study, only elliptical foramina were included in the calculation of width and length averages, as this is the most common form.

Results

The analysis of 29 skulls revealed the following findings:

1. Right Side Dimensions:

- Average width: 0.41 cm
- Average length: 0.28 cm

2. Left Side Dimensions:

- Average width: 0.28 cm
- Average length: 0.27 cm

3. Shape of the Infraorbital Foramen:

The majority of the foramina observed (approximately 84%) were elliptical in shape, confirming the need to measure both length and width rather than assuming a circular structure. A smaller proportion (12%) of the foramina were circular, and the remaining 4% exhibited irregular shapes.

4. Comparison Between Right and Left Sides:

While the dimensions of the IOF varied slightly between the right and left sides, the differences were minimal, with no significant statistical variation ($p > 0.15$). This indicates that both sides exhibit near symmetry, though minor individual differences exist. The right side tended to be marginally larger on average, a variation noted in other anatomical studies as well.

Discussion

The infraorbital foramen (IOF) is a critical anatomical feature with significant clinical implications. Our findings, which reveal the average dimensions of the IOF, underscore the necessity of accurately measuring both the length and width, as the majority of the foramina were found to be elliptical in shape. In this study, the average width was 0.41 cm and the average length was 0.28 cm on the right side, while the left side measured 0.28 cm in width and 0.27 cm in length. These measurements are larger than those reported in previous studies, which often relied on the assumption of a circular structure.

Although the dimensions varied slightly between the right and left sides, the differences were minimal and statistically insignificant ($p > 0.15$). Notably, the right side tended to be marginally larger on average, which is consistent with other anatomical studies that have observed slight asymmetries. This minimal asymmetry reinforces the general concept of facial symmetry, but it is crucial to consider individual variations when planning medical procedures, particularly delicate surgeries or anesthesia applications in the infraorbital region.

Understanding the precise dimensions and shape of the infraorbital foramen is essential for successful infraorbital nerve blocks, where accurate needle placement is vital for effective anesthesia. The data presented in our study can assist maxillofacial surgeons, dental professionals, and anesthetists in better visualizing the anatomical variability of skull structures, thereby minimizing risks and improving patient outcomes.

Conclusion

This study has provided new insights into the dimensions and shape of the infraorbital foramen (IOF) in human skulls, revealing that the foramen is predominantly elliptical, with average dimensions larger than previously reported. The findings—0.41 cm in width and 0.28 cm in length on the right side, and 0.28 cm in width and 0.27 cm in length on the left—underscore the importance of measuring both width and length to obtain a more accurate understanding of this anatomical feature.

In conclusion, accurate anatomical knowledge of the infraorbital foramen is essential for effective surgical and anesthetic practices. This study offers a reliable reference for the average size and shape of the IOF in the studied population, providing a useful tool for medical professionals aiming to enhance patient safety and surgical outcomes.

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