**e-ISSN: 0975-9506, p-ISSN: 2961-6093**

**Available online on http://www.ijpqa.com/** doi: 10.25258/ijpqa.16.3.10

**International Journal of Pharmaceutical Quality Assurance 2025; 16(3); 61-65**

**Original Research Article**

# Morphometric and Morphological Analysis of Infraorbital Foramen

**Vijay Laxmi Sharma[1], Pankaj Saini[2], Sunny Yadav[3], Abhilasha Dadhich[4], Savita[5]**

**[1]Professor, Department of Anatomy, S.M.S. Medical College, Jaipur, Rajasthan, India**
**[2]Assistant Professor, Department of Anatomy, S.M.S. Medical College, Jaipur, Rajasthan, India**
**[3]Assistant Professor, Department of Anatomy, S.M.S. Medical College, Jaipur, Rajasthan, India**
**[4]Associate Professor, Department of Anatomy, S.M.S. Medical College, Jaipur, Rajasthan, India**
**[5]Assistant Professor, Department of Anatomy, S.M.S. Medical College, Jaipur, Rajasthan, India**

**Received: 15-01-2025 / Revised: 21-02-2025 / Accepted: 19-03-2025**
**Corresponding Author: Dr. Pankaj Saini**
**Conflict of interest: Nil**

**Abstract:**
**Introduction:** The infraorbital region of the face is used to block the infraorbital nerve for many procedures, such as wound closure, biopsy, scarification and other facial cosmetic procedures, so a thorough knowledge of this region is essential for doctors to anaesthetize infraorbital nerve effectively. The infraorbital nerve is the maxillary branch, another branch of the trigeminal nerve. The supraorbital foramen or notch and the infraorbital foramen are important anatomical landmarks where important nerves leave the skull.
**Aim:** To assess normal and abnormal morphometry and morphology of the infraorbital foramen.
**Materials and Methods:** A cross-sectional observational study was carried out from 1st January 2024 to 31st March 2024 in the Department of Anatomy of a leading Govt. Medical College of Jaipur, Rajasthan. A total of 50 adult dry skulls were evaluated for various osteological parameters. The metric range, mean and standard deviation of the parameters were calculated.
**Results:** The mean of the greatest vertical diameter of infraorbital foramen was 4.49 mm on the right side and 4.54 mm on the left side. The average of the largest transverse diameter was 4.80 mm on the right side and 4.53 mm on the left side. The frequency of semilunar, oval and round shapes was 62%, 26% and 12%.
**Conclusion:** The information presented in this study is useful in various fields of maxillofacial surgery and regional block anaesthesia medicine, dentistry and anthropometry.
**Keywords:** Infraorbital foramen, Maxilla, Infraorbital nerve, Skull, Nerve block.



## Introduction

The infraorbital foramen (IOF) is situated in the maxilla, about 1 cm beneath the internal edge of the eye. It allows the passage of the infraorbital vessels and nerves. It is positioned either on or adjacent to a vertical line that runs through the supraorbital notch or foramen [1]. The infraorbital artery and vein travel through this foramen [2]. The infraorbital nerve, which is a branch of the second division of the trigeminal nerve, exits the skull via the suborbital foramen.

This nerve is purely sensory and provides innervation to the skin on the upper cheek, the mucosa of the sinus, the maxillary incisors, as well as molars and their adjacent gums, the skin and conjunctiva of the lower eyelid, a part of the nose, and the skin and mucous membrane of the upper lip [3]. A suborbital nerve block is employed to achieve regional anaesthesia in the jaw and face for diagnostic, surgical, and various invasive procedures. Therapeutic infraorbital nerve blocks are utilized for severe cases of trigeminal neuralgia that do not respond well to pharmacological treatment. Having a precise understanding of the anatomical position of the infraorbital cavity is crucial in contemporary surgical interventions and in identifying the best sites for anaesthetic nerve blocks, which subsequently decreases relative risks during clinical procedures [4-6]. Similarly, knowing the precise anatomical position of the infraorbital artery is essential for various procedures, particularly in plastic surgery, where the infraorbital artery flap is utilized for reconstructing the lower nose [7]. This artery's location is also recognized as one of the high-risk zones on the face, as injecting dermal fillers in this area can lead to artery occlusion, potentially resulting in stroke and blindness [8].

A substantial amount of evidence demonstrates significant racial differences in the morphology and relative positioning of the infraorbital opening among different populations [9,10]. A comprehensive understanding of the differences in the infraorbital opening (IOF) and the creation of a reliable reference point for needle insertion is crucial to ensure safe and effective regional anaesthesia and to prevent nerve injury during midface procedures. Consequently, the purpose of this study was to examine the shape, orientation, and measurements of the infraorbital foramen concerning surgically identified anatomical landmarks.

## Material and Methods

Fifty adult dry skulls were collected from the Department of Anatomy, SMS Medical College, Jaipur, and Rajasthan. Skulls without obvious gross pathology, deformity or traumatic damage were included in the study while skulls with lesions in the orbit and nasal cavity were excluded. After assigning a number, both sides of the skull were assessed for shape, size and direction of the infraorbital foramina by direct visual inspection. To analyse the size and relative position of the IOF, the following parameters were measured on the right and left sides with a digital vernier calliper with an accuracy of 0.01 mm:

1. The largest vertical diameter of the IOF (Figure 1).
2. The largest horizontal diameter of the IOF (Figure 2).
3. Vertical distance between the IOF and the inferior orbital margin (Figure 3).
4. Distance between IOF and anterior nasal spine (ANS) (Figure 4).
5. Distance between IOF and nasion (Na) (Figure 5).

Statistical analysis was performed using range, mean and standard deviation of various osteological parameters.


**Figure 1: Measurement of the maximum vertical diameter of the IOF**


**Figure 2: Measurement of the maximum horizontal diameter of the IOF**


**Figure 3: Measurement of the distance of the centre of IOF and inferior orbital margin**


**Figure 4: Measurement of the distance of the centre of IOF and anterior nasal spine**


**Figure 5: Measurement of the distance between the centre of IOF and the nasion**

## Results

All skulls examined showed an infraorbital foramen on both sides (N=100). Among the observed shapes, the most common shape of infraorbital foramen was the crescent (62%). Other shapes seen were oval in 26% and round in 12% of infraorbital foramen (Table 1).

The mean vertical diameter was 4.49±1.65 mm (0.71-5.68 mm) on the right side and 4.54±1.32 mm (1.93-5.68 mm) on the left side). The mean transverse diameter was 4.80±1.23 mm (1.95–7.15 mm) on the right side and 4.53±1.34 mm (0.86–6.09 mm) on the left side. Regarding the distances between the IOF and anatomical landmarks, the average measured distance from the IOF to the infraorbital border was 9.29±1.69 mm on the right side and 8.63±1.78 mm on the left side. The distance between the IOF and the anterior nasal spine varied from 29.87 mm to 39.49 mm, with a mean of 33.67±2.89 mm on the right side and 33.82 ± 2.64 mm on the left side. Likewise, the distance between the IOF and the nasion was almost equal on both sides (40.65-49.42 mm) with a mean of 45.78±2.50 mm on the right side and 43.92±2.70 mm on the left side.

**Table 1: Frequency of shape of IOF**

| Shape | Number | Percentage |
|---|---|---|
| Oval | 26 | 26 |
| Semilunar (Cresents) | 62 | 62 |
| Round | 12 | 12 |

**Table 2: Measurements of various osteological parameters of IOF**

| Measurements | Right IOF | | Left IOF | |
|---|---|---|---|---|
| | Range (mm) | Mean ± SD (mm) | Range (mm) | Mean ± SD (mm) |
| Maximum vertical diameter | 0.71-5.68 | 4.49 ± 1.65 | 1.93-5.68 | 4.54 ± 1.32 |
| Maximum transverse diameter | 1.95-7.15 | 4.80 ± 1.23 | 0.86-6.09 | 4.53 ± 1.34 |
| Distance from IOF to IOM | 6.03-11.15 | 9.29 ± 1.69 | 5.87-11.41 | 8.63 ± 1.78 |
| Distance from IOF to ANS | 29.87-39.49 | 33.67 ± 2.89 | 30.4-37.86 | 33.82 ± 2.64 |
| Distance from IOF to Na | 40.65-49.42 | 45.78 ± 2.50 | 40.64-49.42 | 43.92 ± 2.70 |

## Discussion

The infraorbital nerve, which exits through the IOF and appears on the face, provides a remarkably large area of sensory innervation and is a prime candidate for regional nerve block. Therefore, reliable and accurate IOF location is important in dentistry, maxillofacial surgery and otolaryngology. This study showed the presence of an infraorbital foramen on both sides in all the skulls examined, which is consistent with previous studies [11,12]. The shape of the suborbital foramen showed a higher mid-lunar frequency in this study, but this was inconsistent with previous studies [13,14] because the semilunar orbital foramen was smaller than in previous studies.

The mean distance from the IOF to the infraorbital border was 9.29±1.69 mm on the right side and 8.63±1.78 mm on the left side. These figures agree with previous studies [15,16]. The average distance of the right transverse diameter of the suborbital foramen was 4.80 mm and the left 4.53 mm, which was similar to Oliverira et al. [17] in a study that recorded a larger transverse diameter of 4.2 mm on the right and 4.33 mm on the left side. Much variability has been documented in the location of the infraorbital nerve and its foramina concerning different anatomical landmarks. [13,18,19]. The mean IOF-Na in this analysis, which was 45.78±2.50 mm on the right side and 43.92±2.70 mm on the left side, was lower as compared to other populations [13, 20]. Infraorbital foramen location relative to infraorbital margin, anterior nasal spine and nasion, showed side effects in our sample, suggesting that infraorbital foramen location is not always bilaterally symmetrical in any individual.

## Conclusion

The infraorbital foramen serves as a conduit for the infraorbital nerve and blood vessels, making its precise location essential for professionals working in the jaw area, such as those performing acupuncture, zygomatic fracture surgeries, and administering both intraoral and extraoral anaesthesia. Understanding the spatial relationship between the infraorbital foramen and nearby bony structures aids in estimating its position. Familiarity with the distances to anatomically relevant landmarks observed during surgery in this study may assist surgeons in avoiding complications in maxillofacial procedures, Caldwell Luc surgeries, and nerve blocks. The information is directly applicable to clinical practice and educational settings.

**Limitations:** This research has several limitations. First, the study is based on a sample of 50 skulls (N=100), which restricts the applicability of its results. Second, the measurements were conducted manually and may vary between individuals. Lastly, the measurements might be influenced by regular deterioration of carcasses, which may not be apparent at a macroscopic level. Consequently, additional research with larger sample sizes is suggested. However, the parallels in findings with international studies suggest that the results can be generalized. Understanding the Infraorbital foramen diameter and its distances from different cranial landmarks can aid surgeons in performing thorough preoperative assessments for patients undergoing maxillofacial surgery and regional block anaesthesia.

**Acknowledgement:** We acknowledge the cooperation extended by the Head of the Department of Anatomy, SMS Medical College, Jaipur, for conducting this work.

**References**

1. Standring S, Ellis H, Healy JC, Johnson D, Williams A, Collins P, et al. Gray's anatomy. The anatomical basis of clinical practice. 39th ed. Elsevier, Churchill Livingstone, London 2005:511-551.
2. Lim JS, Min KH, Lee JH, and Lee HK, Hong SH. Anthropometric analysis of facial foramina in Korean population: a three-dimensional computed tomographic study. Arch Craniofac Surg. 2016; 17:9–13.
3. Moore KL, Dalley AF, Argur AM. Philadelphia: Lippincott Williams & Wilkins; 2013. Clinically Oriented Anatomy.
4. Hu KS, Kwak J, Koh KS, Abe S, Fontaine C, Kim HJ. Topographic distribution area of the infraorbital nerve. Surg Radiol Anat. 2007; 29:383–388.
5. Feriani G, Hatanaka E, Torloni MR, da Silva EMK. Infraorbital nerve block for postoperative pain following cleft lip repair in children. Cochrane Database Syst Rev. 2016
6. Aggarwal A, Kaur H, Gupta T, Tubbs RS, Sahni D, Batra YK, Sondekoppam RV. Anatomical study of the infraorbital foramen: a basis for successful infraorbital nerve block. Clin Anat. 2015; 28:753–760.
7. Kovacevic P, Hrgovic I, Kovacevic T, Hrgovic Z. Single stage turn in perforator infraorbital artery island flap for nasal ala reconstruction. Med Arh. 2013; 67:450–453.
8. Hufschmidt K, Bronsard N, Foissac R, et al. The infraorbital artery: clinical relevance in aesthetic medicine and identification of danger zones of the midface. J Plast Reconstr Aesthet Surg. 2019; 72:131–136.
9. Sithiporn Agthong, Thanasilp Huanmanop, Vilai Chentanez. Anatomical Variations of the Supraorbital, Infraorbital, and Mental Foramina Related to gender and side. Journal of Oral and Maxillofacial Surgery. June 2005; 63(6): 800-804.
10. Wandee Apinhasmit, Supin Chompoopong, Dolly Methathrathip, Roengsak Sansuk, Wannapa Phetphunphiphat. Supraorbital Notch/ Foramen, Infraorbital Foramen and Mental Foramen in Thais: Anthropometric Measurements and Surgical Relevance. J Med Assoc Thai 2006; 89 (5): 675-82.
11. Ongeti K, Hassanali J, Ogeng'o J, Saidi H. Biometrie features of facial foramina in adult Kenyan skulls. Eur J Anat 2008; 21: 89-95.
12. Chung MS, Kim HJ, Kang HS, Chung IH. Locational relationship of the supraorbital notch or foramen and infraorbital and mental foramina in Koreans. Acta Anat 1995; 154:162-166.
13. Boopathi S, Chakravarthy Marx S, Dhalapathy S, Anupa S. Anthropometric analysis of the infraorbital foramen in South Indian population. Singapore Med J 2010; 51(9):730.
14. Elias MG, Silva RB, Pimental ML. Morphometric analysis of the infraorbital foramen and accessories foraminas in Brazilian skulls. Int J Morphol 2004; 22:273-278.
15. Gour KK, Nair SG, Trivedi N, Gupta SD. Anthropometric measurements of infraorbital foramen in dried human skulls. Int J Bio Med Res 2012; 3(3):2003-2006.
16. Canan S, Asim OM, Okan B, Ozek C, Alper M. Anatomic variations of the infraorbital foramen. Ann Plast Surg. 1999; 43:613-617.
17. Junior O, Moreira RT, Neto BL, Silva CM, Lima FJ. A morphological and biometric study of the infraorbital foramen in adult skulls. Int J Morphol. 2012; 30(3): 986-992.
18. P. T. C. Lopes, G. A. M. Pereira, A. M. P. V. Santos, C. R. Freitas, B. R. R. Abreu, A. C. Malafaia. Morphometric analysis of the infraorbital foramen related to gender and laterality in dry skulls of adult individuals in southern Brazil. Brazilian Journal of Morphological Sciences. 2009; 26(1): 19–22.
19. Ilayperuma, G. Nanayakkara, and N. Palahepitiya. Morphometric analysis of the infraorbital foramen in adult Sri Lankan skulls. International Journal of Morphology. 2010; 28(3):777–782.
20. A. Przygocka, M. Podgórski, K. Jędrzejewski, M. Topol, M. Polguj. The location of the infraorbital foramen in human skulls, to be used as new anthropometric landmarks as a useful method for maxillofacial surgery. Folia Morphologica. 2012; 71(3):198–204.