Journal of Cardiovascular Disease Research

ISSN: 0975-3583,0976-2833 VOL 16, ISSUE 12, 2025

Morphological Study of Infraorbital Foramen in Human Dry Skulls and CT Images

Akanksha Sharma[*] [1], Vandana Tewari [2]

Department of Anatomy, Rama University, Kanpur, Uttar Pradesh, India

1. Akanksha Sharma*[1]

(corresponding author email id 2643.akanksha@gmail.com) p.g. student, Rama University, Kanpur.

2. Vandana Tewari [2]

Professor and Head, Anatomy Department, Rama University, Kanpur.

ABSTRACT

Introduction: The infraorbital foramen (IOF) is an important anatomical landmark for maxillofacial surgery, dental anesthesia, implantology, and reconstructive procedures. The present study was undertaken to evaluate the **morphological characteristics**, shape variability, and presence of accessory infraorbital foramen (AIOF) in human dry skulls and computed tomography (CT) images.

Aim and Objective: Morphological parameters assessed included the **shape of IOF** (oval, round, semilunar, triangular) and the **presence or absence of accessory foramina** on both sides.

Material and Method: A comparative cross-sectional study was conducted on 50 adult dry human skulls and 50 CT scan images of adult individuals of known sex. The data were statistically analyzed using SPSS software.

Result: Oval and round shapes were the most frequently observed forms in both dry skulls and CT images, while semilunar and triangular shapes were comparatively less common. Accessory infraorbital foramina were infrequent but clinically significant findings. CT imaging demonstrated improved visualization and anatomical accuracy when compared to dry skull analysis, particularly in identifying accessory foramina and subtle morphological variations. The results emphasize that **population-specific anatomical variations** of the infraorbital foramen must be considered during infraorbital nerve block, maxillofacial surgeries, and cosmetic procedures to minimize iatrogenic injury.

Conclusion: The study concludes that a combined osteological and radiological approach provides comprehensive anatomical understanding and enhances clinical safety.

Keywords: Infraorbital foramen, Accessory Infraorbital foramen.

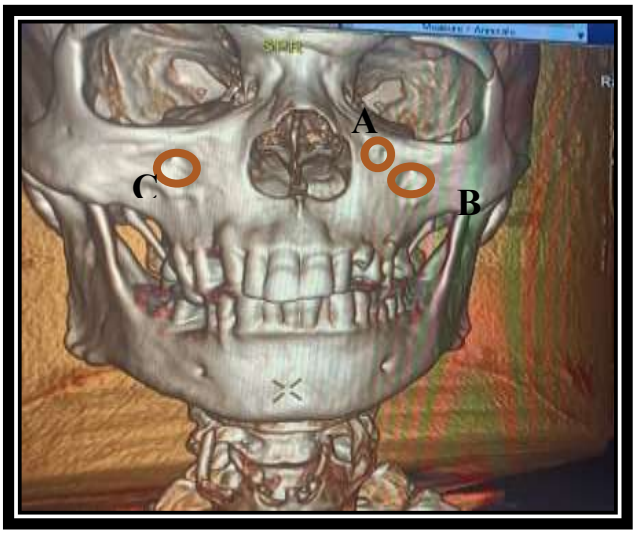
ISSN: 0975-3583,0976-2833 VOL 16, ISSUE 12, 2025

Introduction

The infraorbital foramen is located on the anterior surface of the maxilla, approximately 1 cm below the infraorbital margin, and serves as the exit point for the infraorbital nerve and vessels supplying the midface region (1, 2016). The infraorbital nerve, a terminal branch of the maxillary division of the trigeminal nerve, provides sensory innervation to the lower eyelid, side of the nose, upper lip, and cheek, making the IOF a critical landmark in regional anesthesia and facial surgery (2, 2013). Anatomical variability in the **shape, size, number, and position** of the infraorbital foramen has been documented across different populations, genders, and ethnic groups (3, 2022). These variations have direct clinical implications during infraorbital nerve block, Le Fort fractures, orthognathic surgeries, and cosmetic filler injections, where inadvertent injury may result in sensory deficits, hematoma, or vascular complications (4, 2024). Dry skull studies have traditionally contributed valuable osteological data; however, limitations such as postmortem shrinkage and lack of demographic details necessitate complementary radiological evaluation (5, 2022). Computed tomography (CT), particularly cone-beam CT (CBCT), offers high-resolution three-dimensional visualization of bony structures with minimal superimposition, allowing accurate assessment of infraorbital canal, groove, and foramen in living individuals (6, 2001). Morphological classification of IOF based on horizontal and vertical diameters categorizes it as round, oval, semilunar, or triangular, while the presence of accessory foramina suggests branching variations of the infraorbital nerve (7, 2006). Awareness of such variations is essential to avoid incomplete anesthesia and surgical complications (8, 1999). The present study aims to evaluate the **morphological spectrum of the infraorbital foramen** using both dry skulls and CT images in an Indian population, thereby contributing population-specific data relevant for clinical and surgical applications. (Refs 6,9,12).

Photograph No.1 Showing (A) Accessory infraorbital foramen (B) & (C) Infraorbital foramen in dry skull.

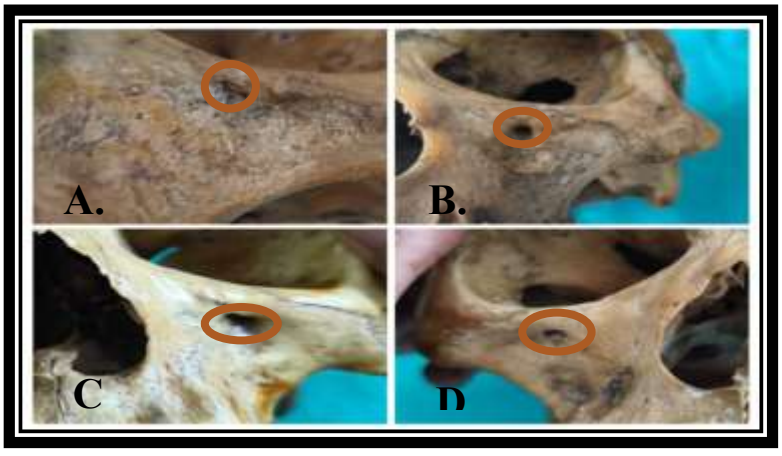
ISSN: 0975-3583,0976-2833 VOL 16, ISSUE 12, 2025



Photograph No.2 Showing (A) Accessory infraorbital foramen (B) & (C) Infraorbital foramen in CT images.

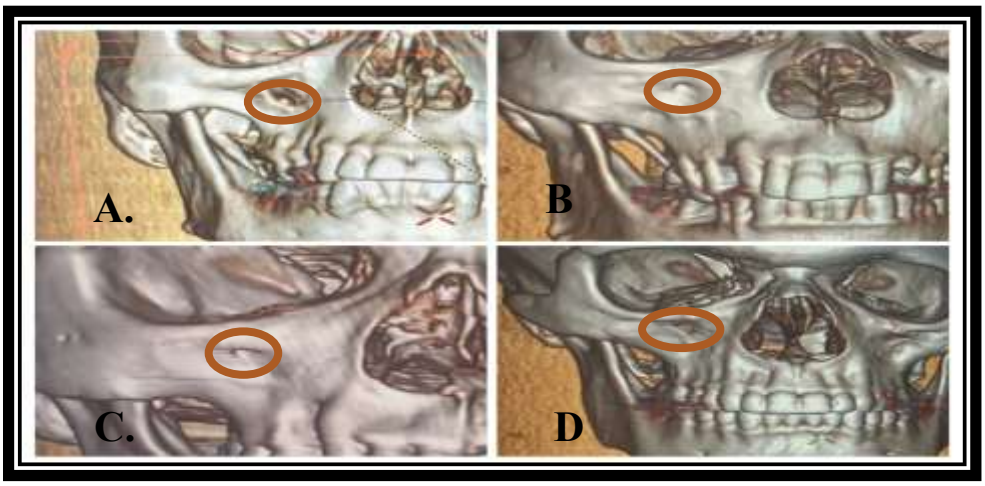
Materials and Methods

A comparative descriptive study was conducted in the Department of Anatomy and Department of Radiology, Rama Medical College Hospital and Research Centre, Kanpur, from April 2025 to January 2026 after obtaining institutional ethical clearance (15, 2020). The study sample comprised **50 adult dry human skulls** of unknown sex and **50 CT scan images** of adult individuals (28 males and 22 females). Dry skulls exhibiting intact maxillary regions with clearly visible infraorbital foramina were included, while skulls with fractures, deformities, or pathological changes were excluded. CT images were selected based on high-resolution axial and coronal sections with no history of craniofacial trauma or pathology (3, 2022). Morphological parameters assessed included the **shape of infraorbital foramen** (oval, round, semilunar, triangular) and the **presence or absence of accessory infraorbital foramen** on both right and left sides. Observations were recorded systematically, photographed, and tabulated. CT images were analyzed using a Wipro CT scanner with two-dimensional reconstructions on the frontal plane to highlight the maxillary bone and infraorbital region (11, 2021). Statistical analysis was performed using SPSS version 22 and Jamovi 2.6.26 software. Pearson's chi-square test was applied for categorical variables, and p-value <0.05 was considered statistically significant. (Refs 1,6,11)



ISSN: 0975-3583,0976-2833 VOL 16, ISSUE 12, 2025

Photograph No. 3 Showing different types of shapes of infraorbital foramen in dry skulls (A) Oval (B) Round (C) Triangular (D) Semilunar.



Photograph No. 4 Showing different types of shapes of infraorbital foramen in CT-images (A) Oval (B) Round (C) Semilunar (D) Triangular.

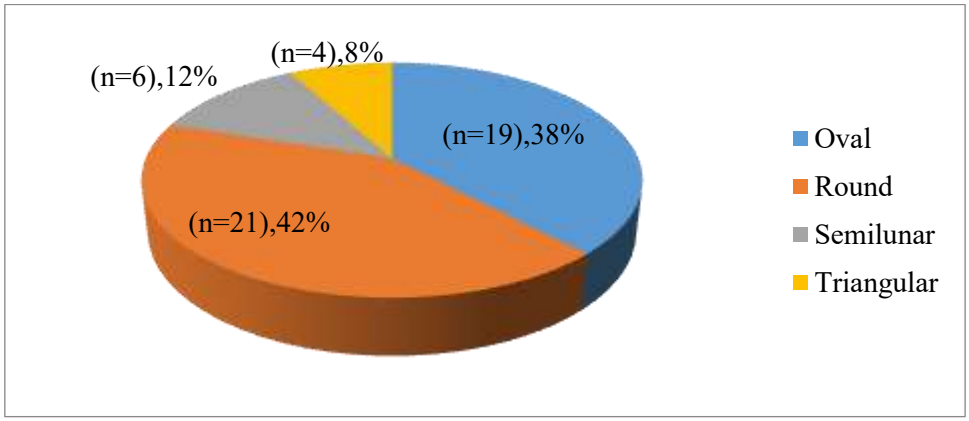
Results

Among the dry skulls, oval and round shapes predominated on both sides, with oval shape accounting for 38% on the right and 44% on the left, while round shape accounted for 42% on the right and 34% on the left. Semilunar and triangular shapes were less common. CT images demonstrated a higher prevalence of oval-shaped foramina, particularly on the right side (62%). Accessory infraorbital foramen was observed infrequently. In dry skulls, accessory foramina were present in 18% on the right and 4% on the left, whereas CT images showed accessory foramina in 8% on the right and 12% on the left. Overall, absence of accessory foramen was the most common finding. These observations indicate significant morphological variability with clinical relevance.

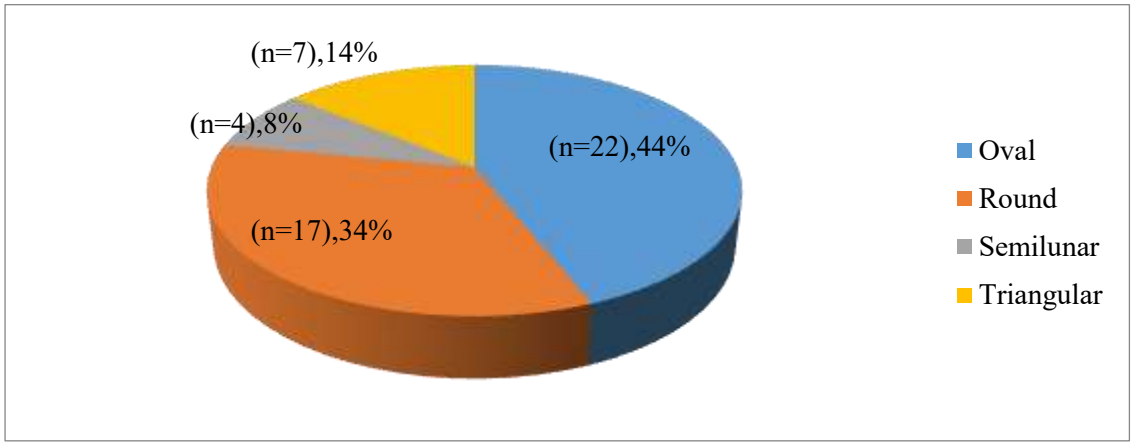
Table No.1: Showing distribution of different shapes of IOF in dry skulls on both sides.

Categories	Right		Left	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Oval	19	38%	22	44%
Round	21	42%	17	34%
Semilunar	6	12%	4	8%
Triangular	4	8%	7	14%

ISSN: 0975-3583,0976-2833 VOL 16, ISSUE 12, 2025



(Figure No.1A) Pie chart showing distribution of Shape of IOF in dry skulls on right side.

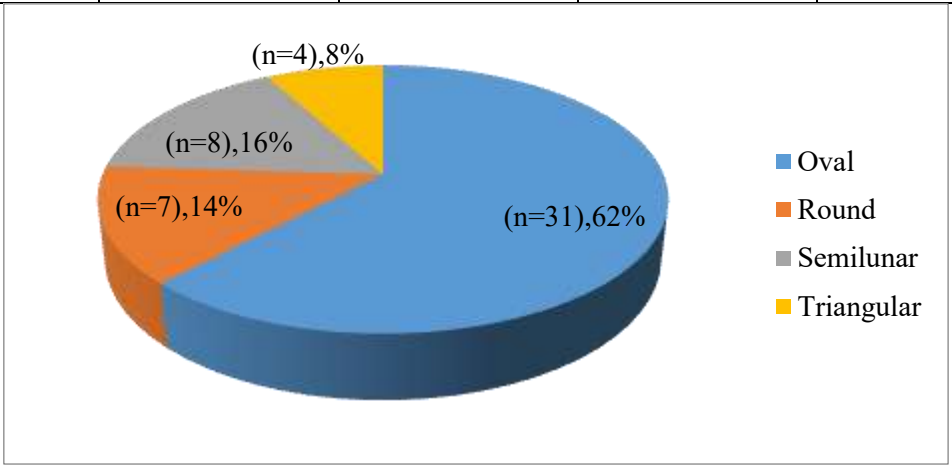


(Figure No.1B) Pie chart showing distribution of different shapes of IOF in dry skulls on left side.

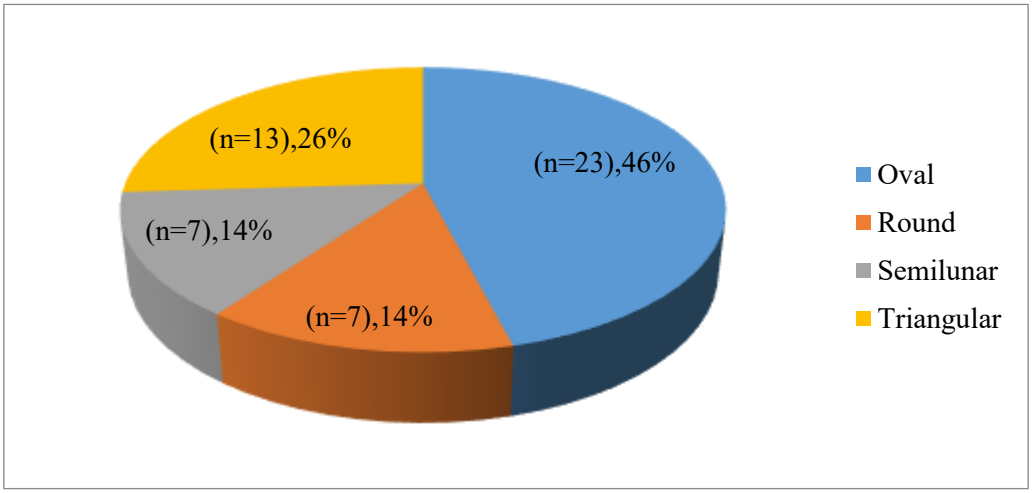
ISSN: 0975-3583,0976-2833 VOL 16, ISSUE 12, 2025

Table No.2: Showing distribution of different shapes of IOF in CT images on both sides.

Categories	Right		Left	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Oval	31	62%	23	46%
Round	7	14%	7	14%
Semilunar	8	16%	7	14%
Triangular	4	8%	13	26%



(Figure No.2A) Pie chart showing distribution of different shapes of IOF in CT images on right side.



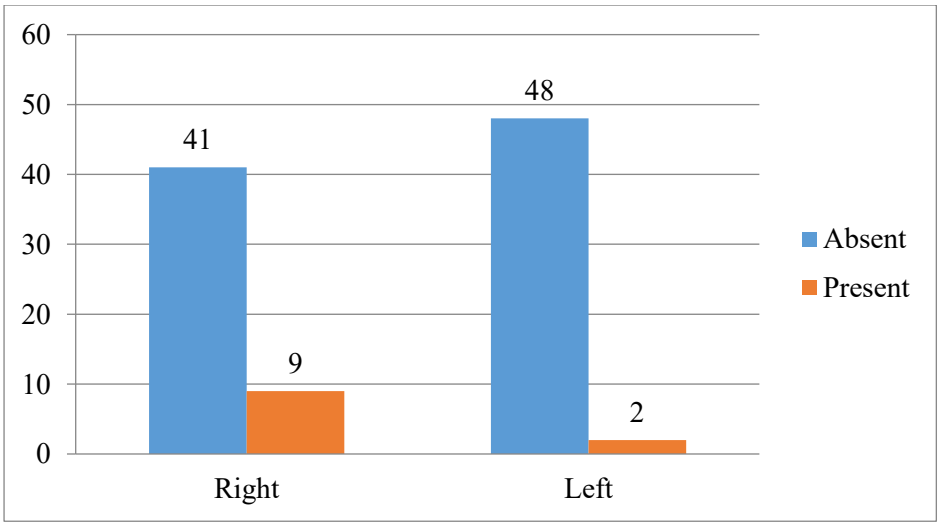
(Figure No.2B) Pie chart showing distribution of different shapes of IOF in CT images on left side.

ISSN: 0975-3583,0976-2833 VOL 16, ISSUE 12, 2025

In the present study, the accessory infraorbital foramen was mostly absent in dry skull. On, the right side (18%) and on the left (4%) of the skulls showed presence of accessory foramen, that is relatively low as shown in table no.3. and figure no.3.

Table No. 3: Showing frequency of Accessory infraorbital foramen in dry skulls on both sides.

Categories	Right		Left	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Absent	41	82%	48	96%
Present	9	18%	2	4%



(Figure No. 3) Graphical representation showing distribution of accessory foramen on both sides in dry skulls

Similarly, the descriptive analysis on CT images showed a higher frequency of absence of accessory foramen, about (92%) on the right and (88%) on the left

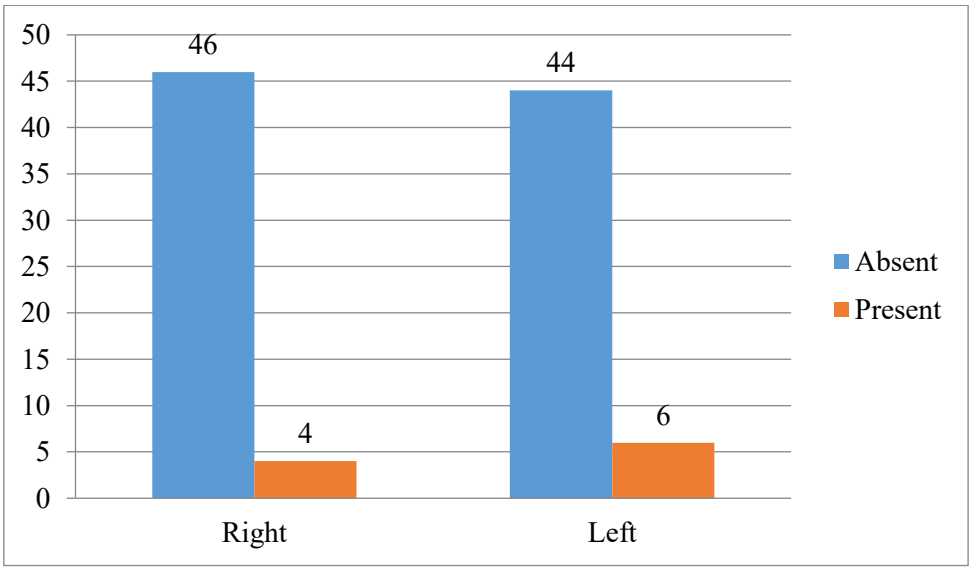
ISSN: 0975-3583,0976-2833 VOL 16, ISSUE 12, 2025

side. The presence of the Accessory foramen was estimated in (8%) on the right side and (12%) on the left side as shown in table no.7 and figure no.7.

Table No.4: Showing frequency of Accessory infraorbital foramen in CT images on both sides.

Categories	Right		Left	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Absent	46	92%	44	88%
Present	4	8%	6	12%

Overall, the distribution of accessory foramen is an infrequent anatomical variation, as it has higher frequency of absence on both sides in both dry skulls and CT imaging.



(Figure No. 4) Graphical representation showing distribution of accessory foramen on both sides in CT images.

ISSN: 0975-3583,0976-2833 VOL 16, ISSUE 12, 2025

Discussion

The predominance of oval and round infraorbital foramina observed in this study aligns with previous morphometric analyses conducted in different populations (13, 2010; 14, 2014). The relatively low incidence of accessory infraorbital foramen emphasizes the importance of careful preoperative assessment to avoid anesthetic failure. CT imaging proved superior in detecting subtle anatomical variations, supporting its routine use in preoperative planning. (Refs 8,16,17)

Conclusion

The infraorbital foramen exhibits considerable morphological variability in shape and number. Oval and round forms are most common, while accessory foramina are relatively rare. A combined osteological and radiological approach enhances anatomical understanding and improves clinical safety during infraorbital interventions. Population-specific data generated by this study are valuable for maxillofacial surgery, dental anesthesia, and forensic identification.

Reference

1. Riyaz ZH, Moizuddin K, Siddiqui AA, Riyaz ZH, Morphometric analysis of Infra orbital foramen in human skulls, Indian Journal of Anatomy & Surgery of Head, Neck & Brain, April-June,2016;2(2): 45-48.
2. Bharti A, Puranik MG. Morphometric study of infraorbital foramen in dry human skulls. National Journal of Integrated Research in Medicine. 2013 May 1;4(3):43-9.
3. Seyedashrafi MM, Gangachin MN, Razeghinejad MH, MounesiRad T, Sharifitabar M. Morphological And Anatomical Variations Of The Infraorbital Canal And Infraorbital Foramen Using Cone Beam Computed Tomography. Journal of Pharmaceutical Negative Results. 2022 Oct 8;13.
4. Desai R N, Batra N, Evaluation of Infraorbital Foramen Position Using Cone-Beam Computed Tomography in a Cohort of Central Gujarat, Indian Population, January 05, 2024 Cureus 16(1): e51722.
5. Akshaya S, Dakshayani KR. Morphometric analysis of infraorbital foramen in human dry skull of south Indian population and its clinical implications. Indian Journal of Clinical Anatomy and Physiology. 2022 Jan 17;9(1):54-61.
6. Kazkayasi M, Ergin A, Ersoy M, Bengi O, Tekdemir I, Elhan A. Certain anatomical relations and the precise morphometry of the infraorbital foramen-canal and groove: an anatomical and cephalometric study. Laryngoscope. 2001:111(4):609-14.
7. Apinhasmit W, Methathrathip D, Chompoopong S, Sangvichien S. Supraorbital notch/foramen, infraorbital foramen and mental foramen in Thais: anthropometric measurements and surgical relevance. J Med Assoc Thai. 2006;89(5):675-82.

ISSN: 0975-3583,0976-2833 VOL 16, ISSUE 12, 2025

8. Canan S, Asim OM, Okan B, Oguz O, Alper M, Ziya AK. Anatomic variations of the infraorbital foramen. Ann Plast Surg. 1999;43(6):613-7.
9. Singh R. Morphometric analysis of infraorbital foramen in adult human skulls of Indian origin. Int J Morphol. 2008;26(2):389-92.
10. Garapati S, Himabindu N, Padmaja V, Santhi C, Bhanu PS. Morphology And Morphometric Study Of Inferior Orbital Foramen. Int J Anat Res. 2016;4(2):2304-07.
11. Bahşi İ, Adanır SS, Orhan M, Kervancıoğlu P, Yalçın ED. Radiologic evaluation of the prechiasmatic sulcus in adults and clinical implications. ENT Updates. 2021 Dec 2;11(3).
12. Drake R, Vogl AW, Mitchell AW. Gray's anatomy for students E-book. Elsevier Health Sciences;Fourth Edition, 2020 Apr 4,Page 11.
13. Ilayperuma I, Nanayakkara G, Palahepitiya N. Morphometric analysis of the infraorbital foramen in adult Sri Lankan skulls. Int J Morphol. 2010 Sep 1;28(3):777-82.
14. Ekambaram G, Shaik RA, Salmani D, Ekambaram G. A genderwise study on the morphometry of infraorbital foramen and its laterally in dry adult skulls of South Indian population. International Journal of Medical Science and Public Health | 2014 |Vol3 | Issue 5.
15. Nanayakkara D, Peiris R, Mannapperuma N, Vadysinghe A. Morphometric analysis of the infraorbital foramen: the clinical relevance. Anatomy research international. 2016;2016(1):7917343.
16. Désiré A, Ebogo M, Amougou M, Essono N, Zogo O. Assessment of infraorbital foramen position using computed tomography-scan in a cohort of Cameroonian adults: landmarks in facial surgery and anesthesiology. Pan African Medical Journal. 2023;45(1).
17. Jafri SR , Muneeb A , Qureshi F, Sikander H , Arif A , Arshad A, Morphometric Analysis of Infraorbital Foramen in Human Dry Skulls,2022, DOI: https://doi.org/10.53350/pjmhs221610670.
18. Sharma S, Sharma A, Thakur C, Modi BS. Anthropometric measurements of infraorbital foramen and its anatomic variations in dried human skulls. Int. J Anat. Res. 2015;3(4):1487-90.