



MORPHOMETRIC ANALYSIS OF SUPRAORBITAL FORAMEN-A RESEARCH

Yashila Periyasamy¹ and Bala Krishna²

¹Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Science, Saveetha University, Chennai

²Department of Oral Surgery, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Science, Saveetha University, Chennai

ARTICLE INFO

Article History:

Received 4th October, 2020
Received in revised form 25th November, 2020
Accepted 18th December, 2020
Published online 28th January, 2021

Key words:

Supra-orbital foramen, Skulls, notches, incomplete foramen, Absence of features, Adult skulls

ABSTRACT

Aim and objective: We aimed to know the clear knowledge of the location of supra orbital foramina, notch which is essential for the clinician while performing endoscopic surgeries and regional nerve blocks.

Materials and method: The present study was done on 50 human adult skulls to observe the various combinations of supra orbital notch, foramen, incomplete foramen and absence of these features.

Result: 9 types of combinations were observed in adult skull amongst notch, foramen, incomplete foramen & absence of these features. The difference between incidences of foramen was Significant in adult skulls. Percentage of notch was higher in adult 34% than other features. Absences of all the features (notch, foramen and incomplete foramen) were not seen in adult skull but were observed. The mean value for supra orbital foramen/notch for 50 skulls on right side is 20.8mm and for the left side it is 19mm. (i.e.) the distance between the nasion to right and left supra orbital foramen.

Conclusion: All features that is notch, foramen and incomplete foramen was present since 4th Lunar month of foetal age and its knowledge of exact location of supraorbital foramen and notch is important in performing invasive surgical procedures involving anaesthetic and therapeutic procedures.

Copyright©2021 **Yashila Periyasamy and Bala Krishna**. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

Supra orbital foramen is the small opening at the central edge of the superior orbital margin in the frontal bone just below the superciliary arches that transmits the supra-orbital nerve, artery and vein. The supra orbital foramen lies under the eyebrow directly. [1] The supra orbital foramen arches transversely, below the superciliary arches and is in the supra orbital margin of the orbit, thin and prominent in its lateral two thirds, rounded in its medial third and presenting at the junction of these two portion, the supra orbital notch or foramen for the supra orbital nerves and vessels. (Supra orbital artery and supra orbital vein) In the roof of the notch or foramen is a small aperture that transmits a diploic vein that joins with the supra orbital vein. It was believed that the point of exit of supra orbital nerve is by way of a supra-orbital notch or a foramen which is slightly medial to the junction of outer 2/3rd and inner 1/3rd of supra orbital rim. Subsequently, it was noticed by surgeons that the exit point was repeatedly not at the site where anticipated. Knowledge of exact location of supra orbital notch/foramen is important when supra orbital block is given. [1]

A study conducted by H. Firdus Faren revealed that the mean distance of Supra orbital foramen and notch from nasal midline on the right are 30.18±3.78 and on the left are 29.51±3.01 and the mean vertical and horizontal diameters of SOF on the right side are 2.45±2.96 and 4.69±1.72, while those on the left side are 1.01±2.90 and 4.55±1.53, respectively. [2]

It is very important to know about the location and dimension of supraorbital foramen and notch when supraorbital block is given. This block is carried out in any maxillofacial surgeries, migraine and chronic paroxysmal hemicrania. Thus, its exact location and dimension will be helpful for surgeons while giving nerve blocks during any maxillofacial surgery. Sri varsha in her study showed that out of the 50 skulls examined, 10 skulls had bilateral supraorbital foramen, 25 skulls had bilateral supraorbital notch, 7 skulls had supraorbital foramen only on right side and 8 skulls had supraorbital foramen only on left side. The average distance between the supraorbital foramen and midline on right side is 15.4-38.4mm and 13.7-39.4mm on left side. The average distance between the supraorbital foramen and frontozygomatic suture on right side is 15.38-40.4mm and 18.19- 41.5mm on left side. The distance between the supraorbital notch and infra-orbital foramen on right side is 23.4- 47.8mm and 32.14-60mm on left side. [3]

*Corresponding author: **Yashila Periyasamy**
Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Science, Saveetha University, Chennai

Supra-orbital nerve is the important cutaneous nerve which passes through supra orbital foramen to innervate skin of forehead and scalp region. The supra orbital nerve blocks are commonly performed in the region of supra-orbital foramen during procedures such as closure of facial wounds, biopsies, and debridements, as absolute but temporary treatment for supraorbital neuralgia and other cosmetic cutaneous procedures. The supraorbital nerve is a terminal branch of the frontal nerve. It exits through its foramen to innervate the skin and may be injured during various surgical and anaesthetic procedures. There are two constant divisions of supra orbital nerve. The first was a medial or superficial division, which went over frontalis, providing sensory innervation to the skin of the forehead and to the front margin of the scalp. The second division was found deeper and lateral and ran across the outer aspect of the forehead between the epicranial aponeurosis and the pericranium supplying sensory innervation to the frontoparietal region of the scalp.[4]

A deep and detailed knowledge of the position of supra orbital notch and foramen is very important in performing invasive surgical procedures involving anaesthetic and therapeutic procedures. It is also helpful for anthropologists and forensic scientists. The supra orbital nerve exit from a foramen and supplies the skin and the scalp of the forehead region, where there are many chances of nerve injury during various surgical and anaesthetic procedures. [5] The supra-orbital foramen is situated along the supra-orbital margin, which is entirely formed by the frontal bone. Just superior to the rim of each orbit are raised superciliary arches. These are more pronounced in men than in women. [6]

MATERIALS AND METHOD

50 dry skulls of unknown age and sex were examined from the collection of the Department of Anatomy of Saveetha Dental College. Any of the skulls showing any breakage near supraorbital rim were not included in this study. In the 50 skulls supra orbital notches or the foramina were differentiated and recorded .Out of 50 skulls, 12 skulls were not included for the study which has no foramen or notch or the skulls which are broken. Observations taken in the study were distances from midline that is from nasion to the supra orbital notch or foramen. The midline in the forehead was encountered by dropping a silk suture from the vertex of the skull through the nasion to the anterior nasal spine and the inter-maxillary suture line. The measurements were done with vernier calliper and measuring tape. Observations thus made were complied and were calculated. Skulls were observed for notches, foramen, incomplete foramen and absence of these features in both right and left sides of individual skull.

RESULT

The combinations were observed in adult skull amongst notch, foramen, incomplete foramen and absence of these features were of nine types. The difference between incidences of foramen was Significant in adult skulls. Out of 50 skulls, 17 human skulls were present with the supraorbital notches, the presence of supraorbital foramen was found in 11 human dry skulls and other combinations are found in minimal number of skulls. Percentage of notch was higher in adult 34% than other features. All the skulls were observed but absence of all the features like notch, foramen and incomplete foramen were not seen in all the adult skulls. The mean value for supra orbital

foramen/notch for 50 skulls on right side is 20.8mm and for the left side it is 19mm. (i.e.) the distance between the nasion to right and left supra orbital foramen. The study revealed that supra orbital notch (34%) was found more frequently than supra orbital foramen (22%).

DISCUSSION

The Supraorbital foramen or notch is considered to be reliably constant in their location. Supra orbital notch or foramen is situated at the junction of lateral 2/3 and medial1/3 of the supra orbital margin. The formation of foramen results because of ossification of periosteal ligament which closes it below. [7] Periosteal ossification of this ligament causes a slight gap at the lower margin resulting into an incomplete foramen. [8] Knowledge of exact location of supra orbital notch or foramen is important when supra orbital block is given. This block is carried out in treatment of migraine and chronic paroxysmal hemicranias. [9] Knowledge of the location of this nerve is also essential during various endoscopic procedures, which are increasingly being used for cosmetic facial surgery. [10, 11] Excessive dissection and retraction close to such neurovascular bundles can cause scarring, which may lead to entrapment neuropathies and painful neuralgias. [12, 13]

Clinicians must be aware of the exact position of Supra orbital foramen or notch while diagnosing conditions like supraorbital neuralgia, as it is normally characterized by forehead pain and tenderness over the Supraorbital notch. In the present study, it has been found that notches varied from broad, flat designs to narrow keyhole or bilobed forms, whereas the foramina were more uniform and did not differ much in the diameter. Foramina were ovoid in shape, with the longer axis lying in the horizontal plane.

In this study, The mean value for supra orbital foramen/notch for 50 skulls on right side is 20.8mm and for the left side it is 19mm. (i.e.) the distance between the nasion to right and left supra orbital foramen. The study revealed that supra orbital notch (34%) was found more frequently than supra orbital foramen (22%). Similarly with the observation of other studies, a study conducted on Indian skulls also showed similar results where SON were more frequent compared to the SOF. [14] Similarly, an earlier study conducted by Berry and Berry also reported markedly low frequency of SOF (12.3%) in North Indian skulls. [15] Similar with the observations reported in other studies, where the distance between the supraorbital foramen/notch and the midline, Gertud. M. Beer observed the skulls and found the distance between supra orbital notch/foramen to nasion was 31mm. [16] Chung M.S also observed the skulls and found the average distance from nasion to supra orbital notch or foramen was 22.7mm. [17] The incidence of supra orbital foramen as reported by Duke Elder and Hollinshed W. Henry was 25% of total adult skulls. [1] Arun Kumar S. Bilodi, Sanikop MB had shown the incidence of supra orbital foramina of 39% on right side and 43.3% on left side. [18] Arun Kumar S. Bilodi, Sanikop MB concluded that in the absence of supra orbital foramina and notches, supra orbital vessels and nerves are more prone for injury due to sharp supra orbital margin at orbital rim. [19]

Ashwini LS *et al.* revealed that there is a difference in the position and dimensions of Supraorbital foramen and notch between different races and people of different places i.e regions. [20] Sabitha singh *et al* in her study concluded that, out of hundred twenty skulls, 33.33% had bilateral notch,

19.75% had bilateral foramen, 20.83% had notch on one side and foramen on other side. The mean (\pm SD) distance of supra orbital foramen/ notch from the nasal midline was 21.94 ± 4.32 mm on right side and 20.18 ± 4.17 mm on left side. The mean (\pm SD) transverse diameter of supraorbital foramen and notch was $4.62 \pm .83$ mm on right side, 4.16 ± 1.12 mm on left side and 6.93 ± 1.19 mm on right side and 6.73 ± 1.14 mm on left side respectively . While the mean (\pm SD) vertical diameter of foramen was $2.29 \pm .75$ mm on right side and $1.93 \pm .83$ mm on left side. [21] The present study revealed that supraorbital notches and foramina frequently vary in positions and dimensions in various races and region. Therefore anatomical knowledge of combinations of supra orbital notches and foramina are essential for clinicians while performing craniofacial surgeries like forehead and brow lift surgeries to avoid injuries of neurovascular bundle passing through these notches and foramina.

Some studies also explain about the variation in dimensions of supraorbital foramen and notch according to the gender. Bruno chrconavic *et al* explained in his study that he studied eighty adult human dry skulls. For which measurements were made to analyze the degree of variability in the location of the supraorbital and infraorbital foramina. All measurements were done bilaterally. Variations were evaluated according to gender and side. There were 54 female and 26 male crania. Almost all mean measurements were longer in males than in females. A statistically significant difference was observed between the left and the right sides in 4 of 10 measurements. When comparing the morphometric measurements between left and right sides of male and female crania, 6 of 22 measurements were statistically higher in men than in women. The findings suggest that gender should be taken into account when the foramina studied here are to be located. [22]

The frequency of supraorbital foramen was reported to be more in North East Asians and North American populations from an arctic region than the other populations. [23, 24] There are reports of gender difference in the location of SOF and is considered to be of forensic importance. It has also been observed that the left supraorbital foramen is situated closer to the midline in females compared with males. [25, 26] The study of 100 adult skulls revealed that the Supraorbital notch 71% on right and 70% on the left was found more frequently than the supraorbital foramen 29% on right and 30% on left. The distance between centre of Supraorbital notch or foramen and midline was found to be statistically significant on right and left sides. [27]

Overall, it can be stated that the position of the SOF/SON is not constant and it varies between different races and people of different regions. SON is observed more frequently compared to the SOF, though there is a slight difference in the frequency rate among the studies conducted in different regions and race groups. The presence of accessory supra-orbital notch and foramina is very common and is more commonly seen lateral to the main Supra-orbital foramen and notch. Since the exit point of the supra-orbital nerve and its branches has got these variations; all the surgical procedures involving the supraorbital rim and adjoining areas has to be performed very carefully with the awareness of these probable variations.

CONCLUSION

The observation of 50 skulls revealed the following conclusion: The exit point of supra orbital foramen is not at all

constant. It can be either a notch or a foramen. It may be an incomplete foramen. Complete absence of notch or foramen may deprive the supra orbital nerves and vessels, the protection given by these and make them more vulnerable to injuries at the sharp supra orbital margin. Because of the several variations of the supra orbital notch or foramen on the supra orbital rim, all surgical approaches to the supra orbital nerve on the supra orbital rim, especially the endoscopic ones, always have to be done under vision and with the necessary care of the nerves. The location of supra orbital notch or foramen will help the surgeons to avoid injuries to the neurovascular bundles passing through the same.

References

1. Antonacie F. *et al.* Chronic paroxysmal hemicrania and hemicranias continua; Anaesthetic blockades of pericranial nerves. *Functional neurology.*1997, 12(1): 11-15.
2. Fareen HF, Thenmozhi MS. A study of anatomical relations of supraorbital notch and foramen. *Asian Journal of Research in Chemistry.* 2016 Jul 1;9(7):769.
3. Varsha LS, Thenmozhi MS. Incidence and Morphological Study of Supraorbital Foramen in South Indian Skulls. *Journal of Pharmaceutical Sciences and Research.* 2015 Sep 1;7(9):711.
4. Knize DM. A study of the supraorbital nerve. *Plastic and reconstructive surgery.* 1995 Sep;96(3):564-9.
5. Gupta T. Localization of important facial foramina encountered in maxillo-facial surgery. *Clinical anatomy.* 2008 Oct;21(7):633-40.
6. Cheng AC, Yuen HK, Lucas PW, Lam DS, So KF. Characterization and localization of the supraorbital and frontal exits of the supraorbital nerve in Chinese: an anatomic study. *Ophthalmic Plastic & Reconstructive Surgery.* 2006 May 1;22(3):209-13.
7. Henry Hollinshed W. in; *Anatomy of surgeon vol-1p* 111 New York and London, Hoeber harper1966; 111.
8. Last FJ. *Eugene Wolff's Anatomy of the Eye and Orbit.* WB Saunders Company, Philadelphia, Penn.; 1968.
9. Antonaice F; *et al.* chronic Paroxysmal hemicranias and hemicranias continua; Anaesthetic blockades of Pericranial nerves. *Functional neurology.*1997; 12(1):11-15
10. Cutright B, Quillopa N, Schubert W. An anthropometric analysis of the key foramina for maxillofacial surgery. *Journal of oral and maxillofacial surgery.* 2003 Mar 1;61(3):354-7.
11. Saylam C, Özer MA, Ozek C, Gurler T. Anatomical variations of the frontal and supraorbital transcranial passages. *Journal of Craniofacial Surgery.* 2003 Jan 1;14(1):10-2.
12. Caputi CA, Firetto V. Therapeutic blockade of greater occipital and supraorbital nerves in migraine patients. *Headache: The Journal of Head and Face Pain.* 1997 Mar;37(3):174-9.
13. Beer GM, Putz R, Mager K, Schumacher M, Keil W. Variations of the frontal exit of the supraorbital nerve: an anatomic study. *Plastic and reconstructive surgery.* 1998 Aug;102(2):334-41.
14. Beer GM, Putz R, Mager K, Schumacher M, Keil W. Variations of the frontal exit of the supraorbital nerve: an anatomic study. *Plastic and reconstructive surgery.* 1998 Aug;102(2):334-41.

15. Carolineberry A, Berry RJ. Epigenetic variation in the human cranium. *Journal of anatomy*. 1967 Apr;101(Pt 2):361.
16. Beer GM, Putz R, Mager K, Schumacher M, Keil W. Variations of the frontal exit of the supraorbital nerve: an anatomic study. *Plastic and reconstructive surgery*. 1998 Aug;102(2):334-41.
17. Chung MS, Kim HJ, Kang HS, Chung IH. Locational relationship of the supraorbital notch or foramen and infraorbital and mental foramina in Koreans. *Cells Tissues Organs*. 1995;154(2):162-6.
18. Bilodi AK, Sanikop MB. Some Observations on Supra Orbital Foramina in Human Skulls in Karnataka. *Anatomica Karnataka*. 2002;1(13):17-23.
19. Cheng AC, Yuen HK, Lucas PW, Lam DS, So KF. Characterization and localization of the supraorbital and frontal exits of the supraorbital nerve in Chinese: an anatomic study. *Ophthalmic Plastic & Reconstructive Surgery*. 2006 May 1;22(3):209-13.
20. Ashwini LS, Mohandas Rao KG, Sharmila Saran SS. Morphological and morphometric analysis of supraorbital foramen and supraorbital notch: a study on dry human skulls. *Oman medical journal*. 2012 Mar; 27(2):129.
21. Singh S, Bilodi AK, Suman P. Morphometric analysis on supraorbital notches and foramina in south Indian Skull. *International Journal of Current Research and Review*. 2013;5(10):43-50.
22. Chrcanovic BR, Abreu MH, Custódio AL. A morphometric analysis of supraorbital and infraorbital foramina relative to surgical landmarks. *Surgical and radiologic anatomy*. 2011 May 1;33(4):329-35.
23. Santos Junior O, Pinheiro LR, Umetsubo OS, Sales MA, Cavalcanti MG. Assessment of open source software for CBCT in detecting additional mental foramina. *Brazilian oral research*. 2013 Apr;27(2):128-35.
24. Agthong S, Huanmanop T, Chentanez V. Anatomical variations of the supraorbital, infraorbital, and mental foramina related to gender and side. *Journal of oral and maxillofacial surgery*. 2005 Jun 1;63(6):800-4.
25. Chrcanovic BR, Abreu MH, Custódio AL. A morphometric analysis of supraorbital and infraorbital foramina relative to surgical landmarks. *Surgical and radiologic anatomy*. 2011 May 1;33(4):329-35.
26. Wandee Apinhasmit DD, Supin Chompoopong MS, Methathrathip D, Sansuk R, Phetphunphiphat W. Supraorbital notch/foramen, infraorbital foramen and mental foramen in Thais: anthropometric measurements and surgical relevance. *J Med Assoc Thai*. 2006;89(5):675-82.
27. Sharma N, Varshney R, Faruqi NA, Ghaus F. Supraorbital foramen-Morphometric study and clinical implications in adult Indian skulls. *Acta Medica International*. 2014 Jan 1;1(1):6.

How to cite this article:

Yashila Periyasamy and Bala Krishna (2021) 'Morphometric Analysis of Supraorbital Foramen-A Research', *International Journal of Current Advanced Research*, 10(01), pp. 23550-23553. DOI: <http://dx.doi.org/10.24327/ijcar.2021.23553.4666>
